Monografico

DOI: http://dx.doi.org/10.25115/eea.v38i3%20(1).4009

Estudios de Economía Aplicada
Volumen:38-3(1) // ISSN: 1133-3197

Methodical Approach To Calculating Information Value In Pricing Policy In Supply Chains

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ABSTRACT

The article proposes a methodical approach for taking into account the information component when prices are set for the production of machine-building enterprises. It is proposed to form the price of the finished product of machine-building enterprises, including the surcharge to the price, which takes into account the value of the information component of the product. The methodical approach is based on the system of statistical and mathematical assessment of the risk of impairment of the information component of the product, thus taking into account the level of price risk. It is proposed to calculate the value of the information component of the machine-building enterprises' products and in supply chains, taking into account the different levels of value created by means of expert assessments and the calculation of the value ratio. The methodological approach is universal in the field of pricing in the management of supply chains.

Keywords: cost of information, value, price, machine-building enterprises, assessment of price risk in supply chains, information in the composition of the price of goods, information in the supply chain system.

JEL classification: P22

Recibido: 14 de Octubre de 2020
Aceptado: 25 de Noviembre de 2020

1. Introduction

The market for information products and services is the most dynamic today. The information business, which has become one of the most profitable and promising, is attracting an increasing number of participants. Information needs of different levels are growing at a rapid pace, which widens the possibilities of information exchange, lead to the emergence of new types of information products, stimulation the development of all types of information activities. The information flow accompanies the logistics flow in the supply chain management system.

Information is the link between all economic stages and components of supply chains. Without streamlined information flows, an effective reproduction process is impossible. The information is necessary for the operation of all four stages of the process of reproduction. There are different types of information is used to organize production: technologies, standards, processes (Hrabovskyi et al., 2020). When distributing and exchanging, you need to have information about who we transfer goods and services to. At the stage of consumption, information also begins to be commodity character. In the system of formation of logistics chains, the information system occupies a leading place in the supply chain management system, as its strategy is based on the use of information services.

Information can act as a specific economic good, which is produced, distributed, exchanged and consumed. There is a creation of new technologies, development of new goods, equipment, other intangible assets in the process of materialization of information (Gontareva et al., 2019).

Production at the enterprises of the information industry, which are part of the logistics chain has several features. In particular, the objects of work in this field is the primary information, the means of labour - ways of its transformation, storage, transfer, and the purpose of production is customer satisfaction. In this regard, there are problems of evaluation of labour, finished product and efficiency of information activities.

Nowadays, most of the costing methods used in the production of information goods and services are based on the same principles used in estimating the costs of producing ordinary goods and services. The peculiarity of information as a commodity makes it difficult to determine the cost of its production by traditional methods. This is due to the complexity of determining the relationship between the costs and the results of information activities. In cases where the factor of timely use of information product plays an important role, the effect of information action is disproportionate to the effort spent on the production of information. A number of information products and services have a small life cycle, but their timely use gives a huge impact (Kazakova, 2019).

2. Literature review

The study of pricing in information economy engaged in a number of foreign and domestic scientists. The most scientists understand by information economy the economy of the information society, the main features of which are as follows: scientific knowledge and information become factors of production; the rate of development of the information sector higher rates of other sectors; growing demand for information and knowledge from consumers.

For example, scientific researches Babenko et al., 2017; 2018 devoted to the development of models of minimax multi-level program and adaptive management of innovation processes at the enterprise taking into account the risks.

Oklander M, Yashkina O. (2017) investigated the information system of an industrial enterprise without taking into account the influence of the cost of information on setting prices in supply chains.

Nitsenko V., Chukurna O. (2019) considered the evolution of value and price in a cognitive economy, without taking into account the information and logistic component.

H. Haddouch, Z. Beidouri, M. EL Oumami (2019), V. A. Osipov, Ekaterina Vi. Astakhova (2019) analyzed the theoretical aspects of creating and managing business models in supply chains**.** Most of them focused on the development of supply chain management systems and the formation of logistics strategies, cost optimization and supply chains. The issue of pricing policy for the information component in supply chains is insufficiently exploratory

3. Methodology.

In the article to be used the methods of mathematical-statistical analysis and risk assessment based on calculations of mathematical expectations; absolute deviation of possible random values from mathematical expectations; scope of variation; dispersion; mean square deviation; coefficient of variation.

4. Results.

However, in the context of rapid technological development of Industry 4.0, given the tendencies of further influence of artificial intelligence and synergy of engineering products with information and intellectual products, the issue of the dependence of marketing pricing on the dynamics of these changes increases. Future technological changes in the field of mechanical engineering are directly dependent on creative technologies, digital and information products and software, which will be integrated into the products of mechanical engineering, being a complex product, which will move through logistics chains and change its initial cost. The global world is changing dynamically due to technological innovations associated with the rapid dissemination of information and its integration with digital platforms that become the hub for managing complex systems over the Internet. The information component begins to occupy an important place in the cost structure on keeping consumers and on continuous renewal information component of technical products. This is the result of the emergence of innovative products whose consumption is related to integration with artificial intelligence or digital platforms.

Today's above trends have contributed to the emergence of scientific and theoretical approaches to the valuation of information as an intangible asset. Financial approaches to this problem are more focused on the market valuation of information as a separate object of pricing. However, there is a problem of substantiation of the value of information component in the finished industrial technical and innovative products. However, the continued operation of technically complex products information components may require periodic costs associated with upgrading or her permanent connection to information networks. In addition, the information component of the technical product is subjected to faster moral wear than its material component. Information may lose its value as knowledge provided with it ceases to be relevant or no longer satisfies certain needs. According to the report of the World Economic Forum, the value of the information reduced twice every five years.

In this respect, the company may have additional costs for customer retention (technical and customer service support and training) and providing logistics services. Given the fact that in logistics systems and supply chains, the information component is an integral part of the system, which requires constant maintenance and updating, there is a need to calculate the cost of its update in the final price of the goods. There is a problem of classification of expenditure in the financial statements and the choice of method of calculating their prices. In terms of enterprise finances, these factors are risky, that is, they are considered for possible financial losses as a result of inappropriate measures for the reliability of the information and its protection. In this context, the calculation of the level of risk, that is, the index of possible losses, taking into account the probability and frequency of the occurrence of a particular threat during the year, the possible loss from its implementation, the degree of vulnerability of the information.

The above approach, forecasting future lost profits, is based on economic calculations of the enterprise risk system, including absolute price risk. This is due to the fact that obtaining credible

information helps to reduce the risks of business activities. However, there is a need not only to estimate future losses, but also to formulate a methodological approach for including them in the price of products. This problem is exacerbated by the costs of machine-building enterprises for information, including marketing. An analytical study of the financial statements of major European Union machine-building enterprises - Siemens and Alstom corporations, confirms that enterprises include commercial expenses and marketing research expenses. In addition, these machine-building enterprises have targeted R&D expenditures.

The practice of accounting for marketing research costs in the structure of commercial costs is also characteristic of Ukrainian machine-building enterprises and enterprises of the machine-building industry of Belarus and the Russian Federation. At the same time, since marketing research is carried out on the request of machine-building enterprises by a marketing research agency, it is quite understandable to refer them to the commercial expenses, which means the costs of promotion and customer support. Thus, the value of information obtained from marketing research is included in the price structure of finished mechanical engineering products. In practice, prices for marketing research and consulting services are increasing at a much higher rate, far outpacing inflation. This indicates that the cost of initial marketing information resulting from marketing research is included in the price structure of finished mechanical engineering products.

In addition, the value of the information component depends on the cost of the enterprise for information, the need for this information, its processing within the enterprise marketing information system and the degree of its importance. Depending on the high degree of importance, the value of information may increase.

The study international experience in this field shows that the world leaders in machine-building are targeted spending on research and development of these enterprises. The author's calculations of the relationship between the growth rate of sales of finished products of machine-building enterprises, depending on the growth rate of R&D expenditures on the example of Siemens and Alstom Corporations confirmed the high degree of such influence. The correlation coefficient between these indicators was as follows: for Alstom Corporations 0.98 for the 6-year observation period and for Siemens Corporations 0.87. It should be noted that both companies have shown such a high level of correlation of these indicators since 2012. This indicates the growing impact of information support for research results on the growth of sales revenue.

Thus, the more an enterprise spends on R&D, the more profit it will receive. The technological innovations of the future are entirely related to the speed of updating of the information component of goods and technologies, including in logistics chains. Researches of Ukrainian machine-building enterprises have shown that domestic enterprises do not have R&D trust funds, and moreover they do not form intangible assets. This approach is outdated and needs to be refined and taken into account in current global trends. It should be noted that the problem of taking into account the information component in the price of the product is also usual for foreign machine-building enterprises. Based on the above provisions, the author proposes a methodical approach of taking into account the value of the information component in the price structure of products of machine-building enterprises, which is as follows.

First of all, it is necessary to define the concept of information component of finished products of mechanical engineering. By this category we mean information assets that include software resources that are integrated with engineering and machine-building products (software, services and hardware) and service resources (web resources, online repositories, data channels). In addition, the information component should include the cost of obtaining information and conducting research using specialized software and the necessary services to transmit such information.

In this context, it should be noted that when pricing software and service resources, as a commodity, there is a difficulty in calculating the cost of information, since the value of a particular software product can only be measured after its use by the user, then the demand for it will depend on the user's perceptions of usefulness the product being purchased. In addition, the difficulty of

calculating the cost of creating software products also has to do with the fact that they are offered to users through a specific technology of innovation, where there is a gradual filling of skills and practical experience, which are of particular value to both users and developers. That is why machine-building enterprises engaged in innovation should take into account the level of value of information for consumers of goods.

It was based on the above provisions, we propose a methodical approach to the pricing of finished products of machine-building enterprises, which takes into account the cost of the information component on the basis of adding to the price a premium that takes into account the value of information. This approach assumes that pricing for machine building products will include a margin on the price that takes into account the value of the information component. This approach can be used in the formation of the final price in the distribution systems of goods and logistics systems and supply chains, which are coordinated by information services. It is based on the determination of the value of this component by a group of experts in the field, with the subsequent calculation of the risk of impairment of this component by the stages of introduction of such a product on the market. Impairment risk is calculated using a mathematical apparatus, on the basis of which a hypothesis is drawn as to the degree of impairment risk, the level of which in the form of a coefficient can be added to the price and adjusted at each stage of introduction of the product to the market. The implementation of this approach was based on the method of calculating the price of scientific products, called the "Three Point Method", but adapted and refined precisely to calculate the value of the information component.

The value of the information component should be calculated expertly, which consists of the following stage.

1) Formation of an expert group.

2) Developing a survey page and obtaining expert assessments on the value of the information component in the products of machine-building enterprises.

3) Calculation of indicators characterizing the uncertainty of the results of expert assessments regarding the change in the value of the information component.

4) Determining the average value of the information component.

5) Generalization of expert assessments regarding the value of the information and software component and making a decision on its inclusion in the price.

In the first phase, a team of five experts determine the three levels of value of information: T_{max} is the maximum possible; T_{min} is the minimum possible; T_{nv} is the most likely. Estimates were made on the example of the European machine-building of Alstom Corporation, as its financial statements have R&D costs, which may be the basis for comparative estimates.

Experts' opinions on the evaluation of the value of the information component were based on the amount of real costs of enterprises for research, information and innovative development. The results of expert assessments and the calculation of risk value indicators for Alstom Corporation are presented in Table 1. This is the result of the second step of the methodological approach.

In the third stage of the methodological approach, the following indicators were used to determine the level of uncertainty of the results of expert evaluations regarding the change in the value of the information component in the finished product of mechanical engineering: mathematical expectation of value (M (x); absolute deviation of possible random values of value from mathematical expectation of value; range of variation; variance of value; mean square deviation of change in value; coefficient of variation of random change in value.

The mathematical expectation M (x) is determined by the formula (1):

$$M(x) = \bar{x} = \frac{x_1 + x_2 + ... + x_{n-1} + x_n}{n} \quad (1)$$

where: $M(x)$ - mathematical expectation of price; $x_1, x_2, ...x_{n-1}, x_n$ - set prices; n - the number of observations.

Absolute deviation of possible random values of price from mathematical expectation of price. When selling a product in different markets or different customers, you need to compare the absolute deviation of the price from its average level. Large absolute variations indicate the possibility of price risk. Absolute deviations are determined by the following formula (2):

$$\Delta x_i = \left| x_i - M(x) \right| \tag{2}$$

where: Δx_i - absolute deviation of possible random values of price from mathematical expectation of price.

The range of variation in prices. The difference between the highest and lowest set prices (3):

$$R = x_{\max} - x_{\min} \tag{3}$$

where: R - the range of variation in prices; $x_{\max}$ - the highest set price; $x_{\min}$ - the lowest set price.

Dispersion of prices. A common characteristic "dispersion" random variable values around the mean or expected value is the variance, which is calculated by the following formula (4):

$$D(x) = \frac{\sum_{i=1}^{n} x_i^{\,2} w_i}{\sum_{i=1}^{n} w_i} - (M(x))^2 \tag{4}$$

Standard deviation of prices. To characterize the dispersion of random variable in those units where it is measured, applies standard deviation (5):

$$\delta(x) = \sqrt{D(x)} \tag{5}$$

where: $\delta(x)$ - standard deviation of prices.

Variation coefficient of price. Expressed as a percentage of the ratio of the root mean square deviation to the mathematical expectation (6):

$$V = \frac{\delta(x)}{M(x)} \times 100\%. \tag{6}$$

where: V – coefficient of variation of prices.

According to the approach proposed, the expected value of the information and software component of the product of machine-building enterprise, for 5 stages of product introduction to the market, is calculated according to the formula of mathematical expectation M (x) (1.). Summary calculation values are expected for the Alstom Corporation, are presented in Table 2.

Table 1. Results of expert assessments and calculations of risk values of change in the value of information for Alstom Corporation (Germany, EU)

1 expert

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	703 000	755 000	735000	731 000	4 000	52 000	688000000	26229,7541	3,588201655
2	704 000	760 000	740000	734 667	5 333	56 000	805333333,3	28378,3955	3,862758013
3	705 000	765 000	750000	740 000	10 000	60 000	975000000	31224,99	4,219593242
4	702 000	780 000	750000	744 000	6 000	78 000	1548000000	39344,6311	5,288256874
5	703 500	770 000	740000	737 833	2 167	66 500	1109083333	33302,9028	4,513607785

2 expert 3687500

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	713 000	775 000	750000	746 000	4 000	62 000	973000000	31192,9479	4,181360311
2	714 000	770 000	750000	744 667	5 333	56 000	805333333,3	28378,3955	3,810885703
3	715 000	785 000	750000	750 000	0	70 000	1225000000	35000	4,666666667
4	712 000	785 000	760000	752 333	7 667	73 000	1376333333	37098,9667	4,931187427
5	713 500	775 000	750000	746 167	3 833	61 500	956583333,3	30928,6814	4,145009793

3 expert 3739167

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	710 000	775 000	750000	745 000	5 000	65 000	1075000000	32787,1926	4,400965453
2	700 000	770 000	750000	740 000	10 000	70 000	1300000000	36055,5128	4,872366588
3	705 000	775 000	750000	743 333	6 667	70 000	1258333333	35472,9944	4,772151716
4	702 000	775 000	760000	745 667	14 333	73 000	1486333333	38552,9938	5,170271859
5	703 500	755 000	750000	736 167	13 833	51 500	806583333,3	28400,4108	3,857877853

4 expert 3710167

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	690 000	775 000	730000	731 667	-1 667	85 000	1808333333	42524,5027	5,81200493
2	580 000	770 000	735000	695 000	40 000	190 000	10225000000	101118,742	14,54945929
3	655 000	775 000	740000	723 333	16 667	120 000	3808333333	61711,6953	8,531570775
4	700 000	775 000	750000	741 667	8 333	75 000	1458333333	38188,1308	5,148961455
5	650 500	755 000	750000	718 500	31 500	104 500	3474250000	58942,7689	8,203586479

5 expert 3610167

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	695 000	775 000	730000	733 333	-3 333	80 000	1608333333	40104,0314	5,468731553
2	680 000	770 000	735000	728 333	6 667	90 000	2058333333	45368,8586	6,229133908
3	675 000	775 000	740000	730 000	10 000	100 000	2575000000	50744,4578	6,951295593
4	770 000	775 000	750000	765 000	-15000	5 000	175000000	13228,7566	1,729249223
5	670 500	755 000	750000	725 167	24 833	84 500	2247583333	47408,6842	6,537625946

3681833

Table 2. Summary of expected value of Alstom Corporation ($\bar{V}_{ex}^{i}$) (Source: own development)

Stage	Expert				
	1	2	3	4	5
1	731000	746000	745000	731667	733333
2	734667	744667	740000	695000	728333
3	740000	750000	743333	723333	730000
4	744000	752333	745667	741667	765000
5	737833	746167	736167	718500	725167

A composite matrix of variance variance of experts' estimates of the levels of value calculated by formula (4.) is presented in table 3.

Table 3. Summary matrix of variances of deviation of experts' estimations on levels of value for enterprise «Alstom» (Source: own development)

Stage	Expert				
	1	2	3	4	5
1	688000000	973000000	1075000000	1808333333	1608333333
2	805333333,3	805333333,3	130000000	10225000000	2058333333
3	975000000	1225000000	1258333333	3808333333	2575000000
4	1548000000	1376333333	1486333333	1458333333	175000000
5	1109083333	956583333,3	806583333	3474250000	2247583333

The next, fourth stage of the methodological approach involves the calculation of the average value of the information component of the product for each stage of the introduction of finished products of machine-building enterprise on the market. In order to implement this step, the average values of the variance values of the value levels for each step were calculated by the formula (7):

$$\bar{Dx} = \frac{1}{\sum_{j=1}^{m} r_j \times d_{ij}^2}. \tag{7}$$

where: $\frac{1}{r_j}$. - this rank j-th expert; d_{ij}^2 - the variance values of the deviations of each j-th expert.

For example, we calculate the average value of the variance in the deviation of the value levels for the first stage of introducing the product to the market.

$$\bar{Dx} = \frac{1}{\sum_{j=1}^{m} r_j \times d_{ij}^2} = \frac{1}{\frac{1}{688000000} + \frac{1}{973000000} + \frac{1}{1075000000} + \frac{1}{1808333333} + \frac{1}{1608333333}} = 218044147$$

The average values of the variance values of variance levels for each stage of expert estimates for the Alstom Corporation are presented in table 4. On the basis of the obtained results of the estimation of the average value of the variance values levels, the average level of value for each stage of product introduction on the market was calculated by the sum of estimates of all experts. The average value is determined by the formula (8):

$$\bar{V}_{\exp ected}^{i} = \sum_{j=1}^{m} R_{ij} \times V_{ex}^{ij} \tag{8}$$

where: $\bar{V}_{ex}^{ij}$ - the expected value for each step; R_{ij} - the variance estimate for each step. Moreover, the variance estimate is as follows using the formula (9).

$$R_{ij} = \frac{D_x}{d_i} \quad (9)$$

So to get the value R_{ij} it is necessary to divide the average value of each stage of the value assessment by the average variance of each stage by each expert.

The example of the calculations for the first phase, will hold calculation index R_{ij}.

$R_1 = \frac{218044147}{688000000} = 0{,}32$;

$R_2 = \frac{218044147}{973000000} = 0{,}22$; $R_3 = \frac{218044147}{1075000000} = 0{,}2$;

$R_4 = \frac{218044147}{1808333333} = 0{,}12$; $R_5 = \frac{218044147}{1608333333} = 0{,}13$

Table 4. Average values of variances of deviation of value levels for each stage of expert estimates for the Alstom Corporation

	$\sum_{j=1}^{m} r_j \times d_{ij}^2$	$\bar{\bar{D}}x$
1 Stage	4,5862309	218044147
2 Stage	1,0759408	92942150,85
3 Stage	3,287609	304173154
4 Stage	8,4453609	118408220,3
5 Stage	3,9195809	255129085,7

The total estimate of the expected value is calculated by summing the values $\bar{V}_{ex}^{ij}$, which were expected at each stage of product introduction to the market. Let's find an indicator $\bar{V}_{ex}^{i}$ for the first stage by the formula (8):

$$\bar{P}_{ex}^{i} = \sum_{j=1}^{m} = 0{,}3 \times 731000 + 0{,}22 \times 734667 + 0{,}2 \times 740000 + 0{,}12 \times 744000 + 0{,}13 \times 737833 = 737597{,}8$$

Then the average value that is expected from all the expert data for the other stages of implementation is calculated, on the basis of which a coefficient is calculated, which shows the share of the value in the cost of production of machine-building enterprise, which in the last stage is included in the price.

It is proposed to calculate this factor by referring the average value of the expected value to the cost of machine-building enterprise by the following formula (10):

$$R_{info} = \frac{\bar{V}_{ex}^{i}}{Cost_i} \quad (10)$$

The results of the calculation of the ratio of the value of information for the Alstom Corporation are presented in table 5.

Table 5. Results of calculation of the Factor of a share of value of information component for the Alstom Corporation.

Indicator	Stage				
	1	2	3	4	5
Cost, (euro)	3640890	3640890	3640890	3640890	3640890
Expected value ($\bar{V}_{ex}^{i}$), (euro)	737597,779	738987,289	740776,267	758869,263	736671,324
The ratio of the value of information (R_{info})	0,202587219	0,20296886	0,203460216	0,208429605	0,20233276

It is recommended to add this factor to the price for finished products of machine-building enterprises as a surcharge. In addition, the values of this coefficient, calculated for each stage of promotion and introduction of the product on the market show that the proportion of value that was calculated and added to the price, according to calculations remains approximately the same in all 5 stages. This indicates that there is no risk of impairment or change in the value of the information component in the price structure of finished products of machine-building enterprises. The proposed approach to evaluate the value of the information component in the structure of the price of products of machine-building enterprises allows to estimate the degree of risk of its depreciation according to each stage of introduction of such goods on the market.

Table 6. Results of expert assessments and calculations of the risk value of information value change for the Siemens Corporation (Germany, EU).

1 expert

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	3 500	10 500	7400	7 133	267	7 000	12303333,33	3507,61077	49,17211364
2	3 400	9 000	7000	6 467	533	5 600	8053333,333	2837,83955	43,88411681
3	5 000	11 500	7500	8 000	-500	6 500	10750000	3278,71926	40,98399078
4	3 200	12 000	5 000	6 733	-1 733	8 800	21613333,33	4649,01423	69,04476583
5	2 800	10 000	4500	5 767	-1 267	7 200	14163333,33	3763,42043	65,26162595

2 expert 34 100

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	2 700	10 500	7500	6 900	600	7 800	15480000	3934,46311	57,02120456
2	3 500	9 500	7000	6 667	333	6 000	9083333,333	3013,85689	45,2078533
3	3 700	8 500	6500	6 233	267	4 800	5813333,333	2411,08551	38,68051619
4	4 500	9 000	5 500	6 333	-833	4 500	5583333,333	2362,90781	37,30907073
5	5 100	7 500	4500	5 700	-1 200	2 400	2520000	1587,45079	27,8500138

31 833

3 expert

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	2 800	9 500	6500	6 267	233	6 700	11263333,33	3356,08899	53,5546116
2	3 500	10 500	6000	6 667	-667	7 000	12583333,33	3547,29944	53,20949163
3	3 700	9 000	6000	6 233	-233	5 300	7063333,333	2657,69324	42,63678987
4	3 500	7 500	5 500	5 500	0	4 000	4000000	2000	36,36363636
5	3 000	7 500	5000	5 167	-167	4 500	5083333,333	2254,62488	43,63790083

4 expert 29 833

Етап	Цінність min	Цінність max	Цінність нв	M(x)	Δ X	R (розмах варіації)	D (x) дисперсія	∑ (X)	V (варіація)
1	2 900	9 500	6000	6 133	-133	6 600	10903333,33	3302,01958	53,83727583
2	3 200	10 500	5900	6 533	-633	7 300	13623333,33	3690,98	56,49459178
3	3 500	11 200	5500	6 733	-1 233	7 700	15963333,33	3995,41404	59,33783224
4	3 500	8 500	5 200	5 733	-533	5 000	6463333,333	2542,30866	44,34259294
5	3 500	9 500	5000	6 000	-1 000	6 000	9750000	3122,499	52,04164999

5 expert 31 133

Stage	Value min	Value max	Value nv	M(x)	Δ X	*R* (range of variation in prices)	D (x) dispersion	∑ (X)	V (Variation coefficient)
1	2 500	10 500	7300	6 767	533	8 000	16213333,33	4026,57837	59,50608422
2	3 500	9 500	7500	6 833	667	6 000	9333333,333	3055,05046	44,70805556
3	3 200	8 500	7200	6 300	900	5 300	7630000	2762,24546	43,84516609
4	3 000	7 500	7 000	5 833	1 167	4 500	6083333,333	2466,44143	42,28185311
5	3 000	6 500	6500	5 333	1 167	3 500	4083333,333	2020,72594	37,88861142

31 067

It was carried out the value of the information component in the price of products of machine-building enterprises for Siemens Corporation, using the above approach. The results of expert assessments and for Siemens are presented in Table. 6.

The summary of expected value estimates for «Siemens» is presented in Table 7.

Table 7. Summary of expected value of Siemens Corporation ($\overline{V}_{ex}^{i}$) (Source: own development)

Stage	Expert				
	1	2	3	4	5
1	7 133	6900	6267	6133	6767
2	6 467	6667	6667	6533	6833
3	8 000	6233	6233	6733	6300
4	6 733	6333	5500	5733	5833
5	5 767	5700	5167	6000	5333

A summary of the variance matrix of the deviations of experts' estimates of the levels of value calculated by the formula (8.) Is presented in Table 8.

Table 8 Summary matrix of variances of deviation of experts' estimations on levels of value for the Siemens Corporation (Source: own development)

Stage	Expert				
	1	2	3	4	5
1	12303333,3	15480000	11263333,3	10903333,3	16213333,3
2	8053333,3	9083333,3	12583333,3	13623333,3	9333333,3
3	10750000	5813333,3	7063333,3	15963333,3	7630000
4	21613333,3	5583333,3	4000000	6463333,3	6083333,3
5	14163333,3	2520000	5083333,3	9750000	4083333,3

The calculation of the average values of the variances of the deviation of the value levels for each stage was performed according to the formula (7):

For example, we calculate the average value of the variance in the deviation of the value levels for the first stage of the introduction of the product on the market for Siemens Corporation.

$$\bar{Dx} = \frac{1}{\sum_{j=1}^{m} r_j \times d_{ij}^2} = \frac{1}{\frac{1}{12303333,3} + \frac{1}{15480000} + \frac{1}{11263333,3} + \frac{1}{10903333,3} + \frac{1}{16213333,3}} = 2576956,705$$

грн.

The average values of the variance values of variance levels for each stage of expert estimates for Siemens Corporation are presented in table 9. Based on the results of the estimates of the average value of variance value levels, the average level of value for each stage of implementation of goods on the market was calculated by the sum of estimates of all experts.

In the example of calculations for the first stage, we will calculate the indicator R_{ij}.

$$R_1 = \frac{2576956,705}{12303333,3} = 0,2,\ R_2 = \frac{2576956,705}{15480000} = 0,16, R_3 = \frac{2576956,705}{11263333,3} = 0,23,$$

$$R_4 = \frac{2576956,705}{10903333,3} = 0,23, R_5 = \frac{2576956,705}{16213333,3} = 0,16$$

Table 9 Average values of variance values deviations for each stage of expert assessments for the Siemens Corporation (Source: own development)

	$\sum_{j=1}^{m} r_j \times d_{ij}^2$	$\bar{\bar{Dx}}$
1 Stage	3,8805507	2576956,705
2 Stage	4,942807	2023142,891
3 Stage	6,0032307	1665769,987
4 Stage	7,9447507	1258693,314
5 Stage	1,0116106	988519,7061

Let's find an indicator $\bar{V}_{ex}^{i}$ for the first phase for Siemens Corporation by the formula (8):

$$\bar{V}_{ex}^{i} = \sum_{j=1}^{m} = 0,2 \times 7133 + 0,16 \times 6900 + 0,23 \times 6267 + 0,23 \times 6133 + 0,16 \times 6767 = 6601,56$$

грн.

The results of the calculation of the ratio of the value of information for the Siemens Corporation are presented in table 10.

The calculations make it possible to obtain information about the value of the information component in the cost structure and to form a mathematically sound level of value that can be added to the price.

Table 10 Results of calculation of the Factor of a share of value of information component for the Siemens Corporation (Source: own development)

Indicator	Stage				
	1-й	2-й	3-й	4-й	5-й
Cost, (euro)	34812,6	34812,6	34812,6	34812,6	34812,6
Expected value ($\overline{V}_{ex}^{i}$), (euro)	6601,56	6632,84	6573,6	5873,87	5542,6
The ratio of the value of information (R_{info})	0,18963134	0,19052987	0,18882818	0,16872827	0,15921246

The main advantage of the proposed methodology is the ability to take into account the change in the value of information and the use of mathematical apparatus to measure the degree of risk of impairment of the information component in the price of machine-building products.

5. Conclusions.

It has been developed the scientific-methodical approach to the calculation of the price for the products of machine-building enterprises. It applies a system of mathematical and statistical evaluation of the risk of reducing the value of the information component of the product and taking this component into account in the price structure.

This approach is based on the formation of the price of products of machine-building enterprises with the addition of a mark-up, which takes into account the coefficient of value of information. It is based on determining the value of the information component in the price by a group of experts in the field with the subsequent calculation of the risk of depreciation of this component by the stages of introduction of such a product on the market.

The method of calculating the price for scientific production of "three points" and the methods of mathematical estimation of price risk were chosen as the basis for the implementation of this approach, but they were considered in synergistic interaction. They have been adapted and refined precisely to calculate the value of the information component of the price of machine-building products.

The main advantage of the technique is the ability to account for changes in the value of information and to measure the degree of risk of impairment of the information component in the price of machine-building products, including in supply chain logistics systems. This gives the opportunity to obtain information about the share of the value of the information in the cost structure and to form a mathematically justified level of value that can be added to the price.

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