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Features of developing indicators for the economic assessment of the quality of business incubator services

Abstract: The University business incubator is not an independent organisation, but is a division of the university. The development of indicators for the economic assessment of the business incubator services quality is a preparatory stage in developing a methodology. Its purpose is to create tools for analysing the quality of services, which will identify the strengths and weaknesses of the existing business incubator, like determine the directions of development. The study subject was the economic assessment of university business incubators. The study object was a university business incubator. The study aimed to develop economic assessment indicators for four types of university technological, non-technological, project training and mixed business incubators. Analytical, logical and mathematical research methods were used to achieve this purpose. The study used scientific works in innovative approaches to developing the university environment, like statistical data and analytical materials. The author developed blocks of indicators for evaluating a university business incubator, considering its type according to the classification of the author of the study: technological, non-technological, project training and mixed. The indicators of the economic assessment of university business incubators serve as the basis for developing a methodology to evaluate the services provided by a university business incubator.

Keywords: university business incubator, economic assessment, economic efficiency coefficients, intellectual activity results, small innovative enterprise, project training program.

Abbreviations:

CSI is customer satisfaction index,
IAR is intellectual activity results,
SIE is small innovative enterprise,
SPS is scientific and pedagogical staff.

Introduction

The university business incubator is not an independent organisation, but it is a division of the university. The indicators development for the economic assessment of the business incubator services quality is a preparatory stage in developing a methodology. Its purpose is to create tools for analysing the quality of services, which will identify the strengths and weaknesses of the existing business incubator, like determine the directions of development. It is worth noting that the economic assessment of direct indicators is difficult due to the fact that it is not

always possible to determine the degree of participation of a business incubator in the performance indicators of the university and SIEs created on its basis. The evaluation of indirect indicators should consider the influence of external and internal factors unrelated to the activities of the business incubator.

The study subject was the economic assessment of university business incubators.

The study object was a university business incubator.

The study aimed to develop economic assessment indicators for four types of university technological, non-technological, project training and mixed business incubators.

Analytical, logical and mathematical research methods were used to achieve this purpose.

The study used scientific works in innovative approaches to developing the university environment, like statistical data and analytical materials.

Results

Common indicators include the commercialization coefficient of IAR results and the efficiency coefficient of IAR creation, presented in the article "Academic entrepreneurship in the University community: world and Russian experience" (*Medvedeva, 2023a*) and the appendix (*Table 1*). These coefficients demonstrate the share of commercialized IARs in the total number of IARs, their market demand and payback. This subgroup also includes the following indicators below.

1. The growth rate of jobs created for implementing university's IARs, characterizing the impact of the creation of innovative university units on strengthening economic stability in the region. The creation of new jobs for implementing universities' intellectual property through SIEs will reduce the unemployment rate in the region. The growth rate is determined by the formula:

$$K_{hw} = \frac{n_{cw}}{N_{cw}}, \quad (1)$$

where

n_{cw} is the number of jobs created in SIEs for implementing IAR in the reporting period;

N_{cw} is the total number of jobs created in SIEs for implementing IAR.

To determine the range of values of this coefficient, the author of the study decided to extrapolate the average growth in the number of high-performance jobs in the fields of "Professional, Scientific and Technical Activities" and "Research and Development." The calculation of the growth indicators is presented in the appendix (*Table 2*). The range of values of the indicators is 1,032-1,054. The value of the indicator exceeding the specified limits indicates an increased importance of the activities of the university business incubator on the state of the regional economy. The value of the indicator below the specified range indicates a slight impact (lack thereof) of the university business incubator's activities on the stabilization of the region's economy.

2. The growth rate of the number of licensing agreements concluded by university's SIEs, demonstrating the interest of external users in innovative university developments and determined by the formula:

$$K_{la} = \frac{n_{la}}{N_{la}}, \quad (2)$$

where

n_{la} is the number of licensing agreements concluded by university's SIEs in the reporting period;
N_{la} is the number of licensing agreements concluded by university's SIEs in the previous period.

The range of values for technological and non-technological indicators is determined according to the average value for the relevant universities in 2023 according to the table in appendix (*Table 3*). The study author suggests setting the optimal range for technological business incubators from 1.8 to 4.5. Since at the moment the number of SIEs created with the participation of socio-humanitarian profile universities is significantly lower than the above range, the author suggests determining the optimal range for non-technological business incubators from 1.2 to 1.6. The value of the indicator exceeding these limits indicates an increased interest of third-party organisations in the intellectual property of university's SIEs and the positive effect of the university business incubator's mediation activities. The value of the indicator below the specified range indicates either the low demand for IAR of university's SIEs, or the weak intermediary activity of the university business incubator.

3. The share of licensing agreements concluded during the university business incubator exhibitions and conferences, like when the university is represented at external events (this indicator demonstrates the significance of these events and participation in them for the implementation of innovative goods, works and services of the university) in the total number of licensing agreements. The specified indicator is determined by the formula:

$$Y_{la} = \frac{n_{la}}{N_{la}}, \quad (3)$$

where

n_{la} is the number of licensing agreements concluded by university's SIEs in the reporting period;
N_{la} is the number of licensing agreements concluded by university's SIEs in the previous period.

To determine the values range, consider the example of St. Petersburg State University. The total number of licensing agreements concluded by St. Petersburg State University, according to the monitoring of the higher education institutions' effectiveness in 2023 was 44 (*Monitoring..., 2021*), while the number of licensing agreements concluded by the St. Petersburg State University business incubator was 25. Thus, the share of licensing agreements concluded by the business incubator of St. Petersburg State University is approximately 57% of the total number of licensing agreements. In this regard, the author suggests using this value as the average and the range of optimal values for this indicator from 0.45 to 0.65 of the total number of university licensing agreements. The indicator value exceeding the specified limits indicates the increased significance of these events and the strong dependence of concluding agreements on the university business incubator activities in terms of holding events and participating in them. The indicator value below the specified range indicates either a small number of these activities, or their insignificant impact on concluding agreements for a particular university.

4. The share of the royalties' total amount received from the sale of innovative goods, works and services created at the university's SIEs in the total volume of the university's total cash flows. The indicator demonstrates the significance of cash flows from the joint work of the university business incubator and SIE to finance the university development at its expense. The indicator is determined by the formula:

$$Y_r = \frac{n_r}{N_r}, \quad (4)$$

where

n_r is the amount of royalties received from the sale of innovative goods, works and services created at the university's SIEs;

N_r is total income of the university.

To determine the area of indicator' optimal values, the author proposes to extrapolate the average value of the R&D income share in the total income of the university for 2023 according to the table in appendix (*Table 4*). For technological incubators, the area of optimal values will be from 0.2 to 0.4. For non-technological business incubators, the optimal values area will be from 0.04 to 0.06. The value of the indicator exceeding these limits indicates the increased significance of income from the joint work of the university business incubator and SIEs to strengthen the university's financial stability and finance the development of its research activities. The indicator value below the specified range indicates a minor impact of income from the joint work of the university business incubator and SIEs on the financial stability of the university. It is advisable for this indicator to have a positive dynamic over time.

5. The university's SIEs growth rate, supervised by the business incubator, shows the university's interest in commercializing IAR through the creation of SIE and is determines by the formula:

$$K_{hsie} = \frac{n_{sie}}{N_{sie}}, \quad (5)$$

where

n_{sie} is the number of SIEs created with the participation of the university business incubator in the reporting period;

N_{sie} is the total number of SIEs founded by the university in the reporting period.

The author of the study suggests to take 3 years preceding the year of calculation as the reporting period, considering the existing, not previously closed SIEs. For the previous period, respectively, data of 3 years preceding the reporting period are used. The author determines the range of specified coefficient values for technological and non-technological business incubators by extrapolating the average value of the number of SIEs presented in appendix (*Table 5*; *Table 6*) and determining the minimum and maximum optima based on it. For technological business incubators, the range of optimal values will be from 0.1 to 0.2. It is worth noting that at this stage non-technological business incubators show greater growth, considering the fact that with a total small number of SIEs, a change even by one gives higher growth. For non-technological business incubators, the range of optimal values will be from 0.15 to 0.3. The value of the indicator exceeding the specified limits (1.31–1.5) indicates the high interest of the university in the IAR's commercialization to a greater extent due to SIEs supervised by the university business incubator. The value of the indicator below the specified range indicates that the university is not interested in commercializing IAR in this way. In the case of a high coefficient (more than 1.5), there is a high probability that some of the newly formed SIEs were closed during the billing period. Thus, SIEs that were registered and closed during the billing period is not worth included in this calculation.

6. The university's SIEs attrition rate, supervised by the business incubator, is calculated for the reporting period and is the inverse of the growth rate and is determined by the formula:

$$K_{dsie} = \frac{n_{sie}}{N_{sie}}, \quad (6)$$

where

n_{sie} is the number of liquidated SIEs in the reporting period, supervised by the SIEs' university business incubator;

N_{sie} is the total number of SIEs founded by the university in the reporting period.

It is advisable that the specified coefficient's extreme values do not exceed the extreme values of the university's SIEs growth coefficient, in connection with which the author of the study suggests determining their values from 0.1 to 0.3. It is significant to consider that the coefficient value in dynamics should tend to zero.

7. The proportion of liquidated university's SIEs over the entire period of the university's existence, supervised by a business incubator, characterizing what proportion of university's SIEs became to be operating at a loss. The indicator is determined by the formula:

$$Y_{dsie} = \frac{n_{dsie}}{N_{sie}}, \quad (7)$$

where

n_{dsie} is the number of liquidated SIEs for all time;

N_{dsie} is the total number of SIEs founded by the university.

The author suggests determining their values from 0.2 to 0.4. It is significant to consider that the coefficient value in dynamics should tend to zero.

8. The ratio of the cost of maintaining a business incubator and the university's income from commercialization IAR, characterizing the payback of the cost of maintaining a business incubator from the university's income from equity participation in the authorized capital of SIE in the reporting period, is determined by the formula:

$$K_{c3} = \frac{B_{ui}^1 + \ldots + B_{ui}^n}{C_{bi}}, \quad (8)$$

where

n is the number of SIEs founded by the university in the reporting period;

B_{ui} is income of the university from equity participation in the authorized capital of SIEs in the reporting period;

C_{bi} is the cost of maintaining a business incubator in the reporting period.

In many ways, this indicator is similar to the profitability indicator, in connection with which the author considers it possible to take as a basis the normative values of the average profitability from 1.05 to 1.2, since this interval allows us to assess the stability of the business incubator (*Profitability..., n.d.*). The value of the indicator exceeding these limits indicates an increase in the significance of the university business incubator's activities and the increase in the positive effect of its activities. The indicator value below the specified range indicates either the presence of internal problems of the university business incubator, or the influence of external factors that have a negative impact on its activities.

I.P. Mitrofanova and Yu.V. Zakharova, whose research in evaluating the effectiveness of the university's innovative infrastructure was considered in the author's article (*Medvedeva, 2023a*), propose to evaluate the joint participation of students and SPS in the innovative activities of the university (*Mitrofanova & Zakharova, 2017*). However, the author suggests considering them separately from each other due to the fact that the number of students significantly exceeds the number of university's SPS. In addition, their involvement in the activities of the business incubator should be more significant, as it provides them with the opportunity to implement

their research projects by the university. According to the above, the author developed the students and SPS participation coefficients in the business incubator activities.

9. The student participation rate in the business incubator, demonstrating their interest in creating and commercializing IAR through participation in incubation programs, is determined by the formula:

$$K_{ps} = \frac{n_s}{N_s}, \quad (9)$$

where

n_s is number of students participating in incubation programmes;

N_s is the total number of university students, respectively.

This coefficient was developed on the basis of the students and SPS involvement coefficient in innovative activities by I.P. Mitrofanova and Yu.V. Zakharova, in connection with which the indicator value is similarly determined in the range from 0 to 1. Despite the fact that this indicator should strive for 1, in real conditions its value does not exceed 0.2 (*Mitrofanova and Zakharova, 2017*). At the same time, the author considers it advisable to determine the range of optimal values from 0.2 to 0.4, since in modern conditions one of the university activities is to attract students to innovative activities (*Medvedeva, 2023a*).

10. The coefficient of participation in the activities of the business incubator of full-time SPS, demonstrating their interest in the creation and commercialization of IAR through participation in incubation programmes, is determined by the formula:

$$K_{pspe} = \frac{n_{spe}}{N_{spe}}, \quad (10)$$

where

n_{spe} is the number of SPS participating in incubation programmes;

N_{spe} is the total number of university's SPS.

This coefficient has similar trends with the coefficient of students' participation in the business incubator activities, in connection with which the author considers it advisable to determine the optimal range of values from 0.3 to 0.5, since in modern conditions one of the university activities is to provide SPS with the opportunity to implement their scientific projects by the university.

11. Savings when SIEs uses the university's preferential trademark by incubation programme' participants, showing the advantage of participating in the incubator programme in terms of brand sharing, is determined by the formula:

$$E_t = \frac{C_{pct}}{C_{fct}}, \quad (11)$$

where

C_{pct} is preferential cost of using the university's trademark for incubation programme participants in the reporting period;

C_{fct} is the full cost of using the university's trademark for the reporting period.

This indicator's value is calculated only for those universities that provide this benefit to participants of incubation programmes. For other universities, the indicator value is assumed to be 0. Due to the fact that this indicator is rather optional, but recommended for calculation, the presence of an optimal range of values is not mandatory. The author suggests setting the optimal

range of values of this indicator in the range from 0.7 to 0.85. The differentiation in calculated values demonstrates the benefits of creating a SIE in a particular university in terms of using a joint university brand.

It is worth noting that most of the listed indicators only indirectly assess the quality of services provided by the business incubator, since it is in some way a tool for commercialization of IAR, an intermediary between the university itself and SIE created on its basis.

Particular indicators of economic assessment for technological business incubators are related to the conduct of development work, the need to use certain equipment and laboratories, as well as the form of research results and payback periods for projects. The following indicators belong to this subgroup below.

1. The share of patents for inventions, utility models, industrial designs and breeding achievements developed and implemented by SIEs in the total number of university patents, demonstrating the degree of SIE's participation in obtaining patents for intellectual property of universities. The indicator is determined by the formula:

$$Y_p = \frac{n_p}{N_p}, \quad (12)$$

where

n_p is the number of patents for inventions, utility models, industrial designs and breeding achievements, developed and implemented SIEs;

N_p is total number of university patents.

The range of values of this indicator will be determined based on the data on the amount of data from St. Petersburg State University. According to the "Patent. Service," St. Petersburg State University has 170 patents. The St. Petersburg State University business incubator has 12 patents. Thus, the share was 7%. To determine the extreme values, the author of the study suggests considering the difference in indicators between the number of St. Petersburg State University's SIEs and universities with the largest and smallest number of SIEs – TSU and St. Petersburg State Electrotechnical University named after V.I. Ulyanov Lenin "LETI," respectively. According to Table 4, the number of SIEs at TSU is 50% higher than at St. Petersburg State University, while at the LETI it is 81% less (*Table 4*). The optimal range of values for technological business incubators will be from 0.05 to 0.11. The value of the indicator exceeding these limits indicates that the university is striving to commercialize its intellectual property mainly through SIEs supervised by the business incubator. The value of the indicator below the specified range indicates that the university prefers other ways of bringing IAR to the market.

2. The growth coefficient of the SIE technologies released on the market, developed on the basis of the intellectual property of the university and brought income, showing their relative increase in the number of these technologies in the reporting year compared to the previous year, determined by the formula:

$$K_{ht} = \frac{n_t}{N_t}, \quad (13)$$

where

n_t is the number of SIE technologies released on the market, developed on the basis of the university's intellectual property and generating revenue, in the reporting year;

N_t is the number of SIE technologies released on the market, developed on the basis of the university's intellectual property and generating revenue, in the previous year.

This indicator should be strictly positive. To determine the maximum value, the author decided to extrapolate the average increase in the cost of shipping innovative goods, works and services of his own production in accordance with the appendix (*Table 7*). Thus, the optimal range of values will be from 1.16 to 1.26. The value of the indicator exceeding these limits indicates the increased importance of the university business incubator in terms of mediation in the release of competitive SIE technologies to the market. The value of the indicator below the specified range indicates either a decrease in inventive activity at university's SIEs, or that the consulting and mediation activities of the university business incubator did not lead to the expected results.

3. Profitability of innovative projects developed at university's SIEs, showing the ratio between costs and profits for each project. The indicator is determined by the formula:

$$R_{ip} = \frac{P_{ip}}{C_{ip}}, \quad (14)$$

where

P_{ip} is валовая прибыль от реализации инновационных проектов;

C_{ip} is затраты на разработку и реализацию инновационных проектов.

The author of the study considers it possible to take as a basis the normative values of the average profitability from 1.05 to 1.20, since this interval allows us to assess the stability of the business incubator (*Profitability…, n.d.*). The value of the indicator exceeding these limits indicates an increase in the importance of the university business incubator and an increase in the positive effect of its activities. The value of the indicator below the specified range indicates either the presence of internal problems of the university business incubator, or the influence of external factors that have a negative impact on its activities.

4. Savings in using preferential access to university laboratory equipment for participants in incubation programs, showing the advantage of participating in the incubator program in terms of finding an alternative to equipment leasing, determined by the formula:

$$E_e = \frac{C_{pce}}{C_{fce}}, \quad (15)$$

where

C_{pce} is preferential cost of using the university's laboratory equipment for participants of incubation programs in the reporting period;

C_{fce} is the full cost of using the university's laboratory equipment for the reporting period.

The value of this indicator is calculated only for those universities that provide this benefit to participants in incubation programs. For other universities, the indicator value is assumed to be 0. Due to the fact that this indicator is rather optional, but recommended for calculation, the presence of an optimal range of values is not mandatory. The author of the study suggests setting the optimal range of values for this indicator in the range from 0.85 to 0.7. The differentiation in calculated values demonstrates the benefits of creating SIEs in a particular university from the point of view of sharing the university's laboratory equipment.

5. The growth rate of inventions and technologies created in SIE, supervised by the business incubator, determined by the formula:

$$K_{hiat} = \frac{n_{iat}}{N_{iat}}, \quad (16)$$

where

n_{iat} is number of inventions and technologies created at SIE, supervised by the University Business incubator, in the reporting period;

N_{iat} is the total number of inventions and technologies created at SIE, supervised by the university business incubator, in the previous period.

This indicator must be strictly greater than one. To determine the maximum value, the author decided to extrapolate the average value of the increase in the number of advanced production technologies according to the appendix (*Table 8*). Thus, the optimal range of values for this indicator will be from 1.1 to 1.2. The value of the indicator exceeding these limits indicates an increased importance of the university business incubator in terms of stimulating the development of inventions and technologies' SIEs. The value of the indicator below the specified range indicates the stagnation of the development of new inventions and technologies in SIE, supervised by the university business incubator.

6. The efficiency coefficient of the university's investments in SIE implementing technological projects, as well as the cost of maintaining a business incubator, demonstrating the return on invested funds from the income from the implementation of these projects, determined by the formula:

$$K_e = \frac{V}{I+C_{bi}}, \quad (17)$$

where

V is the average annual profit of university SIEs implementing technological projects;

I is the amount of investment in creating SIE implementing technology projects;

C_{bi} is среднегодовая величина затрат на содержание университетского бизнес-инкубатора.

Since this coefficient is inherently similar to the profitability indicator, the author of the study considers it possible to take as a basis the normative values of average profitability from 1.05 to 1.2 (*Profitability…, n.d.*). The value of the indicator exceeding these limits indicates an increased importance of the university business incubator and an increase in the positive effect of its activities. The value of the indicator below the specified range indicates either the presence of internal problems of the university business incubator, or the influence of external factors that have a negative impact on its activities.

The indicators of the economic assessment of non-technological business incubators include:

1. The proportion of copyright objects developed by university's SIEs in the total volume of university copyright objects, demonstrating the degree of SIE's participation in the development of protected intellectual property objects of universities. The value of the indicator is determined by the formula:

$$Y_{ok} = \frac{n_{ok}}{N_{ok}}, \quad (18)$$

where

n_{ok} is number of copyright objects developed and implemented by university's SIEs;

N_{ok} is total number of university copyright objects.

Since this indicator for non-technological incubators is essentially equivalent to the indicator "the share of patents for inventions, utility models, industrial designs and breeding achievements developed and implemented by SIE in the total number of university patents" proposed for evaluating technological business incubators, the author of the study considers it possible to use a similar range of values from 0.05 to 0.11. The value of the indicator exceeding the specified limits indicates that the university strives to create intellectual property mainly through SIE forces supervised by the business incubator. The value of the indicator below the specified range indicates that the university prefers other ways of creating intellectual property objects of the university.

2. The growth coefficient of income-generating social and humanitarian projects created in SIE, supervised by the business incubator, demonstrating the growth or decline trends of these projects, determined by the formula:

$$K_{hshp} = \frac{n_{shp}}{N_{shp}}, \quad (19)$$

where

n_{shp} is the number of profitable social and humanitarian projects created in SIE, supervised by the business incubator, in the reporting year;

N_{shp} is the number of profitable social and humanitarian projects created in SIE, supervised by the business incubator, in the previous year.

The specified coefficient must be strictly greater than 1. To determine the maximum value, the author decided to extrapolate the average increase in internal research costs in social sciences and humanities according to the appendix (*Table 9*). Thus, the range of values of this indicator will be from 1.1 to 1.2. The value of the indicator exceeding these limits indicates an increased importance of the university business incubator's activities in terms of mediation during graduation social and humanitarian innovations of SIE to the market. The value of the indicator below the specified range indicates either a decrease in inventive activity at university's SIEs, or that the consulting and mediation activities of the university business incubator did not lead to the expected results.

3. The share of total income for all projects of each scientific direction of the socio-humanitarian sphere in the total income of all socio-humanitarian projects of the university's SIEs (this indicator allows you to determine in which branch of socio-humanitarian scientific knowledge there is the greatest interest in the commercialization of intellectual property of the university). The value of the indicator is determined by the formula:

$$Y_{pshp} = \frac{p_{shp}}{P_{shp}}, \quad (20)$$

where

p_{shp} is the total income of all projects in a certain area of social and humanitarian science;

P_{shp} is total income of all social and humanitarian projects.

This indicator does not require defining areas of values, as it characterizes the economic effect of projects in various fields of science and reflects the specialization of each individual business incubator.

4. The growth rate of private investments attracted through the mediation of the business incubator, which financed social and humanitarian projects, characterizing the activity of the

business incubator as an intermediary in establishing business contacts, determined by the formula:

$$K_{hpi} = \frac{n_{pi}}{N_{pi}}, \quad (21)$$

where

n_{pi} is the volume of private investments attracted through a business incubator that financed social and humanitarian projects in the reporting year;

N_{pi} is the volume of private investments attracted through a business incubator that financed social and humanitarian projects in the past period.

This coefficient must be greater than one. To determine the range of optimal values, the author of the study suggests extrapolating the average annual growth in domestic investment in research and development at the expense of the business sector according the appendix (*Table 10*). The optimal area for the growth rate of private investment in social and humanitarian projects of the business incubator will be from 1.08 to 1.18. The value of the indicator exceeding these limits indicates an increased importance of the mediation activities of the university business incubator and an increase in its positive effect. The value of the indicator below the specified range indicates that the university's mediation activities did not bring the expected results and needs to be improved.

5. The share of long-term social and humanitarian projects in the total volume of the specified university's SIEs projects supervised by the business incubator, characterizing the rationality of the distribution of projects with different deadlines and payback periods, to cover the costs of SIE activities and the functioning of business incubators. The value of the indicator is determined by the formula:

$$Y_{ltshp} = \frac{n_{lgshp}}{N_{shp}}, \quad (22)$$

where

n_{ltshp} is the number of long-term social and humanitarian projects implemented by university SIEs supervised by the business incubator.

N_{shp} is the total number of social and humanitarian projects implemented by SIE, supervised by the business incubator.

Since the economic effect of long-term projects is stretched over time, the financing of current activities is performed at the expense of income from implementing medium- and short-term projects. In this regard, the author of the study considers it advisable that the share of long-term projects does not exceed the total share of short- and medium-term projects.

6. The efficiency coefficient of the university's investments in SIE implementing social and humanitarian projects, as well as the cost of maintaining a business incubator, demonstrating the return on invested funds from the income from the implementation of these projects, determined by the formula:

$$K_{eshp} = \frac{n*P_{sie}^{a}}{n*I_{sie}+C_{bi}^{a}}, \quad (23)$$

where

P_{sie}^{a} is the average annual profit of the university's SIE, which implements social and humanitarian projects;

I_{sie} is the weighted average value of investments in creating one SIE implementing social and humanitarian projects;
C_{bi}^{a} is the average annual cost of maintaining a university business incubator;
n is number of SIEs implementing social and humanitarian projects.

Since this coefficient is inherently similar to the profitability indicator, the author of the study considers it possible to take as a basis the normative values of average profitability from 1.05 to 1.2 (*Profitability…, n.d.*). The value of the indicator exceeding these limits indicates an increased importance of the university business incubator and an increase in the positive effect of its activities. The value of the indicator below the specified range indicates either the presence of internal problems of the university business incubator, or the influence of external factors that have a negative impact on its activities.

The economic indicators for evaluating services to project training business incubators include:

1. The growth coefficient of participants in the project training programs of the business incubator, which characterizes the intensity of the business incubator's activities to involve students in entrepreneurial activity through the acquisition of necessary knowledge and competencies, determined by the formula:

$$K_{hpt} = \frac{n_p}{N_p}, \quad (24)$$

where
n_{pt} is number of participants in the project training programs of the business incubator, in the current year;
N_{pt} is the number of participants in the project training programs of the business incubator in the previous year.

To determine the area of optimal values of the indicator, we will consider the growth in the number of teams participating in LETI's project training programs in 2023 and the growth in the number of participants in the Sberbank youth accelerators. The increase in the number of teams participating in the project training programs of the LETI in 2023 was 1.6 (80 teams in 2023, 50 in 2022) (*Triple axel…, n.d.*). The increase in the number of participants in the Sberbank youth accelerators was 2.5 (*The number…, n.d.*). In this regard, the author considers it advisable to take the optimal range of values of the indicator from 1.5 to 2.05. The value of the indicator exceeding these limits indicates an increased importance of the project training activities of the university business incubator, as well as the growing interest of students in participating in these programs. The value of the indicator below the specified range indicates a decrease in the interest of students in acquiring entrepreneurial competencies and the low efficiency of the business incubator in attracting new participants in project training programs.

2. The growth rate of the number of graduates of the project training programs of the business incubator who have opened their business, characterizing the impact of the business incubator on the regional economy in terms of the formation of new producers and sellers of innovative goods, works and services, determined by the formula:

$$K_{hg} = \frac{n_g}{N_g}, \quad (25)$$

where

n_g is the number of graduates of the project training programs of the business incubator who have opened their business this year;

N_g is the total number of graduates of the project training programs of the business incubator who have opened their business.

To determine the area of optimal values of the indicator, we will consider the actual data on the growth of the number of young entrepreneurs in the Russian Federation. In 2021, the growth was 2.5 (*The share..., 2022*), in 2022 – 1.5 (*In Russia..., 2023*), in 2023 – 1,206 (*The authorities..., 2024*). The average annual growth is 1.74. In this regard, the author of the study suggests introducing an optimal range of values for this indicator from 1.3 to 1.74. The value of the indicator exceeding these limits indicates the increased importance of the university business incubator for creating of new enterprises. The value of the indicator below the specified range indicates that the activities of the university business incubator have not brought the expected results and require improvement.

3. The proportion of graduates of the business incubator's project training programs who have started their own business in the total number of graduates of these programs (this indicator demonstrates for which part of the participants in the incubation programs, obtaining services proved to be the most effective). This indicator considers the change in the number of graduates who have started their own business over the entire existence of the business incubator. The value of the indicator is determined by the formula:

$$Y_{ge} = \frac{n_{ge}}{N_g}, \tag{26}$$

where

n_{ge} is the number of graduates of the design and training programs of the business incubator who have opened their own business.

N_g is the total number of graduates of the design and training programs of the business incubator.

The author of the study suggests determining the optimal range of values for the indicator from 0.25 to 0.50, extrapolating the trend of the maximum and minimum share of people employed in small and medium-sized businesses from the total number of people employed in the economy in 2023 in the regions (*The leading regions..., 2023*). The value of the indicator exceeding these limits indicates the increased importance of the university business incubator for the creation of new enterprises. The value of the indicator below the specified range indicates that the activities of the university business incubator have not brought the expected results and require improvement.

4. The share of commercial organizations in the total number of participants in project training programs, which characterizes the demand for business incubator services from representatives of the private sector of the economy. The value of the indicator is determined by the formula:

$$Y_{co} = \frac{n_{co}}{N_{pt}}, \tag{27}$$

where

n_{co} is the number of commercial organizations participating in the project training programs of the university business incubator;

N_{pt} is the total number of participants in the project training programs of the business incubator.

This indicator applies only to those project training university business incubators that work simultaneously with students and commercial organizations, and therefore the author of the study suggests setting the optimal range from 0 to 0.3, since the main target audience of these business incubators should be students of the relevant university.

5. The share of commercial organizations of graduates of project training programs, whose profits from innovation activities increased after completing these programs, in the total volume of commercial organizations of graduates of these programs (this indicator characterizes the presence of positive changes in the cash flows of organizations after using the services of a business incubator). The value of the indicator is determined by the formula:

$$Y_{co} = \frac{n_{co}}{N_{co}}, \quad (28)$$

where

n_{co} is the number of commercial organizations of graduates of project training programs that have increased profits from innovation activities after completing these programs;

N_{co} is the total number of commercial organizations graduates of the project training programs of the business incubator.

In order to determine the range of optimal values of this indicator, the author of the study suggests using data on the results of the acceleration program "Axel.Social Order." According to the results of the program, 1/3 of the participants became executors of the social order (*Social order ..., 2023*), in connection with which the author of the study considers it advisable to determine the area of optimal values from 0.2 to 0.4. The value of the indicator exceeding these limits indicates the increased importance of the university business incubator for the creation of new enterprises. The value of the indicator below the specified range indicates that the activities of the university business incubator have not brought the expected results and require improvement.

6. The proportion of projects of various branches of science developed by participants in project training programs in the total volume of these projects, characterizing in which areas of innovation the entrepreneurial competencies acquired during participation in project training programs are most applicable.

$$Y_{pp} = \frac{n_{pp}}{N_{pp}}, \quad (29)$$

where

n_{pp} is the number of projects of some branch of science developed by the participants of the project training programs of the business incubator;

N_{pp} is the total number of projects developed by the participants of the project training programs of the business incubator.

This indicator does not require defining areas of values, as it reflects the specialization of each individual business incubator and the area of interest of the business incubator participants.

7. The level of satisfaction with the quality of the project training services of the participants of the incubation program, determined by calculating the CSI, which makes it possible to understand how the services of the business incubator meet the needs and expectations of the participants of the incubation programs.

For university business incubators of a mixed type, a set of indicators is used that combines indicators for other types of business incubators, depending on whether this unit coordinates SIE activities of different profiles and project training activities.

Conclusion

Thus, the author developed blocks of indicators for evaluating a university business incubator, considering its type according to the classification of the author of the study: technological, non-technological, project training and mixed. Since the university business incubator is a structural unit of the university, currently economic assessment is more concerned with indirect indicators. The indicators of the economic assessment of university business incubators serve as the basis for developing a methodology to evaluate the services provided by a university business incubator.

Conflict of interests

The author declares no conflict of interest.

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Appendix

Table 1. Efficiency coefficients of the university's innovation infrastructure

Name of the Coefficient	The Content of the Coefficient	Formula	Symbols
IAR commercialization coefficient	Assessment of the demand for IAR in the market	$K_k = \frac{n_k}{N_k}$	K_k is the coefficient of IAR commercialization; n_k is the number of commercialized IARs of the reporting period; N_k is total IARs number of the reporting period.
IAR creation efficiency coefficient	Evaluating the effectiveness of IAR commercialization transactions	$K_c = K_k \times \frac{P_p}{C_p}$	K_c is the efficiency coefficient of creating IAR; K_k is the coefficient of IAR commercialization; P_p is profit from IAR commercialization; C_p is the costs of obtaining IARs and their commercialization.
Growth rate	Assessment of the sustainability of the development of innovative infrastructure, taking into account the	$K_g = \frac{n_p}{N_p}$	K_g is the growth rate of the innovation infrastructure; n_p is the number of innovative infrastructure

	dynamics of jobs created by it		elements created in the reporting period; N_p is the total number of elements of the innovation infrastructure.
Engagement rate	Assessment of the level of involvement of students, postgraduates and university staff in innovative activities	$K_e = \frac{n_{st} + n_{em}}{N_{st} + N_{em}}$	K_e is engagement rate; n_{st} and n_{em} are the number of students and university employees engaged in innovative activities, respectively; N_{st}, и N_{em} are the total number of students and employees of the university, respectively.
Human resource potential coefficient	Assessment of the qualification level of employees	$K_{sp} = \frac{n_{em}}{N_{em}}$	K_{sp} is human resource potential coefficient; n_{em} is the number of university employees, advanced their qualifications in innovative entrepreneurship and technology transfer; N_{em} is the total number of university employees

Resource: *Mitrofanova & Zakharova, 2017*.

Table 2. The growth in the number of high-performance jobs in Russia from 2017 to 2022

Indicator	2017	2018	2019	2020	2021	2022
Professional, scientific and technical activities						
Number of jobs	139,801	155,798	164,234	150,741	170,898	179,797
Growth, %		11.44	5.41	-8.22	13.37	5.21
Scientific research and development						
Number of jobs	588,874	605,146	647,855	664,976	678,525	688,862
Growth, %		2.76	7.06	2.64	2.04	1.52

Created by the author (*State statistic, 2024*)

Table 3. Technology exports of the higher education sector from 2012 to 2021

Indicator	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Export, thousand dollars	2,313	4,443.1	5,970.7	6,359.7	4,416.8	57,986.5	7,232.1	6,1984.2	13,984.1	11,537.2
Growth, %	62.11	92.09	34.38	6.52	-30.55	1212.86	-87.53	757.07	-77.44	-17.50

Created by the author (*Indicators of innovation activity, 2019-2023*)

Table 4. Number of SIEs

University	2019	2020	2021	2022	2023
Tomsk State University	23	28	29	31	33
St. Petersburg State University	16	18	20	20	22
Belgorod State University	19	19	19	19	19

N.E. Bauman Moscow State University	17	17	17	17	17
National Research Technological University "MISiS"	15	15	16	16	17
Kazan Federal University	15	15	15	15	15
Moscow Physical Technical University	6	6	6	12	12
ITMO National Research University	8	8	9	10	10
M.V. Lomonosov Moscow State University	7	7	8	8	8
Saratov State University	6	6	6	6	6
Peter the Great St. Petersburg Polytechnic University	5	5	5	5	5
St. Petersburg State Electrotechnical University "LETI"	4	4	4	4	4

Created by the author (*Accounting and monitoring…, 2023*).

Table 5. Dynamics of internal expenditures on researching and developing educational institutions of Russia's higher education for 2013-2021

Indicators	2013	2014	2015	2016	2017	2018	2019	2020	2021
Internal costs for research and development of educational institutions of higher education, billion rubles.	63.14	77.98	82.97	80.42	86.84	91.74	100.26	108.34	121.33
Growth, %		23.5	6.4	-3.1	7.9	5.6	9.3	8.1	12.0

Created by the author (*Indicators of science…, 2023*)

Table 6. The growth in the volume of innovative goods, works, and services in some areas of the service sector in Russia from 2018 to 2021 in percentage

The service sector	2018	2019	2020	2021
Transportation and storage	-	-	164.49	-34.54
Publishing	-38.03	74.53	9.45	9.89
Activities telecommunications	146.46	-3.50	14.19	119.31
Activities computer software development, consulting services	207.07	121.09	7.63	3.15
Information technology	-13.38	203.47	21.58	268.85
Law and accounting	-	-	36.71	-74.94
Management consulting	-	-	-80.55	-1.19
Architecture and engineering design	35.65	-58.79	129.60	0.15
Research and development	33.84	-16.29	18.06	12.55
Advertising and market research	-	-	13.07	56.40
Activities professional scientific and technical other	-	-	59.19	7.20
Activities in the field of healthcare	-	-	84.16	-39.45

Created by the author (*Indicators of innovation activity, 2019-2023*)

Table 7. The growth in the number of innovative goods, works and services in Russia

Year	2011	2012	2013	2014	2015	2016
Cost, mln rubles	2,106,740.7	2,872,905.1	3,507,866.0	3,579,923.8	3,843,428.7	4,364,321.7
Growth, %	69.4	36.4	22.1	2.1	7.4	13.6

Year	2017	2018	2019	2020	2021	2022
Cost, mln rubles	4,166,998.7	4,516,276.4	4,863,381.9	5,189,046.2	6,003,342.0	6,377,248.5
Growth, %	-4.5	8.4	7.7	6.7	15.7	6.2

Created by the author (*Indicators of sciences, 2024*)

Table 8. The growth in the number of advanced manufacturing technologies developed in Russia

Year	2011	2012	2013	2014	2015	2016
Number of technologies	1,138	1,323	1,429	1,409	1,398	1,534
Growth, %	31.71	16.26	8.01	-1.40	-0.78	9.73
Year	2017	2018	2019	2020	2021	2022
Number of technologies	1,402	1,565	1,620	1,989	2,186	2,621
Growth, %	-8.60	11.63	3.51	22.78	9.90	19.90

Created by the author (*Regions of Russia…, 2020*).

Table 9. The growth in the number of internal expenditures on research in the Humanities in Russia from 2017 to 2022

	2017	2018	2019	2020	2021	2022
Research costs	12,983	15,825.90	16,756.50	18,660.00	21.451.90	23.148.50
Growth, %	2.60	21.90	5.88	11.36	14.96	7.91

Created by the author (*Regions of Russia…, 2020*)

Table 10. The growth of domestic investments in research and development at the expense of the business sector in Russia from 2017 to 2022

	2017	2018	2019	2020	2021	2022
Research costs	307,459.0	303,219.2	342,833.0	343,278.0	378,026.0	415,285.7
Growth, %	1.16	0.99	1.13	1.00	1.10	1.10

Created by the author (*Regions of Russia…, 2020*)