## **Restrictions of the Development of Sustainable Education**

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- Keywords: Principal-Argent Problem, Problems of Sustainable Development of Education in Kazakhstan, Citation Index, Wages, Human Behavior Model, Futurization of Education.
- Abstract: The most suitable term characterizing the modern condition of Kazakhstan's science is the "transition period". The first years of Kazakhstan's independence are marked by a bifurcation stage for Kazakhstan's science and education. Reforms left a painful mark, breaking the continuity, the disappearance of some scientific schools, and in general, leading to the disorientation of the sphere of science and education. The main issue is considered, interrelation of two factors: citation index and salary. Due to the fact that most of the elderly age group of scientists does not have the research tools, the model of the behavior of scientists did not change due to erroneous signals from the leader the Ministry of Education and Science of the country, the issue about the multiplier effect of increasing the salary of scientists in the transition period for Kazakh science arises. The study showed that in the period under consideration, the increase in wages is not a panacea for solving the problem. The consequence of the policy pursued by the leader is the inability and unwillingness of education to accept the ideas of futurization.

# **1** INTRODUCTION

The study of the interrelation of two factors, citation index, and salary, showed its absence. In the context of this issue, the well-known theories in economics, which have not been confirmed in the applied field in relation to the Kazakh sphere of science and education, were considered. The explanation lies in the time gap that was formed during the formation of the country as an independent state. This period destroyed the basis of the Kazakhstan's science. The lack of continuity, the destruction of the scientific and methodological approach in the broad sense of science has led to a low level of citation of Kazakhstan's scientific articles.

During the period of the first reforms, the functioning chain of interrelation between science, real sector, and economy was destroyed. This interrelation is not restored, and the state of education is aggravated by aggressively implemented technological and social trends. Education is not able to respond quickly and adequately to the new challenges of the time.

The solution is to implement the strategy of futurization of education. The transition to the designated vector is complicated by the lack of a single vector for the development of science and education. The lack of this understanding from the leader leads to sending of wrong signals and, as a result, to the formation of a flawed model of the leader's behavior.

The increase in wages during the "transition period" cannot be considered as the main motivating tool for increasing the role of science in the economy as a whole. The reason lies in the weak knowledge of the research tools or in their complete absence, with the exception of young scientists who were trained and got their degrees abroad, who perfectly speak foreign languages, whose number is not enough in a general group of scientists in the country.

According to the Kazakhstani experts (Periodicheskoye izdaniye Kursiv, 2018), there is a "brain drain" in the country. One of the reasons for the departure of qualified personnel from the country

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is the creation of a comfortable environment for attracting talented people by the countries involved, the second reason is the inability to apply the knowledge gained abroad in Kazakhstan due to the inability and unwillingness of the economy and the environment to accept them.

There are lots of reasons that explain the outflow of qualified people who are able to develop technologies, help the state to develop the existing potential, these the most significant reasons are: corruption, poor quality of life, the culture of the scientific environment, lack of investment environment. It is impossible to commercially apply the existing scientific developments, since the level of industrial development is either not ready or unwilling to accept them, and the mechanisms of the investment climate are not worked out.

According to the Office of National Statistics of the Republic of Kazakhstan, the share of domestic R&D expenditures from the gross domestic product in 2003 and 2004 was 0.25%, 2005 - 0.28%, 2017 - 0.13%, 2018 and in 2019 - 0.12\%, according to preliminary data in 2020 - 0.12%. This data shows the need for a radical change in attitudes to science and education. The problem lies not only in the lack of funding but also in the competent management of science funding in the country (Forbes Kazakhstan, 2019).

In modern Kazakhstani science, the level of development of science is assessed by such indicators as the number of articles and the publication of an article in journals with a non-zero impact factor. What can revive the country's science? What will save the country in the future? What prevents us to improve the quality of life of people? The answer lies in the formation of global education and the advanced development of science.

In the light of the changes taking place on a global scale, the rapid development of technologies, the ongoing changes in geopolitics make us think about the future of the country. Many other questions led to one of the solutions - science. An interesting aspect of the issue under consideration lies in the plane of the scientist's behavior. Are the two factors, citation index and scientists' salary, related to each other?

The citation index of articles depends on the relevance of the chosen topic, the outlined methodology. What can serve as a nudging signal for increased research interest? According to the results of the conducted survey, the incentive to conduct the study is the salary. The logic is that an increase in wages will arouse interest in science, an influx of young scientists to the field of science, not only increase the number of published articles but also have a positive impact on the research process, on the citation index. In general, there will be a shift in science, including through the interaction of the real sector and science. At the same time, we should not forget about the principal-argent problem, about the context that contains information about salaries and concepts of the internal labor market, which makes it possible to assess not the place of work, but its competence and skills.

### 2 RESEARCH METHODOLOGY

The study of the subject is based on a quantitative research method. To confirm the assumption, the  $\chi^2$  criterion of independence between qualitative (categorical variables) is applied. When verifying independence, two factors were considered, each of which has several levels. One sample is extracted from the general population, and the values of qualitative variables corresponding to different levels of factors are placed in the cells of the contingency table.

In the  $\chi^2$  criterion, the independence criterion of the hypotheses is formulated as follows:

*H0*: the two qualitative variables are independent (i.e. there is no relationship between them),

*H1*: the two qualitative variables are dependent (i.e. there is the relationship between them).

In order to check independence,  $\chi^2$  test statistics are used and the testing procedure is as follows:

 $\chi \alpha$ ,  $\nu$  - critical value of test statistics, determined by the distribution tables  $\chi 2$ .

Y *ij* - the observed number of successes or failures located in a particular factor cell at the intersection of row i and the column j

Ri - (sum on the row i)

where

Cj = (sum on the column j)

$$E_{ij} = \frac{R_i \cdot C_j}{n} 2$$

Where Eij is the expected number of successes and failures in a particular cell of the feature conjugacy table, provided that the null hypothesis is true. And there are v = (r - 1) (c-1) degrees of freedom. Assume that the significance level of the hypothesis test is  $\alpha = 0.05$ . Let's calculate the expected values of the contingency table:  $E_{11}=(36*63)/94=24$ ,  $E_{12}=(36*27)/94=10$ ,  $E_{13}=(36*4)/94=2$ ,  $E_{21}=(58*63)/94=39$ ,  $E_{22}=(58*27)/94=17$ ,  $E_{23}=(58*4)/94=2$ .

It is necessary to calculate:

 $\chi_{Ha6\pi^2} = \sum_{i,j} \frac{(Y_{ij} - E_{ij})^2}{E_{ij}} \mathbf{3}.$  $\chi_{Ha6\pi^2} = \frac{(21 - 24)^2}{24} + \frac{(12 - 10)^2}{10} + \frac{(3 - 2)^2}{2} + \frac{(42 - 39)^2}{39} + \frac{(15 - 17)^2}{17} + \frac{(1 - 2)^2}{2} = 3.37$ 

According to the distribution table  $\chi^2$ , given that the significance level is 0.05, and the number of degrees of freedom v=(3-1)\*(3-1)=2 -  $\chi_{0.052}$  =5,99.

The conclusion is that salaries do not affect the citation index. To check the hypothesis by determining the probability *p*-value, which in the case under consideration takes on a value equal to 0.19. Since *p*-value> $\alpha$ , it means that the null hypothesis is accepted: two qualitative variables (citation index and salaries) are independent. With *p*-value = 0,19, which is higher than the value  $\alpha$  = 0.05. At the 5% significance level, the second test method resulted in a *p*-value of 0.19, which also confirms the hypothesis of independence of the citation index and salaries.



Figure 1: Verification of the hypothesis

The next approach used to test hypotheses is twoway ANOVA.

A comparison of several categories of scientific publications was carried out, as well as an estimate at what salary the largest number of scientific publications with a non-zero citation index is published. Does the difference in publication between the three categories of journals depend on the salary of the authors?

Table 1: Comparison of several categories in scientific publications, their assessment with the help of the two-way analysis of variance ANOVA.

	Citation	Citation	Citation	Interviewee
	(0; 0,50)	(0,51;0,90)	>=0,91	
Wages of	7	0	0	Respondent 1
110000-189999	5	1	0	Respondent 2
	4	2	0	Respondent 3
	4	2	1	Respondent 4
	7	1	1	Respondent 5
Wages of	5	3	1	Respondent 6
190000-270000	8	2	2	Respondent 7
	2	1	2	Respondent 8
	3	1	1	Respondent 9
	4	3	0	Respondent 10

Two-way analys									
	Citation	Citation	Citation	Total					
	(0; 0,51)	>=0,90	(0,51; 0,90)						
TOTAL									
Wages 110000-189999									
Count	5	5	5	15					
Amount	27	6	2	35					
Average	5.4	1.2	0.4	2.333333					
Dispersion	2.3	0.7	0.3	6.095238					
Wages 190000-270000									
Count	5	5	5	15					
Amount	22	10	6	38					
Average	4.4	2	1.2	2.533333					
Dispersion									
Total									
Count	10	10	10						
Amount	49	16	8						
Average	4.9	1.6	0.8						
Dispersion	3.655556	0.93333	0.622222						
Dispersion analysis									
Source of variation	SS	df	MS	F	P-value	F-critical			
Sample	0.3	1	0.3	0.174757	0.679635	4.259677			
Columns	94.46667	2	47.23333	27.51456	6.15E-07	3.402826			
Interaction	5.4	2	2.7	1.572816	0.228105	3.402826			
Within	41.2	24	1.716667						
			7						
Total	141.3667	29	7		7				

Table 2: Analysis of Variance Table (ANOVA): The result of a two-way analysis of variance for the number of scientific publications.

In order to analyze the results, the first step was to check the existence of an interaction between factor A (average salary of the author) and factor B (category of scientific publication). In the case of a significant interaction effect, further analysis is limited only to the assessment of this effect. If the interaction effect is not significant, we should focus on the main effects - potential differences between the level of average salaries (factor A) and the categories of scientific publications (factor B).

To determine the presence of an interaction effect at the significance level of 0.05, the following decisive rule is applied: the null hypothesis of the absence of an interaction effect is rejected if the calculated value of the F-statistic is greater than 3.40 (cell G27), i.e. greater than the upper critical value of the F-distribution. Since F=1.57 (cell E27) < FU=3.40 (cell G27), then the value of p is 0.23 (cell F27), the hypothesis H0 is not rejected. Therefore, there is no sufficient reason to say that the factors of salary and the categories of publications interact with each other. At a given significance level of 0.05, the basis for checking the difference between the two levels of average salaries of authors of publications (factor A) is the following decision rule: the null hypothesis is rejected if the calculated value of the F-statistic is greater than 4.25 (cell G25), i.e. more than the upper critical value of the F-distribution. Since F = 0.17(cell E25) < FU = 4.25 (cell G25), and the value of p = 0.68 (cell F25) and exceeds the significance level  $\alpha$ = 0.05, the null hypothesis is not rejected. Thus, there is no sufficient reason to claim that there is a significant difference between different average salaries and the number of scientific publications with a non-zero citation index published by the author.

At a given significance level of 0.05, the basis for checking the difference between the categories of scientific publications (factor B) is the following decisive rule: the null hypothesis is rejected if the calculated value of the F-statistic is greater than 3.40 (cell G26), i.e. greater than the critical F-distribution. Since F=27.51 (cell E26)>FU = 3.40 (cell G26), and the value of p is almost zero (cell F26) and less than the significance level  $\alpha = 0.05$ , H0 is rejected. Thus, it can be concluded that there is a significant difference between the number of scientific publications published in scientific journals with different citation indices. Testing the hypothesis in the two ways described above led to the null hypothesis: there is no interrelation between the citation index and salaries.

## **3 RESEARCH RESULTS**

Poor knowledge of research tools does not allow you to have a high citation rate of scientific articles. Articles must be interesting, relevant, and arouse interest, including due to the research methodology included.

The citation rate characterizes the level of development of science, and the citation rate does not depend on the salary amount. The quality of the research is not closely related to the salary amount for a number of reasons. Kazakhstani science is undergoing a "transition period". At this period of time, an increase in salary is not a panacea for solving this acute issue.

The available research and works prove the interrelation between salary and scientific activity of scientists. A reasonable question arises. Why the opposite result was obtained in Kazakhstan?

## **4 DISCUSSION OF RESULTS**

The first restriction is a weakness of the scientific school. The second one is the lack of a constructive understanding of the vector of development of science and education in the regulator. R. Thaler in his book "Misbehaving: The Making of Behavioral Economics" (Thaler, 2016) writes: "The owner is responsible for creating the problem to the same extent as his subordinates". The theory of relations between the principal and the agent sees the fault in the weak level of development of science and the principal itself - the regulator of the sphere of education and science.

The lack of prospects also leads to the drain of professionals. Over the past four years, the outflow of qualified personnel has increased by 34 percent according to IA "NewTimes.kz" with a reference to Finprom. About 90 percent of those leaving Kazakhstan are young people aged 25-35.

The third reason is the culture of the scientific environment, paternalism. Young people who studied abroad do not see themselves in science because of the lack of prestige of scientific activity, the inability to apply the acquired knowledge in the country, there is no platform for applying knowledge, or there is an element of unpreparedness of society. Richard Thaler, a well-known scientist in the field of behavioral economics, adheres to the position of irrationality in human behavior. Irrationality is not random or meaningless – on the contrary, it is quite systematic and predictable. How to change the behavior of an employee in the field of science and education? How to encourage employees to do science, publish cited articles?

To resolve the issues raised, the Ministry of Education and Science should:

1. Develop a clear strategy for the development of science, the policy should work ahead of the curve, i.e. it should be based on a model of global education.

2. Clarifications on the need for changes in the field of science and education.

3. The strategy must be formed with the participation of representatives of research organizations and universities. Otherwise, the developed strategy will meet with resistance from employees of the scientific and educational sphere.

Considering the nature of human behavior, R. Thaler identified three barriers: limited rationality, limited willpower, and limited self-interest (Thaler, 1980). During economic interaction, the choice of an individual is influenced by such factors as altruism, the desire for justice, compliance with generally accepted norms of behavior, trust, reciprocity, and much more.

In modern behavioral economics, it is proposed to pay attention to the emerging institutional order. According to S. Sunder (Sunder, 2002), it is necessary to take into account the fact that individuals make choices within a certain institutional their environment, and its architectonics directly affect both the decisions that are made by individuals and the consequences of these decisions. The social environment has a huge impact on an individual's decision-making. The concept of emergence reflects a situation in which, as a result of the strategic interaction of egotistical individuals, an overall positive effect suddenly appears. Efficiency is necessarily the result of the interaction of institutional rules with the actions of economic actors (Smith, 2002). The task of the institute is to create prerequisites for individuals to unite for conducting joint research, writing high-quality articles. Efficiency is achieved only in the interaction of the state, science, and the real sector.

The "endowment effect" of R. Thaler suggests that people tend to value things that they already have, significantly higher than exactly the same ones, but which they do not yet possess (Thaler and Shefrin, 1981). The high self-esteem of the country's scientists is proved by the presence of an academic degree. The criterion for success is to have an academic degree, not a high degree of citation. In Kazakhstani society, there is no such value as a high level of citation of an article. However, in Kazakhstan, there are scientists whose articles are published in scientific journals with a high impact factor or who have high citation rates. No additional allowances are provided for their salaries. What is the driver? Such factors as altruism and the desire for justice push scientists to conduct high-quality research and publish their results.

The behavior of workers in the field of science and education should be considered not from the position of their rational behavior, but from the position of the teachings of behavioral science. The conclusions are as follows:

1. People often do not consider opportunity costs in their actions. For example, learning a foreign language. Proficiency in a foreign language increases competitiveness, the ability to receive additional payment for proficiency in a foreign language. Knowledge of a foreign language gives other advantages as well.

2. People do not know how to think in terms of limiting values. The current decision must be defined not by the past, but by the future result.

3. People attach importance to relative, not absolute, values. For example, if a person earns \$100 000 a year, then, as a rule, he or she feels quite confident, living and working in almost any city in any country in the world, for example, in New York. However, everything changes if this person lives in a prestigious area of New York, located on the Manhattan Peninsula. Seeing his or her neighbors, whose average earnings are in the millions of dollars a year, over time, he or she begins to feel unhappy. Today, teaching is well paid, but with the right policy of the Ministry of Education and Science, doing science can be more profitable than being limited to teaching only. Restriction leads to a loss of time, loss of existing skills, and not gaining new ones in the process of research.

4. People think about justice, and therefore may not behave rationally.

5. People are very short-sighted when dealing with probable quantities.

6. Most people are overconfident in their abilities. As noted above, the self-esteem of Kazakhstani scientists is very high, and that the main incentive for such an assessment is the achievement of an academic degree. High self-esteem is explained by the respondents' high level of qualification, huge scientific experience. A smaller proportion of respondents named the demand for the results of their work as the main motive for their assessment. Having

a high level of qualification and the presence of a large scientific experience, Kazakhstani scientists are supposed to have high citation rates, however, statistics show the opposite.

7. People only pay attention to facts that support their own views. This feature of human behavior is well described in the book "The Black Swan: The Impact of the Highly Improbable" (Taleb, 2007). In real life, there are so many different events happening that it is not difficult to find those that support a certain point of view and accept them as proof of that point of view. For example, extremely hot summer is seen as proof of the theory of global warming.

## **5** CONCLUSIONS

The nudging role should be performed by the country's Ministry of Education and Science or the Science Committee. Mechanisms of direct coercion, such as dismissal in the absence of cited articles, should not be used. It is necessary to create conditions under which a person makes decisions that are likely to be optimal from a social point of view. The designer of the creation of conditions is the Ministry of Education and Science of the country or the Science Committee.

The endowment effect should also be kept in mind. In many situations, the subjective justice of an action depends not only on who helps or does harm but also on how the problem is formulated. Perception of justice is associated with the endowment effect. The endowment effect is that all economic decisions are made based on the assumption of the costs of an alternative opportunity. Considering the salary amount as an incentive to conduct research and publish high-quality articles, it is taken into account, but attention is drawn to the amount of money, which may seem large or small, depending on the context.

People are overly self-confident, they have the effect of false consensus and such a pronounced trait as a deviation towards the status quo, as well as a tendency to avoid risks.

In this regard, a number of recommendations is suggested. But, initially, the principal-agent problem should be emphasized again. It is wrong to blame scientists for the poor level of development. The principal is as responsible for the creation of the problem as the agent. Yes, there are problems in science, but it is primarily the Ministry to be blamed for creating such a condition.

It is often assumed that the head of a Ministry or a scientific organization or university has a wide range of skills, a share of analytical abilities, and who can hire professionals to help them. However, as the importance of the management decision increases, the tendency of managers to rely on analytical notes and recommendations prepared by professionals decreases. Therefore, the role of leaders should be seen as managers with a broad outlook, scientific taste, and a modern set of management tools.

It is the principal who must determine the object of the desire, know the ways to achieve it, and understand the system of evaluating the results.

A nudge can only be the second step. It is the signal theory that contributes to the solution of the issue in one action.

But before generating a signal, the following should be taken into account. Firstly, the endowment effect. All economic decisions are made based on the assumption of the cost of an alternative opportunity. Secondly, a person tends to overestimate the level of his or her awareness. Thirdly, scientists do not discount what they now have - an academic degree, which over time can be estimated at half that.

Based on the listed properties, proceed to the generation of a signal. But one should take seriously the generation of this signal and think about the incentives. This measure will allow scientists and educators to review and understand their preferences. There is a category of employees who are more inclined to engage in science or teaching or can be generators of ideas. There are teachers who are not by nature generators of ideas, but perfectly possess a set of tools for communicating information to students.

The following should be considered as a motivational tool.

1. Economics. Despite the fact that the salary is perceived by Kazakhstani scientists as low, however, this does not guarantee that an increase in salaries will lead to an increase in the citation. The amount of money seems large or small depending on the context. The main thing is to create conditions to do science. First of all, it is an opportunity to sell scientific works Ongoing research and and developments. development can be sold if they are interesting and in demand. This knowledge can be sold because it is understandable and people like it. You can motivate people to do science through an incentive system, i.e. through bonuses for citation, for monographs, for innovations, developments. It should be noted that the average monthly nominal salaries of workers in research activities are higher than the average level noted for the country as a whole. Undoubtedly, at this time period, when the gap is created, the impact of salaries on the citation index is small. But it is worth considering a reward system for ongoing research, the results of which are reflected in publications with a

high impact factor. The state should encourage such scientists in the form of scholarships or one-time financial incentives.

2. Political Motivation. Under political motivation, the authors of this article consider the theory of signals. Send the necessary signal to the scientific community, which should not consist in the number of publications, but, for example, in the citation. In this direction, it is necessary to increase the requirements for the content of materials, review, and export evaluation, in other words, to come to a more thorough, rigid system of selection of scientific papers. For this purpose, it is proposed to create an association of editors and publishers of scientific publications in the form of an export-consulting center. Its tasks will include such issues as training of domestic authors in the preparation of scientific publications, professional translation into English, German, Russian, and Chinese, the development of a unified web platform for the websites of scientific journals. Political motivation can also be viewed through such a tool as "forcing" by giving signals. For example, to increase the requirements for the assignment of scientific titles, the quality of published articles, i.e. to pay attention to the non-content part. But no matter what harsh conditions are put forward, the teacher, for example, will not do science, because the latter will always calculate the costs. There must be strict working conditions and requirements. Fear of losing a job in the light of the ongoing global changes in the world, the Fourth Industrial Revolution, rising unemployment. It will force scientists to pay attention not to salaries in the first place, but to the preservation of their workplace.

3. The new behavioral economics proved that the basis of the human behavioral model is not rationality, but irrationality due to various facts, including the inability of a person to work and process big data, to make the right choice due to certain restrictions. A person values what he or she owns. The survey shows that in the Kazakhstani scientific society having an academic degree is considered to be an achievement. It is necessary to change the point of value, show through nudge that an academic degree is discounted and loses its value over time.

4. The next motivation is moral. The principalagent problem is covered here. One of the problems of the decline of the moral climate is reduced to the problem of the principal. The principal must know that the object of desire, the solutions, and all of this must be appropriate. The moral climate plays an important role. Moreover, the data given above about the population migration suggests that workers do not feel stable, there is a situation in socio-economic terms in the country.

5. The next point is scientific curiosity. Only scientific curiosity can motivate you to do science, the desire to solve a problem that captured your imagination. For this, it is necessary to create conditions, namely: to create moral conditions, to give them a sense of belonging. It is necessary to eliminate corruption, nominate decent people, a transparent system of management and remuneration, create a competitive environment.

As the result of the study showed, for this period of time (the last five years), the Kazakhstani scientific community is only beginning to understand and is inertly trying to adapt. The main problem of Kazakhstani science is not salaries but socioeconomic conditions in which science finds itself. There are still echoes of the reforms that took place in the past. In this period of time, a lag was created when a young generation of scientists did not mature and the older generation did not raise them to replace themselves. The conditions in the country do not give the academic freedom that scientists need, the socioeconomic conditions of life in the country are a very strong factor of influence. The recommendations listed above will lead to the sustainable development of education in the country.

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