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THE ROLE OF AGRICULTURAL EDUCATION OF UNIVERSITY GRADUATES FOR THE AGRO-INDUSTRIAL COMPLEX

ЖОО ТҮЛЕКТЕРІНІҢ АГРАРЛЫҚ БІЛІМІНІҢ АГРОӨНЕРКӘСІПТІК КЕШЕН ҮШІН РӨЛІ

РОЛЬ АГРАРНОГО ОБРАЗОВАНИЯ ВЫПУСКНИКОВ ВУЗА ДЛЯ АГРОПРОМЫШЛЕННОГО КОМПЛЕКСА

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Abstract. In the context of globalization and digital transformation, the importance of the socio-economic contribution of graduates is increasing. Their competitiveness, employment, income, and professional mobility largely depend on the macro- and microenvironmental conditions. The issue becomes particularly relevant for agricultural education due to the growing mismatch between labor market demands and the competencies of degree holders. *Objective* – to substantiate the choice and methodological approach to assessing the impact of factors on the social and economic performance of a graduate who has completed the educational process at an agricultural university, using the example of North Kazakhstan University, and to develop recommendations aimed at enhancing it. *Methods* of logical interpretation were used to clarify the concepts of “socio-institutional effectiveness of a graduate” and “professional well-being of a young professional”; a questionnaire survey was conducted to collect empirical data on the level of basic and additional knowledge, business, and financial stability; and correlation analysis was applied to determine the direction of the relationship between the level of graduates’ acquired skills and their socio-labor competitiveness indicators. *Results* – the necessity of monitoring the impact of various prerequisites on the socio-economic value of an agricultural university graduate was substantiated, the percentage increase in the efficiency of graduate training returns with the growth of managerial qualities along with an increase in practical experience was shown, and recommendations for optimizing the educational system were proposed. *Conclusions* – evidence-based measures to

improve the training of agricultural personnel as a priority direction of the country's agricultural policy were considered. An agricultural university graduate must not only generate new ideas, but also be able to implement them. The agricultural academic base can serve as a model for successful interaction among scientists, universities, and AIC producers.

Аңдатпа. Жаһандану және цифрлық трансформация жағдайында түлектің әлеуметтік-экономикалық үлесінің маңызы арта түсуде. Оның бәсекеге қабілеттілігі, жұмысқа орналасуы, табысы, кәсіби ұтқырлығы көбіне макро- және микроорта жағдайларына байланысты. Еңбек нарығының талаптары мен дипломды мамандардың құзыреттері арасындағы өсіп келе жатқан алшақтыққа байланысты бұл мәселе аграрлық білім беру үшін ерекше өзектілікке ие болады. *Мақсаты* – Солтүстік Қазақстан университеті мысалында аграрлық бейіндегі ЖОО-да білім беру процесін аяқтаған түлектің әлеуметтік және экономикалық нәтижелілігіне факторлардың әсерін бағалауға әдістемелік тәсілді және оларды таңдауды негіздеу, оны арттыруға бағытталған ұсыныстар әзірлеу. «Түлектің әлеуметтік-институционалдық тиімділігі», «жас кәсіби маманның кәсіби әл-ауқаты» ұғымдарын нақтылау үшін логикалық түсіндіру әдістері, негізгі және қосымша білім деңгейі, іскерлік пен қаржылық орнықтылық бойынша эмпирикалық деректерді жинау кезінде сауалнама жүргізу, диплом алған мамандардың қалыптасқан дағдыларының дәрежесі мен олардың әлеуметтік-еңбек бәсекеге қабілеттілігі көрсеткіштері арасындағы өзара байланыс бағытын анықтау үшін корреляциялық талдау қолданылды. *Нәтижелері* – ауыл шаруашылығы бағытындағы сертификатталған қызметкердің әлеуметтік-шаруашылық құндылығына әртүрлі алғышарттардың әсеріне мониторинг жүргізу қажеттілігі дәлелденді, басқарушылық сапалар мен бір мезгілде практикалық тәжірибенің өсуі кезінде университеттік кадрларды даярлау қайтарымы тиімділігінің арту пайызы көрсетілді, білім беру жүйесін оңтайландыру бойынша ұсыныстар берілді. *Қорытынды* – елдің аграрлық саясатының басым бағыты ретінде аграрлық персоналды оқытуды жетілдіру бойынша ғылыми негізделген шаралар қарастырылды. Аграрлық университет түлегі жаңа идеяларды тудырып қана қоймай, оларды іске де асыра білуі тиіс. Аграрлық академиялық база ғалымдардың, ЖОО-лардың және АӨК өндірушілерінің табысты өзара әрекеттесуінің моделіне айнала алады.

Аннотация. В условиях глобализации и цифровой трансформации возрастает значение социально-экономического вклада выпускника. Его конкурентоспособность, трудоустройство, доходы, профессиональная мобильность во многом зависят от условий макро- и микросреды. Особую актуальность проблема приобретает для аграрного образования в связи растущим несоответствием между требованиями рынка труда и компетенциями дипломированных специалистов. *Цель* – обосновать выбор и методический подход к оценке влияния факторов на социальную и экономическую результативность завершившего образовательный процесс в вузе аграрного профиля на примере Северо-Казахстанского университета, разработать рекомендации, направленные на её повышение. Используются методы логической интерпретации для уточнения понятий «социально-институциональная эффективность выпускника», «профессиональное благополучие молодого профессионала», анкетный опрос – при сборе эмпирических данных по уровню основных и дополнительных знаний, деловой и финансовой устойчивости, корреляционный анализ – для определения направления взаимосвязи между степенью сформированных навыков дипломантов и показателями их социально-трудовой конкурентоспособности. *Результаты* – аргументирована необходимость мониторинга воздействия различных предпосылок на социально-хозяйственную ценность сертифицированного работника сельскохозяйственного направления, показан процент увеличения ответственности отдачи подготовки университетских кадров при росте управленческих качеств и одновременно увеличение практического опыта, предложены рекомендации по оптимизации образовательной системы. *Выводы* – рассмотрены научно обоснованные меры по совершенствованию обучения аграрного персонала как приоритетного направления аграрной политики страны. Выпускник аграрного университета должен не только генерировать новые идеи, но и уметь их реализовывать. Аграрная академическая база может стать моделью успешного взаимодействия ученых, вузов и производителей АПК.

Keywords: agricultural labor market, socio-economic efficiency of a graduate, returns on university staff training, professional well-being of a certified specialist.

Түйінді сөздер: аграрлық еңбек нарығы, түлектің әлеуметтік-экономикалық тиімділігі, университеттік кадрларды даярлау қайтарымы, дипломды маманның кәсіби әл-ауқаты.

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Ключевые слова: аграрный рынок труда, социально-экономическая эффективность выпускника, отдача подготовки университетских кадров, профессиональное благополучие дипломированного специалиста.

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Introduction

The economic efficiency of higher education is an important factor determining the level of economic development of a country. It shows how effectively investments in education are returned in the form of economic growth and improving the well-being of the population. At the same time, the benefits of investing in higher education extend primarily to its direct consumer, the university graduate.

This article evaluates the degree of influence of factors on the socio-economic efficiency and professional well-being of an agricultural graduate based on the example of a regional university, identifies factors that cause an increase in socio-economic efficiency and professional well-being of graduates employed in rural areas, and substantiates proposals to improve the educational activities of the higher education system for agriculture.

The agrarian labor market is characterized by accelerated dynamics of transformational changes associated with the ongoing processes of economic adaptation to global challenges on a national and global scale. In the context of the digitalization of the economy and the rapid development of new technologies, the process of transformation of professional competencies necessary for the implementation of the labor process is accelerating. In this regard, employers' requirements for applicants for existing vacancies are constantly changing, which contributes to increased competition in the agricultural labor market where the university graduates occupy far from leading positions. This circumstance makes their socio-economic efficiency and professional well-being one of the major problems of the modern labor market, characterized by the development of contradictory trends.

On the one hand, employers in the agricultural market notice a shortage of qualified personnel, and, on the other hand, there is unemployment among university graduates who cannot get a job for several years after graduation.

In the context of the structural imbalance between personnel training and the needs of the labor market in the agricultural sector, the survey of agricultural graduates is becoming particularly relevant. The results of such study allow us to:

– to determine the factors that determine the employment of graduates outside the specialty;

– to identify the competencies that have the greatest impact on the successful professional adaptation and career development of graduates in the region;

– to evaluate the effectiveness of personnel training for agriculture;

to formulate evidence-based recommendations for improving the content of educational programs, enhancing students' engagement in R&D activities, increasing graduates' motivation to pursue master's degree studies, and strengthening collaboration mechanisms between the university and employers.

Literature review

The sustainable development of the region is largely determined by the quality of personnel training, ensuring that graduates' competencies meet the requirements of the labor market. For agricultural regions, the training of specialists in the agro-industrial complex, on which food security depends, is of particular importance [1]. The socio-economic efficiency of an agrarian university graduate characterizes the results of their professional activity and professional well-being.

Professional well-being is a multidimensional structure encompassing the psychological and professional well-being of employees, which is determined by working conditions, the organizational environment and individual characteristics [2].

Professional well-being is defined as a combination of subjective job satisfaction and the ability to function effectively and realize one's potential in professional activities [3]. The scientific literature often identifies the categories of "socio-economic efficiency of a graduate" and "professional well-being", although they reflect different aspects of professional realization. Socio-economic efficiency characterizes the objective results of professional activity, while professional well-being reflects a subjective assessment of professional activity.

Socioeconomic efficiency and professional wellbeing can be considered through interrelated components, including stability in the labour market and financial stability, as well as the continuity of professional development [4, 5]. The ability to adapt to changing labour market con-

ditions is also an important element of graduates' professional fulfilment [6].

A similar approach considers objective and subjective characteristics as complementary components of the professional demand for graduates [7]. The analysis of these components requires studying the factors influencing their formation at the micro and macro levels.

The success of graduates' professional realization is determined by a combination of internal and external factors, including the quality of educational training, individual competencies, social and cultural capital, as well as the specifics of the labor market [8]. The level of professional self-realization of graduates is determined by the quality of educational training and the development of universal skills [1]. In this regard, the factors of the microenvironment include the quality of teaching and educational programs, minors and the level of functional literacy of the graduate. Macroenvironment factors include knowledge of English, use of professional and social networks, and communication skills. The conducted theoretical review confirms the relevance of studying the influence of these factors on the socio-economic effectiveness of graduates.

Materials and methods

To examine the factors determining socio-economic efficiency and professional well-being of graduates, the method of logical analysis was used to consider these categories as interrelated elements of the system of interaction between higher education, the agricultural labor market and the external environment. The study analyzes foreign scientific publications devoted to the problems of graduate employment, professional well-being, and evaluating the effectiveness of higher education. Special attention is paid to research on the influence of factors on the success of agricultural graduates. Additionally, data from a questionnaire survey of graduates were used to assess the level of their professional well-being and the perception of factors influencing professional realization. The correlation analysis method was used to identify the most significant factors affecting socio-economic efficiency.

As a result, a correlation and regression model was built that evaluates the influence of key factors on the level of socio-economic efficiency of graduates of the agricultural sector and the coefficient of elasticity was calculated, reflecting the sensitivity of socio-economic efficiency and professional well-being of graduates of the agricultural sector to changes in individual factors. This methodology comprehensively evaluates

the influence of educational environment factors, individual characteristics and conditions of the regional labor market on their socio-economic efficiency and professional well-being of graduates.

Results

It is advisable to consider the socio-economic efficiency of an agricultural graduate as an external (objective) result of professional life, reflecting the degree of success of professional realization in the agricultural market through indicators of employment in the specialty, employment sustainability, income level, career growth, labor productivity and demand in the agro-industrial complex. The results of graduates' professional development are primarily reflected in their position in the labor market, including the level and quality of employment, the demand for their profession, and opportunities for further professional growth [9]. These provisions are the basis for assessing the socio-economic effectiveness of graduates of agricultural training areas.

In turn, the professional well-being of an agricultural graduate is an internal state of the individual, reflecting a subjective assessment of professional activity in the agro-industrial complex, satisfaction with the chosen profession, working conditions, opportunities for professional and career growth, as well as self-realization in agricultural production. Professional well-being is an internal mechanism of sustainable professional realization, providing motivation for work, professional involvement, the ability to master innovative technologies and adapt to changes in the socio-economic environment of the agricultural sector [10, 11]. The formation of professional well-being contributes to the consolidation of young specialists in agriculture, increasing the efficiency of using their human capital and competitiveness in the agricultural labor market.

Socio-economic efficiency and professional well-being of an agricultural graduate are closely interrelated and complement each other. The success of professional realization is determined not only by the objective results of work, but also by the subjective perception of graduates of their professional capabilities [7]. In this regard, professional well-being acts as an internal mechanism for sustainable professional realization, while socio-economic efficiency reflects its objective results in the agricultural labor market through indicators of employment in the specialty, employment sustainability, income level, career growth and demand in the agro-industrial complex. Responsibility plays the role of an amplifier of basic and additional skills and forms the

basic human capital of the graduate. Thus, these concepts are closely related.

Of particular interest are the factors of the macro and microenvironment, since they form the conditions for training competitive specialists for the agro-industrial complex, determine the level of development of professional competencies of graduates and create the prerequisites for their successful professional implementation in the competitive labor market. The employment of graduates is determined by a combination of various forms of their capital, which contribute to their readiness for professional activity and a successful transition to the competitive labor market [12]. The effectiveness of higher education is determined not only by academic results, but also by the ability of graduates to adapt to changing professional conditions [13].

The authors consider the socio-economic efficiency of an agricultural graduate as an integral resultant indicator that is formed under the influence of micro and macroenvironment factors and reflects the level of realization of a graduate's human capital in the agro-industrial complex. Responsibility, professional and universal competencies, labor and financial stability, as well as professional realization, which characterizes the graduate's success in the agricultural labor market, are highlighted as the main components of the graduate's social and economic efficiency model.

Educational environment factors that ensure the formation of professional competencies, digital skills, and the ability to innovate play a crucial role in training specialists for modern agriculture [14]. Therefore, the microenvironment includes educational and methodological, personnel (teaching staff), logistical, organizational and career, socio-psychological, innovative and entrepreneurial factors that directly affect the development of responsibility, professional competencies and professional well-being of graduates. The operationalization of microenvironment factors is carried out through such indicators as the quality of teaching, the quality of educational programs, minor training, micro-qualifications in certification centers, digital and entrepreneurial literacy.

The macroenvironment covers a wider range of external conditions related to the labor market situation. According to the OECD, the digital transformation of agriculture, the technological modernization of the agro-industrial complex, changes in the requirements of employers and the

development of sustainable agriculture form new requirements for graduates' competencies. For Kazakhstan, the state agrarian policy, rural development, staffing of the agro-industrial complex and the interaction of universities with employers are of particular importance [15].

In this regard, the operationalization of macroenvironment factors is carried out through such indicators as English language proficiency, the use of social networks and professional contacts, the expansion of horizons and cultural understanding, the development of communication skills. Thus, the microenvironment forms the internal resources of the graduate, which directly affect both the professional well-being and the subsequent socio-economic effectiveness of the graduate. The macroenvironment sets the external conditions for the realization of these resources, determining the graduate's demand in the labor market, their career opportunities and socio-economic results. The results of the study confirm that the factors of the macro and microenvironment do not act in isolation, but interact. The microenvironment acts as the primary transformer of human capital formation and directly affects the professional well-being of graduates, however, its effectiveness directly depends on external conditions [16]. Even with high-quality intra-university training, an unfavorable macroenvironment can significantly reduce the final results. The macroenvironment determines the degree of conversion of the formed competencies into the real socio-economic results of the graduate. If the microenvironment can partially compensate for the negative impact of the macroenvironment due to the high quality of competence training, then a favorable macroenvironment significantly enhances the return on investment in the microenvironment.

Socio-economic efficiency and professional well-being of a graduate are an integral indicator of the state of positive human functioning in the professional sphere, associated with a subjective assessment of various dimensions of professional life, having a multidimensional, dynamic structure of factors associated with the influence of professional, personal, organizational and contextual components. The authors believe that the socio-economic efficiency and professional well-being of a university graduate is an integral indicator of a young person's professional development, which shows:

- sustainability, formality and satisfaction with employment relations;

- the state of the employee's cognitive and emotional functions;
- financial stability of the employee.

In 2025, 1 402 graduates of the North Kazakhstan University took part in the study, including 102 graduates of agricultural

specialties. The participants filled out an assessment questionnaire for university graduates using the university's electronic platform. In this questionnaire, the indicators used to build the model were ranked according to the following criteria (table 1).

Table 1 — Questionnaire for building a correlation and regression model among graduates of agricultural specialties

№	Name of the criterion/subcriteria	Results
1	Basic skills	from 1 to 17
1.1	The quality of education in the basic educational program	from 1 to 5
1.2	Minor training, micro-qualifications in certification centers	from 1 to 2
1.3	Digital literacy	from 1 to 5
1.4	Entrepreneurial literacy	from 1 to 5
2	Additional skills	from 1 to 13
2.1	Knowledge of English	from 1 to 5
2.2	Broadening horizons and cultural understanding	from 1 to 4
2.3	Communication skills, social media and contacts	from 1 to 4
3	Professional well-being of the university graduates	from 1 to 12
3.1	Professional stability and working conditions	from 1 to 4
3.2	Occupational health and stress	from 1 to 4
3.3	Financial stability, responsibility, and personal finance management	from 1 to 4
Note: compiled by the authors based on the methodology of econometric modeling [17]		

The authors provide the description of this table and explanation of the relevant evaluation criteria.

1. Basic skills:

1.1. The quality of education in the basic educational program (1 - no knowledge; 2 - minimal knowledge; 3 - satisfactory knowledge; 4 - good knowledge; 5 - excellent knowledge).

1.2. Minor and micro-qualification training in certification centers (1 – no minor training; 2 – there is training in minor).

1.3. Digital literacy (1 – minimal knowledge; 2 – weak knowledge; 3 – satisfactory knowledge; 4 – good knowledge; 5 – excellent knowledge).

1.4. Entrepreneurial literacy (1 – minimal knowledge; 2 – weak knowledge; 3 – satisfactory knowledge; 4 – good knowledge; 5 – excellent knowledge).

2. Additional skills:

2.1. Knowledge of English (1 – low level of knowledge; 2 – average level of knowledge; 3 – good level of knowledge; 4 – high level of knowledge).

2.2. Broadening horizons and cultural understanding (1 – poorly developed global and critical thinking; 2 – moderately developed global and critical thinking; 3 – good global and critical

thinking is developed; 4 – global and critical thinking is strongly developed).

2.3. Communication skills, social networks and contacts (1 – I do not use social networks; 2 – I rarely use social networks; 3 – I use social networks; 4 – I often use social networks).

3. Professional well-being of university graduates:

3.1. Professional stability and working conditions (1–4 points) assesses the stability and formality of labor relations (1 – unemployment / lack of stable employment; 2 – temporary/project work, moderate stability; 3 – stable employment (hiring/ self-employment; 4 – stable employment and satisfaction with working conditions).

3.2. Occupational health and stress (1-4 points), where the focus is on the work-related condition (1 – severe burnout, constant stress; 2 – moderate stress, preserved working capacity; 3 – rare stress, generally good health; 4 – excellent condition, no burnout, good energy).

3.3. Financial stability, responsibility and personal finance management (1-4 points). It includes such parameters as income generation, tax payments, and the purchase decision-making process (1 – unstable income, debts, breaches of obligations, I do not make financial decisions about

buying goods; 2 – income is irregular, but basic obligations are fulfilled, sometimes I make financial decisions about buying goods; 3 – income is stable, obligations are fulfilled on time, I make financial decisions about the purchase of goods; 4 –

stable income, financial decisions are made about the purchase of goods and savings are formed).

Further, table 2 presents additional calculations necessary to determine the parameters of the model $\hat{y} = a_0 + a_1 \cdot x_1 + a_2 \cdot x_2 + \varepsilon$ based on the solution of the system of equations (1).

Table 2 — Calculations for determining the parameters of the model

x_1 – basic skills, $1 \leq x_1 \leq 17$	x_2 – additional skills, $1 \leq x_2 \leq 13$	y – effectiveness, $1 \leq y \leq 12$	x_1^2	x_2^2	$y \cdot x_1$	$y \cdot x_2$	$x_1 \cdot x_2$	y^2
325	327	742	1 593	1 471	2 702	2 546	1 204	5 982
Note: compiled by the authors based on the methodology of econometric modeling [17]								

Based on the data shown in table 2, the system of equations will take the following form:

$$\begin{cases} 102 \times a_0 + 325 \times a_1 + 327 \times a_2 = 742 \\ 325 \times a_0 + 1593 \times a_1 + 1204 \times a_2 = 2702 \\ 327 \times a_0 + 1204 \times a_1 + 1471 \times a_2 = 2546 \end{cases} \quad (1)$$

Having solved this system, model will take the following form:

$$\hat{y} = 4,9249 + 0,5525 \cdot x_1 + 0,1838 \cdot x_2 \quad (2)$$

Based on the application of STATISTICA package, the cumulative multiple correlation coefficient R is 0,6099 or 60.99 %.

Thus, the professional well-being of graduates of the agro-industrial complex who took part in the survey depends on factors (basic and additional skills) by 60.99 %.

Next, we will make an economic interpretation of the model based on the calculation of elasticity coefficients (4), showing the average changes in the effective feature when external factors x_i change by 1 %.

The values of the elasticity coefficients are as follows:

$$E_1 = 0.242; E_2 = 0.081.$$

Thus, according to the calculations, with an increase in the level of basic skills by one percent, the professional well-being of agricultural graduates will increase by 0.242 %, and with an increase in the level of additional skills by one percent, their professional well-being will increase by 0.081 %.

The results of calculations of elasticity coefficients confirm positive trends in increasing the quality of both basic and additional skills and opportunities.

To sum up, the authors conclude that the survey and correlation method is quite applicable in Kazakhstan due to its simplicity and lack of requirements for the availability of a significant amount of statistical information.

Discussion

The results obtained confirm that the socioeconomic effectiveness of a graduate of an agricultural university is a complex characteristic that is shaped by a combination of factors from the educational environment and the external labour market. The correlation regression analysis showed that the level of development of basic and additional skills has a statistically significant impact on the graduate's socioeconomic effectiveness. At the same time, the contribution of basic skills is significantly higher than that of additional ones, which indicates the key role of the quality of the educational process, digital and entrepreneurial training in ensuring the successful professional fulfilment of graduates. These conclusions are consistent with studies showing that the competitiveness of graduates from agricultural universities is determined by their professional knowledge, universal competencies, and ability to adapt to changes in the agricultural labor market [12, 13].

The digital transformation of agriculture increases the importance of developing professional and digital competencies, which enable graduates to adapt to technological changes in the agricultural sector [14]. This study presents a comprehensive approach that combines objective and subjective indicators of a graduate's professional achievements. At the same time, microenvironment factors reflect universities' ability to develop graduates' competencies through the quality of educational programmes, human resources, and the development of digital competencies, while macroenvironment factors characterize the conditions for realizing graduates'

potential in the agricultural labour market. Calculating the elasticity coefficient made it possible to quantitatively assess the change in the socioeconomic efficiency of graduates depending on the change in the level of their competencies. This approach makes it possible to determine the contribution of various factors to the change in the socioeconomic efficiency of graduates, which expands universities' opportunities to evaluate graduates in order to develop measures to improve educational activities and assess their effectiveness.

Conclusions

Based on the conducted research, the following conclusions can be formulated:

1. It is confirmed that the socio-economic efficiency of graduates of the agricultural field is a complex characteristic formed under the influence of micro- and macroenvironment factors. At the same time, the level of professional realization of graduates is determined by both the quality of professional training and the competencies that ensure adaptation to the external environment.

2. The proposed methodological approach to assessing the impact of micro- and macroenvironment factors, based on the methods of questionnaires and correlation and regression analysis, makes it possible to quantify the impact of these factors on the socio-economic effectiveness of graduates of agricultural programs.

3. The proposed methodology for assessing the impact of factors on the socio-economic effectiveness of graduates can be used to assess the quality of training by universities to take measures to improve the educational process.

4. The results of the study showed that the level of formation of basic skills has a more significant impact on the socio-economic effectiveness of graduates than the level of additional skills.

The main directions for increasing the socio-economic efficiency of graduates of the agricultural sector at North Kazakhstan University are to improve the quality of educational programs, provide additional training in micro-qualifications, and strengthen digital and entrepreneurial literacy.

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