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ESSENCE OF UNIVERSITY AND PROSPECTS OF ITS DEVELOPMENT BY A HIGHER EDUCATION INSTITUTION IN MINING

The article presents the essence of university as the organized aspiration for reality and its transformation towards development of mankind. It is shown that the essence of University is structured as a unity of three components: spirit, intelligence and energy. The notion of University is defined as a space of high concentration of various advanced intelligence pregnant with spirit and energy of knowledge and transformation of the latter into the large-scale social phenomena. The levels of the University essences are distinguished as: true, similar and remote. The structural–functional model and the four levels of the academic knowledge mechanisms reflective of the unique nature of academic knowledge and its long-term use by human beings are presented.

The author describes 66 year-long history of one of the leading mining universities in Russia— Kuzbass State Technical University, and its present-day stagnation. It is revealed that the state of the structural components of the University essence (spirit, intelligence and energy) prevent the university from the efficient materialization of its essence even at a scale of a region. The system elements of KuzSTU are characterized from the standpoint of essence – fact, which discloses considerable discrepancies between the essences and facts at all organizational levels of the university.

The academic knowledge mechanism at KuzSTU contains essential defects in the form of the absence of the pioneer and absorption levels of cognition, which eliminates capability of reaching the own breakthrough scientific results and successfully transforming than into large-scale social phenomena. This inevitably entails impoverishment in the quality of the second and third levels of cognition. KuzSTU is yet an educational institute. The prospects for becoming a University depend on a new leader with an efficient managerial team and on the success in their performance aimed, first of all, at consistency between the essences and factual elements of elements at all organizational levels, as well as at making the fourth-level mechanism of academic knowledge in all areas of research.

Key words: *university, higher education institution, essence, fact, level, knowledge, mechanism, prospect, education, science*

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Introduction

In 2015 T. F. Gorbachev Kuzbass State Technical university celebrated its 65th anniversary. The history of the university began 1950 with the establishment of the Kemerovo Mining Institute (KMI) on the basis of the Kemerovo Secondary Technical School for Mining and Construction. The first admission at KMI was announced in Kemerovo and in Moscow (Moscow Mining Institute). The admissions offices at MMI and KMI enrolled 300 students in the first course of training, including 150 students in mineral mining, 75 students in mine construction and 75 students in mine electromechanics. In 1960 the Institute consisted of 4 faculties and 24 departments engaging 150 lecturers, including 2 professors, 40 associate professors and 40 senior lecturers. Aiming to promote mining area of expertise in KMI, the Ministry of Education transferred the oldest Mining Faculty of the Tomsk Polytechnic university (TPU) in Kemerovo. Both students and lecturers, support personnel and required equipment, training and scientific literature were transferred. From TPU 35 lecturers moved to Kemerovo, including associate professors, assistants and senior lecturers.

In the mid-1960s, the Institute launched applied research laboratories in economy, coal mining, improvement of chemical technology processes and equipment, as well as reliability of mining machines. A fundamental research laboratory for spectroscopy was created. Admissions of students and graduations of engineers grew. The graduates of that time remember aura of mutual respect between students and lecturers, training quality responsibility, inspiration and endeavour: "… it was a unity of spirit, honor and glory" [1].

In 1965 KMI was transformed into the Kuzbass Polytechnic Institute (KuzPI). By that time, the fellows of the Institute published 100 research articles, a monograph, and booklets, received 2 author's certificates for invention, and defended 16Candidate Theses. By 1970, the Institute contained 8 faculties and 37 departments. The scope of training specialization expanded, and number of applicants grew. In 1970 the Institute trained 8350 students [1].

In the 1970s–80s, KuzPI developed both in the line of research and education. The Institute's scientists engineered technologies and machinery for coal mining, efficient and reliable chemical processes and equipment, as well as methods and means for reclamation of chemical industry waste. R&D projects of those years included: 4 leg support design; method of opencast coal mining by blocks; method of wastewater purification. In 1971–1975 the received author's certificates for invention totaled 156, and the scope of R&D activities grew 2 times as compared with the previous 5 years. Six R&D projects of KuzPI were awarded with medals at the Exhibition of Achievements of the National Economy. Postgraduate applications and admissions go up. By the late 1980s, the Institute becomes a leadership in the USSR school of miners, and high competency of engineers graduated from the Insti-

tute is acknowledged both by the Coal Ministry and by mining practitioners [2].

In 1993 KuzPI was re-organized into the Kuzbass State Technical university. The "roaring 1990s" came with the dissolution of the Soviet Union and chaos in economy and education. The unexpected freedom and mass uprise of pseudo-universities resulted in "…the jump in the number of students from 17 to 60%. At the same time, as a consequence of exodus of scientists and lecturers (they left to the other areas of activities, or emigrated), the quality of education suffered dramatic effect" [3]. Financial support was slashed in all avenues of university activities. This caused loss of professional scientific people, degradation of training, reduction in research activities, and decrease in the number of patents for invention and in defence of Theses…

As a consequence, by 2007–2008 only 8–9 Candidate's Theses and 2–3 Doctorate Theses were defended yearly. Over a period from 2004 to 2008, the number of publications halved. Postgraduate studentship totaled 270 people in 2000 and reduced to 50 people in 2009. Staff members opened the problems of the university and put forward solutions, but the situation remained unchanged [4-6].

At the same time, at the Tomsk Polytechnic university, 110–120 Candidates of Science and 40 Doctors defended Theses yearly. Regarding financial support of research activities in recent years, KuzSTU is granted 50–70 million rubles a year while TPU gets 2 billion rubles.

The impressive breakthrough of universities in the neighbor China in the last decades is based on the implementation of the large-scale university development program launched by the government of the country in 1996 under the name of Project 211 and Project 985. For the rapid advancement, 39 universities belonging to the Ivy League were selected, 9 of these universities are destined to reach "international" standard. The overall financial backing of these projects over a period from 1996 to 2007 made 10,3 billions of US dollars. Currently, the projects are at the third stage of implementation [7]. Russia set about modernization of higher education in 2010. Under certain terms and conditions, the universities were granted financial support and new statuses. The universities were ranked into federal, national-research and supporting, and an elite group of universities was organized within 5-100 and concluded a contract with the government on entering the list of top universities in the world.

Reduced to stagnation by weak management, aggravating economical and political situation, tacit "noninvolvement agreement" [8] of personnel and by rejection of modification, KuzSTU entered neither development programs. As a result, ranked as 160–165 in the national university rankings seven years ago, the university was placed 178 in 2016. The other two higher education institutions in Kemerovo had the 146th and 78th places (KemTIPP and Kemerovo State university, respectively) [9].

The Strategic Development Program in 2012–2020 formulates the objective for KuzSTU as follows: "The *strategic goal* is to reach leading positions based on strengthening intelligence elite and research and pedagogical schools of the university, engagement of talents to solve education, research, production, social and economic problems of Kuzbass" [10]. It should be acknowledged that the set strategic goal is failed by KuzSTU all together. The last 15 years can be assumed as los for development as KuzSTU is permanently exists in the condition of surviving. At the same time, universities in the neighbor Tom Region are stable leaders in the university rankings of Russia: the Tomsk State university and Tomsk Polytechnic university share ranks 9–10. Furthermore, they boast impressive success in the QS World university Rankings. Started in 2012 at the rank of 600–650, TPU was ranked as 400 and TSU—as 377 by 2016. As of 2016–2017, the list of the leading universities in widely recognized QS rankings is given in **Table 1** [11].

Table 1. Best universities in the world

Top 10 universities in the world	1. Massachusetts Institute of Technology, USA 2. Stanford University, USA 3. Harvard University, USA 4. University of Cambridge, United Kingdom 5. California Institute of Technology, USA 6. University of Oxford, United Kingdom 7. University College London, United Kingdom 8. Swiss Federal Institute of Technology, Switzerland 9. Imperial College London, United Kingdom 10. University of Chicago, USA
10 Russian universities in the QS rankings	108. Moscow State University 258. Saint-Petersburg State University 291. Novosibirsk State University 306. Bauman Moscow State Technical University 350. Moscow Institute of Physics and Technology 350. Moscow State Institute of International Relations 377. Tomsk State University 400. Tomsk Polytechnic University 401–410. National Research Nuclear University 411–422. National Research University Higher School of Economics 411–422. Peter the Grate Saint-Petersburg Polytechnic University

The experts in the area of university management say, "The education to become good and interesting cannot be an excusive subject of care of the centralized government but should be the concern of the universities as well. In this context, it is necessary to complete the transition from the Soviet institution of higher education as industrial personnel training to the university as an independent organization taking the risk on the market of credibility…Harvard needs no permission of Washington or the State of Massachusetts to shape the path of development for the next ten years, whereas the Chancellor of Oxford is more anxious to preserve the status of the university in the years of the applicants, graduates and international academic society rather than the Department for Education of the United Kingdom"[3].

KuzSTU remains a subdivision of the Ministry of Education and Science and absolutely depends on it. The university management did not even raise the question of independence, probably, in fear of such freedom. More brave and up-and-doing senior officials of the Toms Polytechnic university promoted the institution as "independent higher education institution" three years ago [12].

What is happening with KuzSTU? Why does the university report success but not development? What are the buried causes of stagnation? Why does the tree of TPU have been growing and expanding for 12 years, and its branch KuzSTU have been fading for the last 25 years? How KuzSTU can become a real university and approach the leaders of the educational market? The author of this article had been working at KuzSTU for 10 years (while being tied with the institution for 40 years already) and has now been working at TPU for 7 years, which makes it possible to analyze, estimate and compare the activities and performance of these institutions.

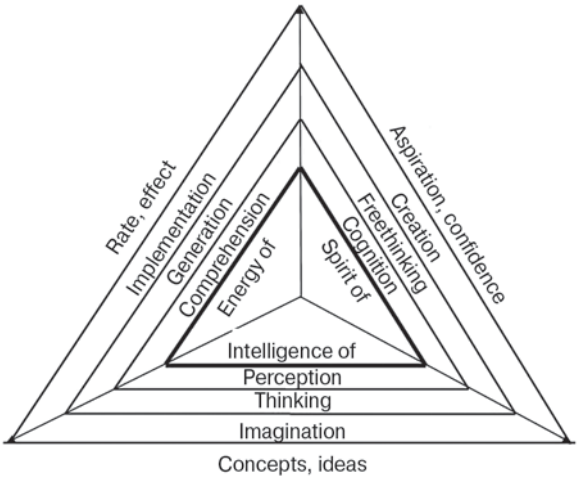

Fig. 1. Triple structure of the university essence

University essence: structure and levels

Tomsk scientists have revealed the essence of university, which consists in the organized aspiration for perception of reality and its transformation for the development of mankind. The force of this aspiration is governed by the unity of three components: spirit, intelligence, energy (**Fig. 1**).

From the standpoint of the essence, the university is a space of high concentration of various advanced intelligence pregnant with spirit and energy of knowledge and transformation of the latter into the large-scale social phenomena [13]. In this context, the spirit is understood as the inwardness, pulse beat and uplift of personnel toward cognition and creation, which give rise to appetence, commitment and confidence. The intelligence means general human ability to perceive reality, to think and imagine, and to generate new conceptualizations and ideas. The energy is the efforts and activities in comprehension of reality, generation of new and its materialization at the socially required rate and effect.

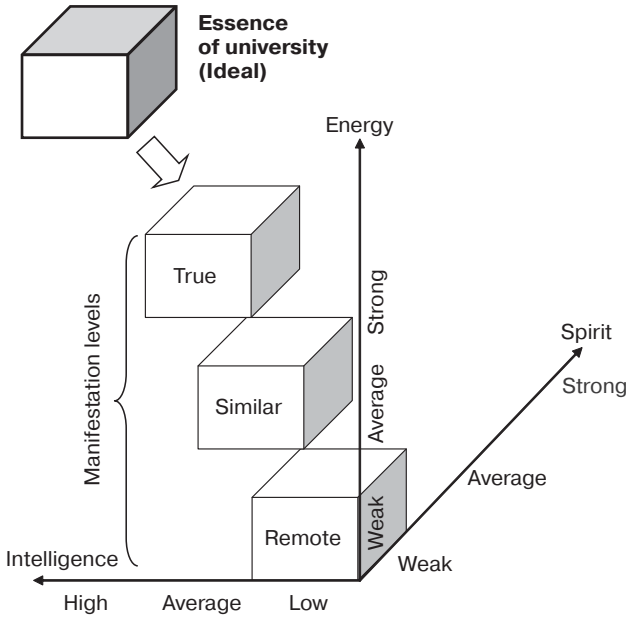

Fig. 2. Levels of the essence of a university

Depending on the quality, relationship and bonding of structural elements, the essence acquires various and numerous representations in the form of specific universities, their functions and states (there more than 23 thousands of classic universities in the world). State of a phenomenon governs its consistence with its essence. In order to characterize consistence of the university–phenomenon and its essence, three levels are distinguished (**Fig. 2**).

The Genuine level is an ideal, an absolute and an eternal goal [14]. The first level of a specific university is estimated by the quality of the essence elements: high, average low. The Existence level is the level of a university having its all components of high quality. The Similar level is characteristic for a university with the average quality components. Weak spirit, intelligence and energy put a university at the Remote level from the true (ideal) level. The other combinations of quality of structural elements within the essence determine the intermittent positions of the university as a phenomenon [15].

According to the up-to-date information, some of the Russian universities occur at the level below average. This is a level of faints, false essence when the spirit, intelligence or energy is suppressed or absent. Such universities are just diploma-issuing offices.

According to the quality of the structural elements, KuzSTU can only to pretend to the Remote level or a bit higher.

Essence of the elements of a university

Then, to estimate the consistency of KuzSTU and the notion of university, the essences and occurrence of the basic structural elements of a university were formulated (**Table 2**). The developed characteristics of the essences of the elements disclose their remoteness from the current state of KuzSTU. Considerable divergence between the phenomena and essences at all organizational levels is the major constraint in the way of KuzSTU to a Genuine or Similar university.

Professor V. A. Tomsinov thinks, “The idea that any training agency composed of many faculties can, on this basis solely, be called a university, distorts the true nature of such institution. The essence of a university shows itself not in the package of sciences learnt and trained but in the prevailing goal of learning and training. The goal is not only training of students and elaboration of some skill in a certain area of science but also their cognitive activity in knowing sciences and, accordingly, development of scientific thinking. Creation of new universities by uniting several institutes completely disagrees with the internal essence of a university. A united institution will be an artificial and amorphous body, and will be a university by name rather than by nature” [16].

Organization of academic mechanism of knowledge

The university is the main and the finest mechanism of the organized cognition of reality by a human being toward the social progression. The objective of the university is the knowledge of the unknown and transformation of new ideas into large-scale social phenomena. The mankind needs the university as the mechanism of the organized and intelligent penetration in the unknown, scaling of the comprehended and its transformation into a sequence of social phenomena.

System of cognition in the university is the basis of all systems of enlightenment (education and upbringing) and innovations (novelties and their effects). The university is for knowing — learning and understanding essence of things

Table 2. Manifestation of the university essences in its elements

No.	Object	Brief description	
		Essence	Fact
1	2	3	4
1	University	Space of high concentration of various advanced intelligence pregnant with spirit and energy of knowledge and transformation of the latter into the large-scale social phenomena	Higher education institution training specialists in basic and applied sciences, as well as branches of economy and culture [15]
	System elements		
2	Scientific council	Authority of cooperative decision-making and approval	Tool for authorization of attitudes and decisions of Rectorate
3	Rectorate	Spiritual, ideological and target accelerator of renovations. Developer and promoter of a strategy, Distributer of resources between the university systems	Executer of orders of the Ministry of Education and Science. Tactical and operative control. Concentrator and distributer of resources between all levels of university
4	Institute	Organizer of knowledge processes in a certain scientific area	Organizer of financial and economic activities
5	Laboratory	Structure of scientific knowledge unknown in a certain sector of reality. Bearer of the knowledge spirit and energy towards renovation of ideas and advanced proposals	Staffed and equipped collective of scientists solving scientific problems in the present topic in an orderly way
6	Researcher	Passionate agent to perceive reality and methods of its transformation	Researcher of a specified problem and developer of its solution
7	Chair (Department)	A community of complementary scientists to transform scientific ideas into advanced training courses, tutorials, lectures and seminars. Bearer of the education culture	Staffed assembly of lectures of different specialties and skills, training standardized graduates with diplomas. Place of employment of lecturers
8	Auditorium	Area duly equipped for the efficient transformation of knowledge of one person into intellectual growth of many persons and for inspiration of many towards self-education	Room equipped with multi-media and instruments for lectures and seminars
9	Lecturer	Explainer and interpreter of complex phenomena of reality in a simple manner and learner of cognition with interest	Lecturer, tutor, examiner
10	Student	Striving for deeper cognition and singularity of conceptualization, mastering scientific thinking and skills of solving typical problems in the area of specialty	Striving for getting diploma of higher education

and processes. This is the primary function of the academic mechanism of knowledge, followed by reasoning, education, creativity, product development, promotion and introduction. **Fig. 3** depicts the model and levels of the academic knowledge mechanism (AKM) and its cyclic functioning.

Knowing and comprehending the essence of something, a person gets a new deeper insight and, thereby, education that transforms into competence. New ideas and skills produce innovations through creativity. The marketing development of a novelty allows a product which is promoted and introduced by a small innovative business (SIB). The renewed product (devices, technology, process) modifies the initial substance being known and provides social innovation and progression.

The modeled cognition cycle at the university has four levels: pioneer, joining, expansion and absorption. An unknown passes the AKM level and becomes the knowledge utilized by society. The pioneer level is the research laboratory personnel who break through beyond the limits of the known. Then, lecturers join the knowledge and transform it to the new training courses to be expanded and perceived by the students gathered in the auditoriums. The fourth level of AKM is the intelligence of SIB and the projects and ideas of researchers and lecturers to the actual production and social sphere.

These four levels of knowledge determine the unique nature of the academic mechanism and the foundation of its centuries-long existence. The leading universities in Russia and abroad have organized these levels well, which ensures fast transformation of the new knowledge into advantageous progressive renovation of reality and new capabilities of society [7, 17–21].

Analysis of the knowledge mechanism at KuzSTU

Aiming to understand the current knowledge mechanism at KuzSTU, a knowledge chart was developed for one of the leading institutes within its structure (**Table 3**).

The analysis of the information in the table points at the falls and deficiencies of the knowledge mechanism: training of students is only represented by educational departments and auditoriums, such critical structures in cognition as research laboratories and innovative business are absent. Consequently, this university lacks structures of progressive knowledge and scientific breakthrough. As a result, there is no backup of the education process with the own knew knowledge. The structures of the purposeful promotion of R&D in the market are also absent. The functional connection is only exists between a department and auditorium. There are links between the departments and industrial plants in terms of small education contracts and episodic relationship within rare R&D project execution.

Moreover, alongside with the falls and deficiencies, there is a deformation of the education process at the university.

Table 3. Knowledge chart construction for the Mining Institute of KuzSTU

No.	Level and structure of cognition	Area of cognition (object)		Interaction between cognition areas
		Opencast mining	Underground mining	
1	2	3	4	5
1	Pioneer Research laboratory	Absent	Absent	Absent
2	Joining Education department	Chair of Opencast Mining — 18 people	Chair of Underground Civil and Mine Construction and Mineral Mining — 30 people	Scientific conferences — twice a year
3	Expansion Student auditorium	Lecture room — accommodates 75 people. Training rooms (2) — accommodate 50 people each	Lecture room — accommodates 150 people. Training rooms (2) — accommodate 50 people each	Absent
4	Absorption Small innovative business	Absent	Absent	Absent
5	Industry	Open pit mines in Kuzbass Annual coal production is 145 Mt	Underground mines in Kuzbass Annual coal production is 82 Mt	Hybrid opencast/ Underground mining

The specified region produces coal in opencast mining two times as much as in underground mining, while the number of teaching personnel and students in opencast mining is two times lower than in underground mining. The joint projects of cognition, education, creativity and promotion between the areas of cognition at the university are absent (apart from episodic scientific conferences) where the region builds up the hybrid opencast/underground coal mining.

The paradox is that earlier the Faculty of Mining (educational structure) possessed the first and forth levels of the knowledge mechanism (there were research laboratories, and R&D projects were rapidly introduced in the industry) and lacks them this time.

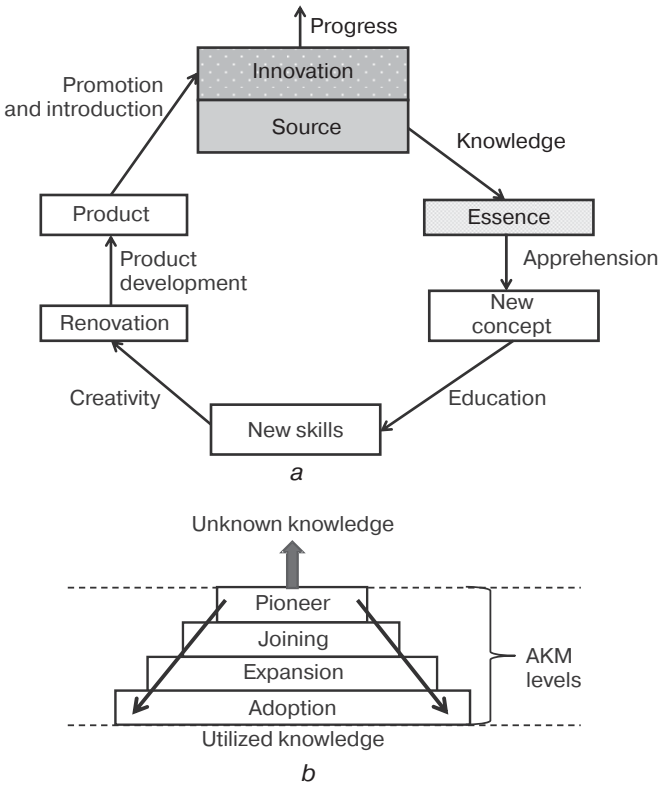

Fig. 3. Structure and functions (*a*) and levels of the academic knowledge mechanism (*b*)

Renaming of the Faculty of Mining into the Mining Institute (research structure) resulted in no qualitative renovation of the cognition process [6]. The situation is valid for the majority of the other "institutes". A few of the small new research laboratories established at the university unalter the state of things given there are no active small business. The scientific personnel and postgraduate studentship are reduced; the university management fails to obtain financial sponsorship for R&D.

The Kuzbass State Technical university remains an educational institution at the weakening quality of education. Rector Nesterov V. I. raised the sensitive question at the personnel training meeting, "… the urgent problem of the day is who will be teaching? The average age of the professors and associate professors at KuzSTU is 67 and 65 years. Training is performed using workbooks from the 1970s–80s (!!!). Lecturers have not been in an actual mine for 15–25 years (!!!). We cannot propose marketable R&D projects…" [22].

Academician P. L. Kapitsa's opinion is yet is the current concern for KuzSTU: "…the higher education is still structured as the transfer of theoretical knowledge and practical experience to youngsters, while development of creativity enjoys neglect. In this manner, a young person, though a brilliant graduate, appears incapable to develop whatever new design or find a nonstandard solution" [23]. The present-day outcome of the old problem is outflow of the best school graduates in the Kemerovo Region to the neighbor regional universities. The average score (58.7) of the enrolled students in 2012 put KuzSTU at the 337th place in the country [24].

The university with the defects of the knowledge mechanism like that is weakly adaptable to the target-oriented cognition and its transformation to reality, and is incapable to pretend for the level of Similar or True. It is still at the Remote level of the Essence of the university.

Conclusion

Having been established more than 50 years ago with the essential backup from the Toms Polytechnic Institute and, then, having lost any cooperation with TPU due to the fault of the last rectors, the present-day Kuzbass State Technical university can find a way out of the unenviable situation through turning to its roots and refreshing connection with this allied ("of blood" and geographically) and developing educational

and research institution. The history of success at TPU suggests some immediate prospects achievable by KuzSTU:

1. Finding and electing a rector as a leading, creative and responsible scientist capable of shaping an efficient managerial team, as well as strategy and program of development. Evidently, KuzSTU needs a profitable rector, more giving than taking, productively interactive in all areas of the external and internal environment of the university towards its competitive strength and long life. The requirement of replacing an administrative rector by a rector–leader is put forward by the modern advanced universities in the world [7].

2. Revival of the spirit, intelligence and energy of personnel by concluding effective contracts with the valid mechanisms of stimulation and sanctions [25]. The use of effective contract as a main tool of optimizing personnel structure through expansion of such categories as gold fund and backbone and reduction of such categories as inert destroyer [26].

3. Rallying, organization and inspiration of talented personnel for development and implementation of commercial projects under programs supported by ministries, industrial companies, foundations, etc. Investment of earnings in advancement of the first and fourth levels of academic knowledge.

4. Elaboration of programs for personnel and all organizational structures to learn their essences for the advancement of the university toward the levels of Similar and True.

5. Restoration (through improvement of the research and education quality) of wide commercial interest of the industry in obtaining efficient results from the university in the form of skills of the graduates and R&D innovations with a view to improving safety and performance.

6. Establishment of the Chair of Science of Universities as a tool of learning the mechanisms of functioning and growth of universities; development of methods to improve systems, structures and functions of universities; training of managerial staff for all levels. It is difficult to gain from successful development of an object without getting insight into it in an orderly way.

7. Entering into cooperation with TPU and TSU—leaders of education in Russia — opens new avenues for KuzSTU to come out of crunch, first, and to advance and grow later on.

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