P. Yu. Saukh,
Habilitated Professor,
Rector of Zhytomyr Ivan Franko State University

The scientific-educational synergy as the engine of the information society; European challenges and Ukrainian problems

The article analyzes a new image of education and science as undergoing essential transformations in the information society where both notions grow into indispensible constituents of human lifestyle and become mostly pragmatic in character. Outlined are the consequences of this irreversible process and the algorithm of an expedient response on the part of Ukrainian education to the modernity challenges is constructed.

Needless to say that science and education are of primary importance in the modern information society as these are the very hi-tech producing spheres which determine economic growth. A country's competitive ability, as evidenced by world experience, is in direct relationship to the competitive ability of its science and education. But as soon as the notion of the information society is involved the commonplace idea of science and education becomes subject to essential transformation. Here it lays groundwork for social stability and economic progress, grows into an indispensable constituent of human lifestyle, becomes rather pragmatic in character, and drastically transforms its application mechanisms. It was Peter Drucker, one of those who coined the "information society" term, who, way back in 1994, managed to envisage the social changes it would bring about. The information society, as he saw it, was to radically change the nature of labor, higher education, and the very ways in which society functions [I, 56]. According to Drucker, the information society was not only to increase the quantitative proportions of the educational element in social structure but to adopt scientific knowledge and science-consuming technologies as its root, its essence, and its natural atmosphere. Today one has every reason to state that the once envisaged phase of scientific and technological interaction as well as the subsequent interaction of this new-type integrity – "hi-tech science" as it may be termed – and of the corresponding social and educational structures is no forecast but reality. *Modern science is regarded to be as objective as it is technically effective* which state of things, on the one hand, makes it generate new ideas and provides it with every sort of encouragement and yet, on the other hand, the production of new technologies determines a need for a *particular kind of science* which automatically results in the latter's limitation and a greater part of its potential left unfulfilled. This type of science is no longer supposed to either search for understanding or provide explanation of things and phenomena. Its major task, instead, is believed to consist in *practical management advice*. In view of this, it is far from accidental that modern social expectations generally regard science as a source of new and still newer applicable and effective technologies rather than an anonymous constructor of mankind's weltanschauung. There is a strong tendency to interpret any particular type of scientific activity and science itself almost exclusively in terms of some technology generating machine, which tendency is equally characteristic of both the present day developed countries and Ukraine.

More than that, modern scientific research is not only expected to provide technological instruction, but to correlate demand with supply, that is to say to meet the particular social requirements and expectations. In this way the growing practical applicability in those scientific spheres which come close to everyday needs of an average person has been giving renewed impetus to science and technologies in terms of stimulating their farther development and specifying the current research issues. This tendency obviously parallels the newest trends in business world which is now offering support to those particular research projects which may interest a mass consumer. So, it is not surprising that the present, already the sixth, scientific

technological setup centers in such key issues as bioengineering, intelligence system, global information technologies, non-waste eco-friendly hydrogen energy technologies, intellectual products of pharmaceutical industry, medical equipment, GM products etc. It can be argued that the contemporary hi-tech civilization is rather excessive in the degree of its market orientation cultivating *universal facility* as its own equivalent of the traditional "humanism" where the former, despite its seemingly noble attempts of making one's life easier, better, and more comfortable to live, tends to display a kind of self-idolatry more often than not. To put it plainly, the emerging anti-ascetic civilization is ruled by the *maximum-kef-through-minimum-effort principle* which *determines*, among other things, *the scientific technological mainstream and provokes its subsequent commercialization*.

New technologies become *goods* which should correspond to mass demand outside which correlation the collective efforts of scientific research laboratories grow ineffective. The needs and interests of prospective customers provide a powerful stimulus determining the goals and tempi of scientific technological development within which scheme a scientific lab and a would-be consumer turn out to be elements of *an integral scientific-economic cycle*. One of the basic constituents of this cycle is business investing in those scientific projects and new technologies which seem promising in terms of profits. Another important element of the above mentioned scientific-economic integrity is *education* which serves as an immediate link, providing its research sector with scientific personnel and helping a consumer to find their way in the world of new technologies. This seems to be the very reason behind such a widely spread phenomenon as either a narrow pragmatic or even exotic interest in matters like the fine structure of matter, composite materials and new generation ceramics, the reproduction and functioning of human capital, cloning, unlimited youth preservation etc. All these factors, of course, are *a challenge to the rigid higher education system which is forced into breaking its most essential concept of a university in favor of new, more flexible and heterogeneous scientific research institutions*. This entails the rapid growth of focused scientific laboratories, design offices, research centers, financed from specialized scientific funds which tendency is especially characteristic of modern developed counties.

These tendencies, however, should not be idealized. The high-speed evolution of modern world towards the information society not only opens a wide range of opportunities for both an individual and society on the whole, but also breeds quite a set of most difficult problems touching upon various aspects of axiology and responsibility. As the results of a particular research are carried into execution they necessarily involve and even underscore the importance of the corresponding ethical context and person-centered approach which demands a correlation between the inner values of science and the outer values of human existence on a large scale. As viewed against this particular background the inner ethics of science stimulating the search for genuine knowledge and its accumulation must keep in close touch with humanitarian values searching for harmony of natural-scientific, technical, and liberal arts methodological strategies. Otherwise, aiming exclusively at the scientific technical result no matter what the cost might be and having only well-trained and disciplined participants of a monotonous technological process one can hardly hope to achieve any breakthrough in the sphere of innovative technologies. Moreover, such a tendency is most likely to place the society on the edge of chaos and catastrophe.

The information society issues an equally harsh challenge to education and this becomes especially clear in view of the fact that the gap between the rapid progress of science and technology and the slow tempo of education reforms is a most burning problem of the present day stage of scientific technological development. Today, when it takes no less than 15 years to organize a full-fledged research institution, a scientific center or a design office the importance of prognosticating and selecting educational priorities is most obvious and urgent. Quite naturally, attention is centered on those universities which have highly-developed scientific schools and research laboratories. But today they are expected not only to restructure but to accelerate their technical scientific constituent in matters connected with "knowledge

production". This obviously means working out a set of new courses to be taught in due connection and subsequence as well as modernizing the forms and methods of conducting classes in terms of making them more effective. And yet it's not as simple as that. As evidenced by world experience, *it would be a grave mistake to take naked utilitarianism as the basis of this updated educational system*. The dynamics of technological development is so speedy these days that those students who begin their studies in strict accordance with most up-to-date if narrowly focused fields not infrequently turn out to be of no use as specialists though it is not until their graduation that they become aware of the fact. Quite a number of outstanding educators seem to be right in stating that despite the challenges of "technical scientific society" it is an egregiously erroneous belief that education should be centered in the scientific "talk of the town". It is more appropriate to teach the essentials and fundamentals and, first and foremost, to teach self-teaching, – in fact, a lifelong self-teaching. And this can only be provided on the basis of fundamental theoretical disciplines and person-centered liberal arts which are in principle incomplete, unfinished, open to new and still newer challenges and, what is of utmost importance, one day the unceasing search for answers becomes part and parcel of a scientist's personality [II, 34].

The possibility of producing hi-tech science intensive goods depends not only on the work of scientific institutions proper, but also on the society's interest in innovations, that is to say on its economic, political, and social potential. And this means, figuratively speaking, that a member of the information society can't be made out of ink and paper but can only be created when provided with due outer conditions, which primarily mean a highly effective education. Besides, it seems necessary to remember that though science is an important constituent of human culture the particular types and forms of its application can vary considerably depending on whether or not they are in keeping with a particular tradition. What matters most here is not the institutions of that tradition as they are, but whether or not they are in principle supportive of innovative activities. And so when it comes to Ukraine's "national idea" in pursuit of which our historians, philosophers, politologists, and politicians have spent twenty years without much success I'd rather vote for education. If possible, the best one. Let it come tomorrow if not today. But that's the very thing we are rather in need of.

There seems to be one more question as to this. What must be the reaction on the part of Ukrainian science and education to the challenges of the information society? First and foremost, I'd like to dwell on the starting potential of Ukrainian science and education. Not so long ago both were renowned for their not the best but far from the worst quality as compared to those in other countries of the world. Way back in 1992, the number of scholars and scientists per one thousand citizens aged from 15 to 70 made Ukraine into a European leader in the field. Despite the losses of the last few years Ukraine remains among the top five countries possessing the newest aerospace technologies (we have 17 out of 22 basic space-rocket technologies). Ukrainian position remains particularly strong in such fields as biochemistry, physics, biomedicine, mathematics etc. In terms of education, the present day matters in Ukraine seem even better than that. According to UNO data of 2010 as stated in "The Real Wealth of Nations: Pathways to Human Development" Ukrainian educational index (0.795) rates as high as the 18th in the world, leaving far behind such countries as Spain, Great Britain, France, Poland, Italy, Portugal etc with an average world-wide educational index being 0.436 which, in case with Ukraine, turns out to be nearly doubled. And yet, simultaneously, by gross domestic product and purchasing power parity per capita Ukraine takes the 90th place among 169 countries of the world with 6535 USD, 10631 being an average index, and now finds itself far behind Spain, Great Britain, France, and Poland…

As to this, there emerges quite a logical question: if this be true that science and education are among the leading constituents of modern economic growth how come it doesn't work out in Ukraine? As I see it, the most probable answers are two.

Answer one: despite numerous declarations, throughout the last two decades Ukrainian science never enjoyed (and, I regret to say, nothing has changed since then) the status of an

established state priority. The cutting down of scientific and educational expenditures is as customary today as it has ever been. The aggregate of Ukrainian educational expenditure is five hundred times less than that of the USA and thirty times less than that of Russia. The state budget finance allotted for needs of scientific research equals 0.4 % of GDP whereas the corresponding norm as figured out of the modern developed countries' experience makes about 2 to 3 percent of the same. Moreover, the allotted sums are shared ineffectively, financing the scientific schools renowned for their former achievements rather than supporting and encouraging the most important scientific projects. The greatest majority of labs have poor and outdated equipment, the position of a scientist is of low social prestige which drives the talented youth out of the field. An average age of a Habilitated Professor is about 63 and that of an Academician is more than 70. The total number of Ukrainian scientists in 1991 was twice that of the present day. The society seems generally unaware of the importance of science in matters of the country's future.

The country's scientific potential is practically excluded from its economic process. Ukraine's knowledge intensive production occupies 0.3% of the whole production sector which figure is rather far from the world-wide average level. The proportion of hi-tech production in the country's GDP is decreasing; innovative activities of industrial companies continue to sink. Way back in 2008, the total of innovative companies was only 13%. The main source of finance for innovative production methods remains to be found by the companies themselves.

And, what is most important, Ukraine remains largely oriented at *the production schemes of the third technological setup* represented by iron-and-steel industry, electrical power engineering, railway transport, inorganic chemistry, mechanical engineering whereas in the developed countries of the world it was characteristic of post-war years of the previous century. On a large scale, about 95% of the aggregate of produced goods may be characterized as representing the third (60%) and the fourth (35%) technological setup. In comparison with this it seems characteristic that the total of higher technological setup products rates at 4% for the fifth and 0.1% for the sixth setup. The GDP growth as resulting from innovative technology application rates at 0.7% whereas in modern developed countries it rates as high as 60% and in some cases 90%. This means that those investments which determine the economic growth strategy for the next few decades are supporting outdated technologies of the third setup (75%) whereas the fields of the sixth setup receive no more than 0.5% of the investment aggregate. To put it in plain words, Ukrainian "hi-tech science" is trying to catch up with the rest rather than take over the leadership.

Answer two: Despite its position of a "quantitative" educational leader, Ukraine, in fact, suffers an obvious decrease in terms of "qualitative" educational constituents. According to American Institute of Public Opinion research data only 38% of Ukrainians are satisfied with the quality of Ukrainian educational system as compared to 42% of Russian Federation citizens, 57% of Belarusians, 59% of Germans, 70% of Britons, Americans and Frenchmen, and 71% of Canadians. Personally, I am inclined to believe that the efficiency of Ukrainian education is challenged not so much on the part of poor financial provision, though this is important too, but on the part of unbelievably low operational efficiency of all the educational process participants. See for yourself! In the years of 2009 / 2010 Ukrainian schools, technical colleges and higher educational institutions were attended by 7 million 518 thousand people taught by 1 million 646 thousand educational workers. So, the total number of educators as included in the general number of working population comprises about 15.5% with 9.7 % as the corresponding figure for Russian Federation, 5.9% for Germany, 7.4% for Poland, 9.1% for Great Britain and the USA, and 6.4% for France which testifies to the fact that Ukraine's educational staff is nearly doubled as compared with other countries. And if one also gives due attention to the fact that Ukrainian compulsory schooling period is one of the shortest as compared with other countries (11 years in Ukraine versus 12 – 13 years elsewhere) and that the average teaching load in Ukraine is thus 30% lower how come that Ukrainian schools are staffed with twice as many teachers as other countries have? It is also of interest to observe that budgetary provisions for

Ukrainian education are as high as those of the most developed countries and sometimes even higher. In 2007 / 2008 state educational expenditures comprised 5.3 % of Ukrainian GDP with the corresponding proportion of 4.4% for Germany, 3.4% for Japan, 4.4% for Spain, 5.5% for the USA, and 5.6% for France and Britain. Other research data are still more puzzling. Paradoxical as it may seem, Ukrainian economists prove that educational level differences as observed among Ukrainian citizens are in no way a decisive factor in matters of labor productivity either in any type of industry or in education itself. Were it not so, we wouldn't have all those questions which have for quite a time been regarded as rhetorical. If our agricultural specialists are prepared in accordance with all the up-to-date educational standards why does our world-famous *chernozem* soil give harvests which are twice pooper than those cropped on barren European soil? Why is Ukrainian energy-output ratio several times that of more developed countries? Why is the noninfectious disease lethal level per 100.000 people nearly twice as high as that of other European countries? Why do our markets, despite a rather decent amount of multidiscipline engineers, economists, and managers show no sign of domestic products? And how come that with all those educators whose teaching load is no heavy burden Ukraine's rates of alcohol abuse, tobacco smoking, and juvenile drug addiction are among the highest in the whole wide world? The present day Ukrainian society is too poor and politicized to give due respect to the axiological constituent of science and education which seem to be the only possible sources of the much-coveted transformations. Instead, the often-declared "European vector" as well as the corresponding social ideal of hi-tech economy are mostly used as a social political phantom which distorts the very idea behind it and through numerous paradoxical decisions ensuing from its transmuting nature brings a complete ruin to both the remnants of the once blooming Ukrainian education and its nascent modern matrix.

But is there any possible way for Ukrainian science and education to fit into the present day information society, to make our economy a knowledge-intensive and competitive one? I personally hope that there is a chance of that. As is common knowledge, Ukraine, acceding to United Nations Millennium Declaration of 2000, declared to make the development of "lifelong learning" and "efficient science" into a state priority. The Economic Reform Program for 2010 – 2014 which has been worked out by Presidential Economic Reform Committee to stimulate economic growth and modernize the economy maintains the necessity of a large scale reforms in scientific-educational sphere. But the first steps on the way towards the proclaimed destination witnessed a gap between the ambitious goals and the way things are. *Firstly*, Ukraine is still oriented at the "overtaking development" strategy which is recommended by international economic organizations despite its being obviously discredited by those Third World countries which, while in pursuit of it, very narrowly escaped an economic disaster. Thus the only possibility for Ukraine's reaching its national development goals and integrating into world-wide economic system consists in the "leading development" doctrine which in the long term, taking into consideration the probability of Ukraine catching up with more developed countries and joining the European Union, might provide twice or thrice higher GDP growth tempi as compared with those of economically developed countries. Among the country's decisive steps in the direction pointed by the "leading development" doctrine must be Ukraine's *aggressive policy* in terms of providing the conditions for scientific-technological development. It goes without saying that, as evidenced by the experience of China, the "leading development"-based economic growth must not necessarily exclude any "overtaking development" elements. Among other things, this refers to the "copying" strategy, that is to say the adoption of new production practices concerning products of high competitive ability which are being produced in more developed countries, the "leader technologies" strategy consisting in producing new types of products and technologies, forming the corresponding demand, and entering new markets, the "explosive technologies" strategy consisting in the creation of new product types which are a generation or two ahead of what the present day has to offer etc. To carry out these projects Ukraine needs a new state-wide innovative strategy which would concentrate on the adoption of the sixth scientific technological setup and such particular directions within it which would

enable the country to grow into a leader. Taking into consideration the existing achievements within the sphere such scientific technological priorities might be represented by: a) aerospace research, nuclear technologies etc; and b) nanotechnologies, information technologies, electric welding, microelectronic technologies, intensive agricultural technologies etc.

An important issue within the context stated above is the renovation of state-controlled scientific research institutions as well as including them into corporative networks, venture businesses etc, with due regard to their limited immediate profit at the expense of long-term technological profitability thus harmonizing interests and urging large groups of population to support innovative technological models. An important function within the project must be fulfilled by both state-controlled and private institutions. As the present day conditions demand, the state must promote the cooperation between the following basic elements of "information society" – science, education, and business. Such work may be organized by means of creating economic clusters, industrial parks, corporate tender committees selecting the priorities of scientific technical development, specialized funds on state-and-business shares etc. The leading part in solving most of these problems must be taken over by the principally renewed Ukrainian Academy of Sciences which, in close cooperation with other prominent research universities of the country, must judge on the innovative potential of scientific projects, make assessments as to the main "explosive technologies" thus effectively distributing financial allotment.

Secondly, there is an obvious need of a content-based educational reform and a considerable modernization of economic mechanisms in educational sphere, due attention paid to the calculation of teaching load on the basis of European experience. This step is quite likely to double the present day salary of Ukrainian educators [III, 13]. There is also a need of coordination between the educational tasks as formulated by Presidential Economic Reform Committee and those stated in United Nations Millennium Declaration with due account taken of the envisaged demographic tendencies of each particular region. Another task of utmost necessity is working out a uniform state standard of educational services. The state standard of educational services must comprise a set of compulsory academic disciplines with supplements as to the terms of study and types of classes as well as the minimum amount of educational and technological provision etc. This seems to be the only way to determine a minimum justified cost of each year at school or a university and, consequently, to start financing not the keeping of educational establishments but *the teaching of students*. This, by the way, may also be helpful in terms of solving the problem of free and paid educational services. Whatever is part of the standard must be free; whatever is additional must be paid for by citizens. This may eliminate many current misunderstandings and release the corresponding social tension.

In the information society special attention must be paid to higher educational establishments, specifically universities, because here their educational activities must necessarily correlate with scientific and/or technical research carried out on the basis of modern scientific achievements. As evidenced by the experience of more developed countries, the greatest part of modern scientific research is carried out by large groups of experts in different scientific fields provided with proper laboratory equipment. Certainly, activities of the type can only be practiced at such establishments as universities which have a large staff of considerable expertise. Unfortunately, in case with Ukraine where universities are generally smaller and much poorer in terms of equipment this particular question cannot be so readily answered. Instead one can only observe that in the years of 2010/2011 Ukrainian higher educational establishments were three hundred and fifty with an average number of students around 6.5 thousand people.

Taking into consideration all the phenomena characteristic of modern Ukrainian higher education, one might agree that the first reasonable step towards its improvement must, first and foremost, consist in making an inventory of its merits and a consequent optimization of its demerits. Basing on the corresponding experience of other countries like Finland or the USA, higher educational establishments might be divided into three types. The establishments of the *first type* might be oriented at pressing industrial production matters, issues of services sector and agriculture – at present we call them colleges. Those of the *second type*, sector universities as

they are called, – polytechnic, technological, medical, agricultural, pedagogical etc, might be turned, wherever possible, into research universities of national importance that would determine the educational and scientific policies in the corresponding spheres. And, finally, the establishments of the *third type*, proper universities, characterized by national importance and international competitive ability, institutions of fundamental, general theoretical, and practical research, all this as a basis for a three-cycle specialist preparation. These universities and some of research universities too must, as I see it, create a subsystem of *elite-breeding higher education* centering in a specialized preparation of scientists and technologists for hi-tech production sector, selecting students on special terms, and providing conditions for individualized training.

In my opinion, basing on what we have, it would be best to create about 24 elite-breeding universities, from 10 to 15 research universities, and several dozens of sector universities, starting a simultaneous process of their integration into the structure of the Ukrainian Academy of Sciences and other sector academies. Encouraging university teachers and students into research and scientists into teaching as well as their sharing funds and equipment might promote both the efficiency of research and the quality of specialist preparation.

Another problem of equal significance is that of university autonomy. Today Ukrainian universities simultaneously carry out educational, scientific, publishing, sporting and other such-like duties using funds from different sources. In the majority of cases budget funds proper make less than a half of the necessary finance. In view of this Ukrainian universities are not, in fact, budget organizations since the Budget Code of Ukraine specifies that “a budget organization is such an organization which is fully financed from either state or local budget.” I personally think that a change in the status of universities from that of budget organizations, that is to say receiving finance for needs of their keeping, to organizations receiving finance as payment for educational services, would significantly promote the efficiency of finance application by appointing more appropriate wages to employees, solving equipment problems, and, generally speaking, acting as independent subjects of economic activities. The functioning of universities which have always had their special tasks must not be regulated by any sort of jack-in-office approach.

Numerous improvements must also be made in the system of state-regulated order for specialists in exchange of finance. The present day state of things in this sphere implies, in fact, that funds are given for particular tasks and cannot be used otherwise. The corresponding ministries and offices distribute the funds as guided by a rather formal approach, striving to preserve the existing educational institutions rather than act in accordance with the strategic tasks of the state. This practice can only be broken by making those bodies of state management which are responsible for a particular sphere of state policy into direct clients, ordering specialists in the corresponding field. That is to say, the Ministry of Science and Education must order a definite number of teachers, the Ministry of Justice – a certain number of lawyers, the Ministry of Agriculture – a proper number of agrarian specialists etc. And, which is more, state orders for specialists must be carried out on competitive terms which would immediately increase the efficiency of budget finance application. But, first and foremost, such a system would finally do away with the constant discrepancy between the number of specialists prepared and the actual need of state economy for their skills.

Generally speaking, the overall task of state educational, scientific, technical, and innovative policy within the context of the information society challenges must be the renovation and growth of its technical-scientific potential, the leading development of science and education, the formation of an effective system of intellectual property application, the creation of modern innovative infrastructure, which would become a corner stone of the country’s leading development in the global economic system. Adapting the words of the American Congress Speaker for needs of Ukrainian reality description, I’d put it like this: we need four priorities – education, education, education, and education. I regret to say that Ukraine’s development in this direction is hindered not so much by lack of economically- , politically-, and culturally-based

progress projects, or by dull scholastic researches in science, or even by outdated technologies and lack of finance, but, first and foremost, by “the human factor”, resulting in the chronic shortage of people possessing the necessary intellectual and moral features. The historical challenge as to finding an educated, morally and innovatively creative, and fully responsible person able to lead the country up the road of new social development so far remains unfulfilled. Solving the problem of educational scientific synergy is one of the answers to both the information society challenges and one’s attempt to find self-realization in modern globalized world.

Works of reference:

1. Drucker P. Age of Social Transformation // The Atlantic Monthly, 274, November, 1994.
2. Карлов Н.В. Книга о московском физтехе. М.: Физматлит, 2008.
3. Витренко Ю. Если мы такие образованные, то почему такие бедные // Зеркало недели, №3, 29 января 2011.

Саух П.Ю. Синергия науки и образования как основной ресурс общества знаний. Евровызовы и украинские проблемы.

В статье анализируется новый образ образования и науки, который претерпевает существенные трансформации в обществе знаний, где они превращаются в неотъемлемую составляющую образа жизни человека и приобретают преимущественно прагматический характер. Очерчены последствия этого необратимого процесса и выстраивается алгоритм целесообразной реакции отечественного образования на требования времени.

Sauch P.J. Synergia nauki i oświaty jako główny zasób społeczeństwa wiedzy. Wezwania europejskie i problemy ukraińskie.

W artykule analizuje się nowy obraz oświaty i nauki, który podlega znacznym transformacjom w społeczeństwie wiedzy, gdzie przekształcają się one w nieodzowny składnik sposobu życia człowieka i nabywają przeważnie charakteru pragmatycznego. Określa się skutki tego nieodwracalnego procesu i buduje się algorytm docelowej reakcji oświaty krajowej na wezwania czasu.