

# NBIC-Convergence of Machinery and Basic Technologies as the Ecological Factor of Wellbeing

S A Zhironkin<sup>1, a</sup>, K A Kolotov<sup>2, b</sup>, A E Genin<sup>3, c</sup>, F V Agafonov<sup>4, d</sup>,  
S A Kovalevsky<sup>5, e</sup>

<sup>1</sup> Yurga Technological Institute (branch) of National Research Tomsk Polytechnic University, Leningradskaya 26, Yurga, Russian Federation, 652055

<sup>2</sup> National Research Tomsk Polytechnic University Lenina av. 30, Tomsk, Russian Federation, 634034

<sup>3</sup> Branch of JSC "SO EES" Siberian ODU Kuzbasskaya st., 29, Kemerovo, Russian Federation, 650000

<sup>4</sup> Kemerovo State Agricultural Institute Markovzeva st. 5, Kemerovo, Russian Federation, 650056

<sup>5</sup> T.F. Gorbachev Kuzbass State Technical University, Vesennyaya st. 28, Kemerovo, Russian Federation, 650000

E-mail: <sup>a</sup> zhironkin@inbox.ru, <sup>b</sup> 594950@bk.ru, <sup>c</sup> geninanton@gmail.com,  
<sup>d</sup> kemshi-ise@mail.ru, <sup>e</sup> koval71@mail.ru

**Abstract.** The development of science and technology in the XXI century is on the way of the extensive use of natural resources. As a result, the scientific and technical progress does not initiate the reduction of environmental damage but encourages its cumulative growth. So the environmental problems have become a serious threat to social wellbeing of all mankind. The development of the core technologies doesn't allow creating the situation in which the new knowledge would generate positive changes in the environment. Therefore, among the issues that define the future of advanced environmental technologies, and potentially significant for the understanding of the humanities, there is the phenomenon of technological convergence and, in particular, the predicted convergence of the nano-, bio-, information and cognitive technologies (NBIC). The consequence of NBIC-convergence may be the transformation of the humanity into a single global mind, which can be linked into a solid set of technologies, establishing united standards for social wellbeing and environmental technologies.

## 1. Introduction

Earlier stages of technological convergence, starting from combining scientific knowledge with the technical activities at the beginning of the industrial revolution, and ending with the most important technological convergence of the XX century - the emergence of information and communication networks - have created miracle expectations in the minds of scientists, a breakthrough that has incalculable social consequences. However, despite the widespread diffusion of the new technologies in human life and a significant increase of social wellbeing in the 20th century, its eco-factor is still determined by the boundaries of the application of the basic technologies. In other words, technological convergence hasn't allowed overcoming the limitations of nature yet other than reinforcing a devastating effect on the environment by the industry - the main achievement of modern



civilization. Under such conditions, social wellbeing, raised by industrial technologies on previously unattainable level, cannot be truly continuous, since it depends on the balance of nature-destructive and environment-saving technologies. As until now this balance is disturbed in favor of irreparable damage to the environment, the social wellbeing, even during the human's life, cannot be continuous. One of the possible ways out of the "vicious circle" of technological, environmental and social problems is the development of NBIC-convergence technologies.

## 2. Material and Method

Many scientists say that nature is "wrong" too often, so we could not unconditionally rely on it [1-10]. Features of this approach can be found in technological convergence studies. For example, one of the reports of the US National Science Foundation was named "Converged technologies for improving human performance" [11]. Its authors suggested that the use of appropriate technologies will contribute to the world peace and the development of fruitful cooperation between people and machines, which will result in the reduction of environmental damage brining human wellbeing growth to a minimum.

Nevertheless, the impact of technological development on the continuous wellbeing of mankind is positively evaluated by not all scientists. So, after a successful start of the process of convergence, when Richard Feynman [12] as early as in 1959 described possibility of manipulation of matter at the molecular level, and Swiss researchers Heinrich Rohrer and Gerd Binnig created a scanning tunneling microscope that could show individual atoms and move them [13], a number of authors stated the danger that the new technology could bring to the world. For example, Eric Drexler warned of the apocalyptic scenario of progress in nano-technology, thanks to which humans can lose ecological niche [14], and R. Smalley, John. Whitesides, R. Kurzweil initiated the discussion about the prospects of the impact of new molecular electronics, nanobiology, algorithmization of the human mind on ecology of the human environment [15].

However, the significant number of scientists, mainly in the fields of humanitarian knowledge was the proponents of the use of new technologies for the growth of social wellbeing.

A number of researchers analyzing wellbeing emphasize the possibilities of new technologies in provision of individuals with wealth and maintenance of social and economic stability of society [16-19]. Other authors give priority to the perception by the individual, community, and even a certain nation of objective living conditions [20-25].

The problem of continuous social wellbeing was closely studied by the authors who observe it as a set of external conditions, economic opportunity, technological development and professional skills making it possible to receive certain benefits over the lifetime period [26-29]. Some researches connect continuous wellbeing with the "lifetime employment" in the high-tech Japanese corporations [30], others – with the social paternalism in the socialist countries – as an attempt to approve the continuous wellbeing [31].

Despite the importance of the wellbeing achieved with the basic technologies, we believe it to be "non-continuous", as it lasts as long as its two main conditions are fulfilled.

The first condition of «non-continuous» social wellbeing is to achieve a certain level of environment preservation in general.

The second condition is the existence of an individual satisfactory state of physical and mental health, sufficient for successful business or labor. And it also depends upon the environmental problems.

Therefore, as soon as one of these conditions is violated, mainly due to the environment harmful technologies, «non-continuous» wellbeing can be lost. At the same time, millions of people constantly face the choice of working in harmful and stressful environment. Accordingly, there is no unity in the research of social scientists devoted to the dilemma between using basic technologies to improve material wellness and keeping nature green (they both, as it was mentioned above, are the basic of continuous wellbeing).

Thus, the proponents of "welfarism" point out that the pursuit of maximum material wealth has some kind of affectation, under the influence of which a person for some time can forget his desire for continuous wellbeing and neglect some threats for his health or put up with severe stress [32]. Using harmful technologies for achieving momentary happiness from the growth of material wellness is a sign of «non-continuous» wellbeing in case people have been deliberately neglecting their health preservation for many years. This can be illustrated by the following examples [33]. People often think that a new car will make them happy, but after two weeks its utility growth is reduced. They think that the life and work in bad ecological conditions give them some extra money and bring them happiness, but it turns out that feeling unwell and destroyed health have much more intensive and long-term negative impact on their wellbeing.

In turn, the supporters of the liberal model of wellbeing assessment offer to take into account people's own preferences in the analysis of various factors of social wellbeing [34]. This depreciates the role of ecological factors in achieving continuous wellbeing and increases the role of other factors, mainly, the profit from selling raw materials and energy (for example, the possibility of getting natural resource rent). This also can explain fairly high stress level, various diseases among the workers of mines, quarries, chemical plants etc.

At the same time, a gradual change in attitude towards ecological factor as a key point of continuous wellbeing illustrates «Easterlin's paradox» [35]. It consists in the fact that in the developed countries the average level of wellbeing, subjectively evaluated by a large number of respondents, is relatively insensitive to changes in income. That is, people are increasingly aware that they tend to material achievements that have little impact on social wellbeing, in particular continuous.

However, in an effort to bring their wellbeing in line with modern ecological standards, people increasingly appreciate an opportunity to live in ecologically favorable environment and to take effective control over their health.

The lifetime health preservation problem makes people look widely at the essence of ecology and nature-friendly technologies. In addition to air and water pollution reduction, avoidance of harmful for environment technologies, the risk of technogenic accidents, continuous wellbeing involves reducing the risk of chronic and fatal diseases leading to premature mortality. It can be achieved with NBIC-converged technologies.

### 3. Results and discussion

Taking into account the opinion of above mentioned authors, we consider ecological factor of social wellbeing as a condition of human existence, which is stipulated by actual performance of new nature-saving technologies. Long-term, not limited by old technologies, stay in such a space we consider to be continuous wellbeing.

It sharpens the problem of "embedding" the modern ecological technologies associated with resource saving, water, air and soil purifying into the continuous wellbeing model. We note that the feature of present stage of technological changes is convergence of basic technologies, which is called NBIC-convergence [11]. NBIC is an acronym for the following types of technologies: N -nano; B - bio; I -info; C - cogno. With regard to the continuous wellbeing, it means the connection of ecological, chemical and economic (marketing, investment) technologies within a new industry – nature purifying.

A key role in the ecological basis of continuous wellbeing we give to chemistry and biotechnologies, which, together with nano-technology, are one of the most important and the fastest "horizontal" technological areas. The intensive development of biotechnologies is stipulated by not only the success of chemistry and molecular biology, but also the crisis of traditional technologies (especially against the background of new trends in medicine and ecology), the need to make purifying facilities, to preserve natural resources, to reduce emissions of pollutants. The presence of serious scientific groundwork and experimental development in the field of continuous wellbeing convergent technologies will make it possible in the coming years, to develop affordable purifying systems [36-38], to expand significantly the scope of preventive harmful influence on the environment [39-43], to

involve business firms and governments to ecological projects investment. Except this direct effect on the process of achieving the continuous wellbeing, the convergence of NBIC technologies will also provide the achievement of a number of goals, indirectly determining the conditions for continuous human wellbeing:

- counter the spread of various types of contamination [44-45];
- producing chemicals for broad application in purifying facilities and in producing renewable materials intended to replace existing primary products;
- conversion into a routine advance development of nature-saving and purifying convergent technologies.

Distribution of NBIC-convergence in the field of wellbeing changes the question about the value of the development and implementation of innovative chemical and biochemical technologies into purifying equipment. If referring to «non-continuous» wellbeing new material things and services have individual value, than when applied to the continuous wellbeing they are valuable for the whole society. Therefore, proclamation of continuous wellbeing as the imperative of ecological development of modern society will undoubtedly require a significant price reduction of nature-saving equipment and technologies. And this price reduction can be achieved only with transferring NBIC innovations into large-scaled industrial producing.

The current development of purifying and nature-saving equipment market is characterized by the following features:

1. The increased volume of this production for ecological purposes (as for the last decade the annual increase of output was up to 10%).
2. An increasing number of customers – large industrial firms and corporations, mainly in the USA, Western Europe, Japan (more than 250 specialized facilities are annually being installed). In the coming years it is expected to increase their number in 2 times).
3. Higher-than-anticipated growth of consumption of the ecologically clean production.
4. Extension of the areas of purifying facilities applications.
5. Increased requirements to the technologies of industrial production (economic cost-effectiveness and environmental safety).

The global market of nature-saving production for ecological purpose has a strong annual growth tendency up to 15%. This trend is expected to continue during the next 15-20 years. Growth in production of nature-saving products and equipment is provided both by expanding the areas of their application and by the development of innovative technologies in this field greatly reducing the cost of their mass application.

So it is impossible to consider the modern discourse of social wellbeing to be complete due to the absence of a single paradigm that integrates objective factors of its dynamics and the subjective perception of the totality accessible tangible and intangible values by the individual. Up to now philosophers, sociologists, economists, ecologists cannot accurately match human wellbeing with various forms of life - material, human, spiritual and social [46]. Therefore, the social scientific analysis does not allow achieving the required identity of factors, criteria, evaluations of individual and social significance of the various ecological factors. As a consequence, it is difficult to search for consistent and effective ways of improving both the environment and social wellbeing.

This significantly improves the relevance of converged ecological and social wellbeing studies, becoming of its diversified methodology, and opens up the prospect for a new discourse – the continuous wellbeing, based on NBIC-convergence.

Modern methodology of social wellbeing tends to the economic and sociological research. Accordingly, new technological possibilities and innovations in the medicine field, bio-chemistry, and microbiology opening the access to the new values of environment conditions, without taking into account the future opportunities. Within the framework of the existing methodology it is difficult to identify ecological factor of continuous wellbeing that accompanies a life of all society, as during this period the availability of the achievements of progress and their distribution radically expands.

Therefore, the key issue in understanding of the continuous wellbeing nature is: "Can prosperity entirely be measured by tangible achievements over the lifetime period?" This issue has become particularly relevant in the last two decades, when the breakthrough innovations have accelerated the pace of progress but have not helped to reduce the negative impact on the nature. As a result the increased environmental risks leads to asymmetry of social wellbeing in different countries, shifts emphasis from possession of material goods towards individuals' access to nature-saving technology.

Institutional environment of formation of continuous social wellbeing throughout a person's life is also undergoing major changes. Along with protection from the destructive consequences of external shocks associated with the risks of inflation, devaluation, cyclical downturn and unemployment social protection mechanisms generated by the state are increasingly focused on stimulating technological innovation.

The increase of innovation ecological factor of continuous social wellbeing is also stipulated by the cyclical nature of material goods consumption and its high dependence on the institutional maturity of a society. In such circumstances, the main vector of the convergence of innovative technologies determining the continuous wellbeing is nature preservation and provision of longevity in the process of reducing mortality from dangerous diseases caused by harmful environment. The synchronicity of material benefits provision and preservation of health, natural resources in the face of increasing instability in ecology becomes the main measurable instrument of continuous social wellbeing.

#### **4. Conclusion**

In summary, we emphasize the important role of the convergence of innovative technologies in the fields of medicine and biochemistry in the formation of the continuous social wellbeing. This continuousness means a lifelong access to both material goods and the latest technologies, preservation of health and prevention of dangerous diseases. Even today, these technologies are becoming the dominant component of the continuous wellbeing, determining its standards in developed countries and directly affecting the consumption of high-tech goods. New diagnostic tools, vaccines and medicinal drugs can be obtained with the help of convergent medical and biotechnologies.

The peculiarity of the development of convergent biomedical technologies in the XXI century is not only in their rapid growth in the applied aspect, but also rapid expansion in human daily life. But for the continuous social wellbeing the development of innovative technologies gives another, more significantly prolonged, effect. It is an exceptional opportunity for sustainable development of the society in which the growth of economic activity of people will be accompanied by the extension of their physical wellbeing in the process of preventive diagnosis and disposal from dangerous diseases.

#### **5. Acknowledgement**

The research was made in T.F. Gorbachev Kuzbass State Technical University under State Assignment N10.782.2014 K "Development of high-performance process for complex processing of low-grade coals and waste coal with producing a low ash coal-and-oil concentrate, composite fuels, rare earth and trace elements".

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