Entrepreneurial platform for the development of microalgae biotechnologies

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Abstract. The research shows that green technologies, microalgae potential in particular, will probably become mandatory to the development of youth entrepreneurship. It is still important to learn about young students` intentions with opening their own business. It is important to remember about the transfer of scientific discoveries about using microalgae in healthy food production and in rehabilitation of the environment. The hypothesis of scientific research has defined a toolkit, methods and techniques in two different directions: an assessment of capacity for the development of the youth entrepreneurship in the region and the inclusion of the microalgae into the strategic asset of the national economy.

1. Introduction

Innovative solutions based on environmentally-friendly behaviour are united under the generic name of "green technologies". There are such major applications of the green technologies as environmental management, use of renewable energy sources, reduction of harmful emissions into the atmosphere, development of environmentally sustainable landscapes, search for new sources of nutrition and drinking water.

According to one of the predictions, by the 2050 the population of the Earth will rise to 9 billion people, which will require the intensification of entrepreneurship and search for new sources. The question about the forming of humans` economical consumer behaviour and the search of intensives to develop innovative youth entrepreneurship.

Today's generation of young people is also known as millennials or Generation Z. Since they were born they have lived in the digital world, none of them can imagine their life without the Internet, a computer, a smartphone. The hyperactivity disorder created by digital technologies makes it possible for young people to interact with a tremendous amount of information and set up international collectives.

According to the Microsoft researches, Generation Z closely monitors the world brands including personalization of food supplies and responsible consumer behaviour. Smart devices allow them to...
programme healthy lifestyle, monitor the UF-radiation, measure the acid-base balance of cutaneous integument, determine the level of physical activity and the number of burnt calories (figure 1).

Figure 1. Smart technologies which make it possible for people to monitor their health and balanced nutrition.

Wellness industry (deliberate healthy lifestyle) is one of the world top ones now, the emerging technologies create new opportunities for balanced nutrition. Thus, the popularity of the category "beauty is inside" is increasing all around the world, consumers take internally products made of microalgae in addition to the external use of cosmetics. At the present day it is granted to eat the following species: Arthrospiraplatensis, Arthospira maxima, Chlorella vulgaris, Chlorella pyrenoidosa, Chlorella sorokineana, Dunaliellasalina, Nostocpruniforme, Aphanizomenonflos-aquae, Spirulina [5].

The hypothesis of the scientific research resolves itself into the rationale of using microalgae in economy on basi of youth entrepreneurship development. Descriptive and theoretical methods were applied to the research, among them are techniques for sociological researches (surveys, predictions modelling), economic-mathematical modelling; these methods have made it possible to describe the entrepreneurial approach in the microalgae potential rise.

2. Results and discussion
The researchers conducted by Volzhsky Polytechnic Institute branch VSTU in cooperation with the regional office of the Free Economic Society (Sizov J. I., 2015-2019), resulted in interviewing more than two thousand students and young people of Volzhsky (Volgograd region, Russia) and separating out groups of youngsters, developing business in the basis of studying their intentions. As it is known, intentions are the initial phase of becoming an entrepreneur. It often happens so that the time of intention - action gap is quite long.

The theory of planned behaviour lets us distinguish the factors which contribute to one becoming an entrepreneur. Among them are parents or relatives with their own business, educational attainment, condition of supporting small and medium-sized business infrastructure in the region. According to the theory of planned behaviour (Ajzen) the motivator of a young person's behaviour is their personal attitude to the entrepreneurship. The research has shown that young people who intend to connect their lives with entrepreneurship proceed with implementation of their intentions when they are still in the university.

They actively participate in scientific groups, speak at conferences. Alongside with family and institute contexts, some external factors affect students’ forming of entrepreneurship intentions: institutional environment for business development in the region (availability of SMB supporting programmes, well-developed supporting infrastructure) and mentality in the existing society. The question about how many people intend to move into small business stays important for the local authorities. The study produced isolation of three age groups with diverse impact of external factors on their entrepreneurial intentions (table 1).
Table 1. The descriptive statistics on participation of diverse youth age groups in entrepreneurship.

| Factors                          | Age group / per cent of a sample (years) | Mean value/ Standard deviation |
|----------------------------------|----------------------------------------|--------------------------------|
| Actual shift from intention to action | The first from 18 to 23 years / 19%  | 3.2 / 1.4                     |
| Entrepreneurial intentions       | The second from 23 to 27 years / 45%   | 4.8 / 1.5                     |
| Presence of family business      | The third from 27 to 35 years / 36%    | 5.4 / 2.1                     |
| Mentality of a university        |                                         | 0.5 / 0.02                    |
| Regional business supporting institutes | 0.7 / 0.1                          | 6.8 / 2.1                     |

In Russian Federation SMB support is carried out in five programmes: "The improvement of business climate", "The increase of SMB subjects access to financial resources", "Acceleration of SMB subjects", "Popularization of entrepreneurship", "Creation of farmers support and rural cooperation system". Entrepreneurial potential of the region can be assessed with the help of the following mathematical model:

\[ E_{entrepreneurial} = \rho_{personal} + \rho_{logistical} + \rho_{investment} + \rho_{innovative} \]  

(1)

where the components of entrepreneurial potential are calculated by the following (2-5):

\[ \rho_{personal} = \frac{W L}{n} \]  

(2)

where \( W \) – the coefficient of validity based on expert assessments; \( L \) – the elements forming personal entrepreneurial potential; \( n \) – the amount of elements.

\[ \rho_{logistical} = \frac{W M}{n} \]  

(3)

where \( W \) – the coefficient of validity based on expert assessments; \( M \) – the elements forming personal entrepreneurial potential; \( n \) – the amount of elements.

\[ \rho_{investment} = \frac{W I}{n} \]  

(4)

where \( W \) – the weighting coefficient based on expert assessments; \( I \) – the elements that form the investment and business potential; \( n \) – number of elements.

\[ \rho_{investment} = \frac{W I}{n} \]  

(5)

where \( W \) – the weighting coefficient based on expert assessments; \( I \) – the elements that form innovative business potential; \( n \) – number of elements.

The motivational component of an entrepreneur is calculated using (6):

\[ \rho_{motivational} = \sum W \frac{L M + I + N I}{n} \]  

(6)

where \( W \) – the weighting coefficient based on expert assessments; \( n \) – number of components of internal motives and incentives.

The capacity of the entrepreneurial potential of SMBs in the city of Volzhsky in the Volgograd region was calculated based on expert assessments, data from sociological surveys on computer programs – 11.87 %. This indicates that the promotion of entrepreneurship needs to be strengthened, especially among young people. It is also important to help young people find business ideas. The increasing demand for products produced by biotechnologies offer new possibilities for small businesses. The global biotechnology market is expected to total $742 billion by 2025. (growth, in comparison with 2019, by 2 times).
There is the potential of the microalgae Chlorella vulgaris among the green technologies. A microscopic monocellular organism, measuring from 2 to 10 microns in diameter, is able to assimilate solar energy (the cell consists of chloroplasts) and form organic substances and disengage oxygen [7]. Dry biomass of Chlorella vulgaris contains 45% protein, including essential amino acids, 35% carbohydrates, 10% omega-3 fatty acids and microelements (iron, iodine, potassium, selenium, etc.) [8].

Chlorella vulgaris has entered the ethnic cuisine of Japan, Malaysia and the Philippines: it is used for making smoothies, cocktails, and added to bread products. There is a huge industry of dietary supplements based on microalgae, mainly from Chlorella vulgaris and Spirulina [9]. Scientists at the Harvard T.H. Chan School of Public Health (USA) have developed a "healthy food Plate" in which proteins occupy 1/4 of the plate, complex carbohydrates 1/4 of the plate, (vegetables + fruits) - 1/2 of the plate. Scientists at Volgograd medical University are using healthy food products to conduct research on metabolic correction in obese patients [10]. Inclusion of microalgae products in medical nutrition is only a matter of time (figure 2) [11,12].

![Figure 2](image)

**Figure 2.** Structure of a "Healthy food Plate" with microalgae products included: dry powder and suspension of Chlorella vulgaris.

Research conducted among students on the inclusion of microalgae products in the "Healthy food Plate" showed that 12% of the respondents are ready to try microalgae products (38% of the respondents preferred smoothies from Chlorella vulgaris); only 1.2% of the respondents are ready to eat regularly. Most students do not have strong ideas about microalgae, they include kelp (algae). The most famous microalgae were named: Chlorella vulgaris and Spirulina platensis (86% of the respondents).

Ideas about microalgae have entered the information space of modern youth, but they are far from being actually included in the diet. One of the reasons is the lack of Russian production of microalgae products and their promotion.

Since 2006 scientists of VNIIOZ (Volgograd) in cooperation with scientific and commercial organizations, agricultural and fish-breeding farms have been creating an evidence base for the legality of the use of the strain of Chlorella vulgaris IFR no. C-111 in the national economy [1]. The laboratory of the Institute conducts research on the use of the strain of Chlorella vulgaris IGF # C-111 in animal husbandry, aviculture, pond fish farming and for cleaning reservoirs [1,13,14].

Research on the use of Chlorella vulgaris in the economy is conducted in Germany, the United States, Japan and China [15]. Designed by Pierre Calleja, street lights generate the ability of microalgae to release energy during photosynthesis, while simultaneously absorbing carbon dioxide and saturating urban air with oxygen. The "BIQ House" project is a building with energy from microalgae, constructed by the design firm "Arup" in collaboration with the German company SSC Strategic Science Consultants and the Austrian architectural studio Splitterwerk. Research is underway in Germany to obtain automobile fuel from Chlorella vulgaris (figure 3) [15].
Figure 3. Use of Chlorella vulgaris in economic sectors: street biolights, big house wall biopanels «BIQ House», biofuel for cars.

3. Conclusion
Our research aims to expand the understanding of the intentions and conditions of youth participation in business. No less important is the study of consumer behavior of a person, his desire to lead a healthy lifestyle, use environmentally friendly products. The introduction of green technologies in the national economy is associated with the assessment of the entrepreneurial potential of territories, the search for new natural resources. The demand for products obtained using biotechnologies, including microalgae, is becoming a global trend. Research conducted at the FGBNU VNIIIOZ (Russia) reveals to young people – future entrepreneurs – the possibilities of microalgae Chlorella vulgaris in food production and environmental health.

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