

Structure of urban bioecoagrocentres in context of universal design principles

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Abstract. The article deals with the strategy of the architectural and urban planning formation of bioecoagrocentres in the Middle Volga Region and city-farming as the forms of public employment in cities, commuter belt and countryside, justifies the system of Universal design that is innovative for the Russian Federation. The hypothesis about the actuality of senior age labour resources' engagement is made in the context of the population ageing problems, lack of qualified labour resources and general out migration from the countryside. It is proved that the planning of innovative, highly comfortable agrocentres environment (including the cities) may be necessary at all major target levels, i.e. urban planning, architectural, objective-spatial on the basis of the Universal design principles as a project tool. The gradual realization of environmental projects is planned. Correspondence with the principles of Universal design in this case is the element of environment accessibility quality control for all the categories of users including the mobility impaired ones.

1. Introduction

The formation of bioecoagrocentres combining the production, processing and selling of agricultural production with scientific centres attracts a great number of urban and rural population. This is the territory of new developments. Consequently, the flow of labour force attracted here can be diverse and one of the key tasks is the creation of favourable labour conditions for everyone. Global problems set before designers new long-term tasks that are to be solved currently. The decrease of birth rate and death rate led to the fact that the percentage of the Russians over 60 increased 3 times (7 and 20% respectively) within the period from 1926 to 2015. The Russian Federation took the 44th place in the ranking of the «oldest countries in the world» in 2013 [1]. The consequence of population's global aging is the necessity to prolong population's employability for as long as possible. People engaged in agricultural sector continue their activity on achieving the pension age. Moreover, the flow-in of the senior age group's labour force in agriculture can be observed in Russia. Most frequently it is connected with the management of individual subsidiary farming. Nevertheless, the demand for high-end professionals is very probable when highly technical bioecoagrocentres are formed. The problem of senior citizens' appointment can become mobility impairments that are most frequently connected with physical abilities. The appointment of specialists with disability, different impairments could be very effective regarding the creation of innovative agrocentres. Consequently, when generating design options at urban planning, architectural-spatial and environmental levels a special approach is needed



to provide the accessibility of all processes: scientific, productive, educational in the being created bioecoagroculture.

2. Materials and methods

Bioecoagroculture clusters are innovative agricultural enterprising clusters unifying the production, processing and selling of agricultural production with research and development centres, educational institutions, networks of agritourism and other related functions (warehousing, logistics of the related produce, utilization and processing of food-industry waste, waste of city-farming, etc.)

Urbanized agroproduction or city-farming is new projects based on the innovative technologies and equipment allowing providing production all the year round regardless of natural conditions. Production can happen inside completely controlled premises or in natural conditions, but with the high level of control, without the application of earth and chemical admixtures, but with the artificial lightning and completely computer-aided production process. Such projects have big popularity in the cities of the developed states.

The basis of the city-farming development becomes the request for healthy, ecological and safe food products. This global trend is justified by the following factors:

- the rise of the notification to the general public about the healthy eating and way of life;
- the increase of the population size, duration of its life and activity;
- individual cases in the number of countries connected with the safety of food products ;
- the rise of the population welfare and increase of readiness to pay for healthy products.

Innovative agrotechnologies became the prerequisite of city-farming development. Agriculture is on the edge of a serious transformation currently. Global problems and realisation of the breakthrough technologies lead to the turn of agriculture into a high-technology industry [2].

In the urban agroproduction it is important to use senior age labour force and to create special conditions for their labour activity. In this case the universal design principles realised at all levels of engineering can find their application in employment creation. Universal design (UD) in this case should be regarded as the technology of engineering the aim of which is such a project product that would satisfy the needs of all user categories including the impaired ones [3]. The main principles of Universal design: the lack of population's labour discrimination, the provision of comfortable and safe work places for labour activity with the help of special equipment, the forming of social spaces having universal characteristics for communication, the increase of environment information content for different levels of perception, the flexibility of use, the principle of "error tolerance". The reasonable adjustment and use of being formed agroproduction not becoming an unjustified burden for any social group having differences in mobility.

On the basis of the preceded analysis of international and national experience the main functional blocks of bioecoagroculture were distinguished: production, science, education, city-farming and agritourism. For architectural and urban planning formation of each of these blocks the necessity of taking this aspect into consideration can be justified.

The sector of agritourism: the environment designed for the presence and active involvement of people with disabilities (PWD) is created at different expositional agricultural venues and fairs without any limits or discrimination.

The production block: there is a necessity in the employment of personnel among people with different health impairments as well as senior citizens.

In the *city-farming block* there is also a necessity in the organisation of city farms on the basis of innovative technologies with the consideration of specialists, senior age workers and people with limited mobility's employment.

In the *block of education* the received main knowledge about the market of agriculture and information about the latest developments in the sphere of biotechnologies must be accessible for all people regardless of their age or disability.

Moreover, in the *sphere of scientific activity* young scientists, high-end professionals of senior age and people with limited mobility (PWLM) must be engaged comfortably in the development of

innovative biotechnologies in a bioecoagrocentre. Apart from separate functional blocks all the environment of a multifunctional object must conform to the UD principles that will provide the sustainable development of the territory in the future.

3. Results

The article exposes the UD technologies in engineering and exploitation in the bioecoagrocentre. For this purpose it is necessary to distinguish and explore the application of UD principles in every of the elicited functional blocks through the examples [4]. The creation tools of spaces accessible for PWLM on the basis of the bioecoagrocentre can become:

- special equipment and organisation of working places;
- organisation of social spaces;
- increase of environment informativity for different levels of perception.

The analysis being held allows defining the obligatory UD principles for the design of bioecoagrocentres.

The functional block embracing the majority of population with limited abilities is the sector of agritourism. Every person must have equal rights for visiting a social space. The application of the “flexibility in use” principle is possible by organisation of Internet sites popularising agriculture as well as online stores delivering agricultural produce for customers. This would allow providing the variants of service usage possibility. The whole social environment must be informative and easily perceived despite the literacy, experience and language barriers. A unified design with the application of pictograms helps to avoid the complexity in understanding information. The literate development of navigation system is very important. Information at a trade fair and in an agricultural exhibition centre must be given by artistic, verbal and tactile tools. The principle of “error tolerance” is realised in the functional block under consideration due to the bioecoagrocentre geometrical parameters allowing returning to the reference position being the anchor of the route beginning. Movement along the social spaces must not require much physical strength from people. This comes down to the reduction of irregularities, levels, to the presence of lifts and rampants in desired stations, easy opening of doors on the ways of movement. It is not less important to provide sufficient sizes and necessary minimal space for access and the use of agritourist sector functions (in expo-centres, at trade fairs, in hotels). Information and services must be accessible for both standing and sitting people.

The techniques of the comfortable social environment organization corresponding with the parameters of universality for the visits of dwellers and tourists were applied in the project Agro Food Park designed by local architectural bureau WilliamMcDonough + Partners and GXN jointly with 3XN Architects, BCVA and Urand in Aarhus, Denmark in 2015 [5]. It is possible to reach this bioecoagrocentre situated 6 km away from the centre of Aarhus by car, bus and commuter train. The developed public transport allows visiting the bioecoagrocentre to the huge number of population including tourists. The position optimization of parking places for automobiles was held in the project. In the cluster under consideration three types of parking spaces are given. One of them is the paid parking where the majority of parking spaces are situated. They are in the farthest position from working places and socially significant facilities. This parking stretches along the long side of the bioecoagrocentre that shortens travel time to the destination. Five multistoried parkings are planned in the centre apart from the paid parking. Immediately near the edifices there are pocket parkings for the limited number of places. First of all, they are for the limited time of parking and for the disabled. Besides the parking spaces the optimization of pedestrian routes helps to reduce people with disabilities’ physical efforts. The pedestrian route that connects two socially significant facilities (the centre for innovations with the building of the market and conference centre (Figure 1) goes via the central park of achievements in the sphere of agriculture.

The input of people with disabilities in the agricultural produce can influence the food safety significantly as it is stated in the research of Food and Agriculture Organization of the United Nations (FAO). People with limited abilities can get necessary knowledge, skills and experience to work in city-farming as well as in small agricultural enterprises (horticulture and aviculture) [6]. The UD

principles must be applied in this case as well. Thus, the important quality in production is the adjustment of tools for people with limited abilities. Moreover, one of the most important principles is the opportunity of error tolerance and prevention of the secondary fault. For this the unconscious actions should be prevented when executing responsible tasks and works and the possibilities of dangerous and erroneous situations should be informed about. This is connected with the increase of equipment safety, with the intuitive manual and simple design. It is necessary to provide enough space for work to people with limited abilities, comfortable access to a working place.



Figure 1.Project ‘Agro Food Park’ in Aarhus, Denmark. Central Park.

The program ‘AgrAbility’ that improves the farmers, stockbreeders and other agricultural workers with limited abilities’ quality of life exists in the USA since 1990 [6]. The purpose of this program is the financing of PWLM engaged in farming, provision and information exchange about the technologies of people with limited abilities’ engagement into agriculture, the adaptation of new technologies in the sphere of UD in agriculture, city-farming, individual consultations. The receiving of additional education can be done via the Internet that increases the access to knowledge. It is said about subsidiary technologies including appliances, modifications and services helping a disabled person to work and live independently in this program [7]. The following items are related to them:

- technologies applied at the working place: lifts for staircases, electrical openers for doors and gates, levers as door handles, key switches, working surfaces resistant to sliding;
- technologies used at work: pneumatic or accumulator tools and equipment, manual operation, hydraulic or electric access equipment, automated equipment, antistatic matting;
- appliances for placement, positioning and movement: seat with pneumatic elevator, appliances for moving of a wheel chair to the working place, utility carts with seats as well as different appliances for movement (canes, wheel chairs, walking frames, scooters or quadricycles);
- appliances for transport means: modified steps, manual or pedal control devices, means for grip;
- different modified prostheses, acoustic aids and visual aids.

The application of UD principles in the educational block will provide the opportunity for the major part of population to get professional education as well as for retraining and continuing education courses in the field of agriculture. The flexibility in the provision of services can be realized due to the distant education allowing adaptation for a customer’s learning tempo. Both short and long educational programs should exist. The UD principles are related both to the system of education and an educational edifice directly. It will be more important to pay attention to the architectural element of education in this article. It is essential that every person has an opportunity to reach all the necessary premises smoothly. With the help of the lift not only people with limited abilities, but senior employees and students, people with heavy cargo can move between stores. All navigational information must be absolutely clear and subject to the general design of the building for the comfortable learning. Important data about the schedule, position of lecture rooms must be communicated to a user via various informers: visual, tactile, acoustic. For the reduction of physical

strength it is necessary either to reduce movement along the corridors by organizing universal lecture rooms for studying or foresee the sufficient number of recreation spaces designated for all population groups. Apart from the size of spaces for rest special attention should be paid to the dimensions of lecture rooms and spaces, routes of people's comfortable movement, sanitary conveniences, libraries, canteens, etc.

The application of UD principles in city-farming must provide similar opportunities for comfortable and safe labour activity for senior people and the disabled as well. These principles should be realized in greenhouses, on the roof, in warehouses or industrial spaces, in mobile containers, growing factories or vertical factories and even in domestic conditions and on small-scale settings.

The UD principles application in scientific and educational block corresponds with each other to a large extent. The characteristic trait of blocks engaged in biotechnological or other developments is extreme safety. The design of the scientific centre must take to minimum the danger and the negative consequences of accidental and unforeseen actions. People should be provided with enough space to manoeuvre to prevent unconscious actions. Easy access to desks with the consideration of ergonomic parameters must be provided for any user. Such premises as laboratories must have broad aisles and be well lit by natural and artificial light. Easy and user-friendly design, color, texture, infographics must induce a person to take correct decisions in the space.

A biotechnological block engaged in the selection of potato seeds is planned in industrial park Rogachevo in the Moscow Region (Figure 2). Laboratories, technology and production and engineering premises, canteen, big patio and other additional spaces are placed there [8].

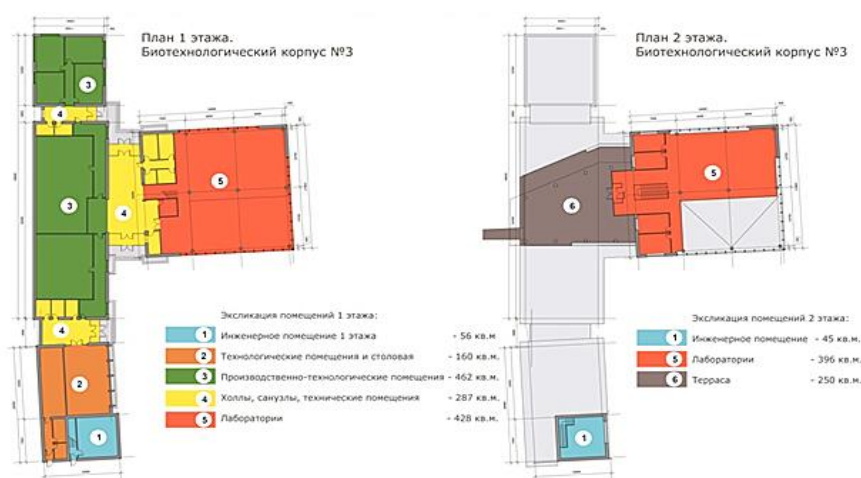


Figure 2.Industrial park Rogachevo, Moscow Region. Biotechnological block project.

From the point of view of universal design the spatial structure of the given edifice does not correspond to its principles. It can be seen in the sketch plan that this block is not accessible for people with mobility group M4. Rampants on the entrance were not planned as well [9]. Stores are connected only via staircases. However, the space has good potential for UD technology usage as laboratories have free layout. The premises are rather well lit due to the big amount of full glazing. The main functional zones are connected by the pairs of doors; it is possible to access the service rooms and utility spaces via single doors. The width of halls, lobbies, corridors allows people in wheel chairs to reverse.

4. Conclusion

In UN Convention on the Rights of Persons with Disabilities the following definition is fixed: "Universal design is the design of objects, furniture, programs and services aimed at making them to the highest possible degree be adept at usage for all people without the necessity of adaptation or

special design” [2]. It should be mentioned that this definition touches the wide range of different activity types. The project activities connected with the creation of innovative humane spaces and architectural and urban planning solutions are not an exception. This work is an attempt to use Universal Design principles as one of the main engineering tools. On the basis of the aforesaid the conclusion can be made that:

- the conception of UD embraces the whole range of issues on the formation of accessible, safe, informative and comfortable environment of bioecoagrocentres;
- this method touches upon the solution of social and demographic tasks, makes possible the attraction of labour forces of different qualification, age and state of health by the provision of comfortable labour conditions.

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