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Agricultural modules situated in arcology skyscrapers for production of certain oil crops, soft fruits and vegetables as well as honey realized

Yanko Aleksandrov

University of Structural Engineering and Architecture "Lyuben Karavelov", 1373 Sofia, Bulgaria
E-mail: aleksandrov@vsu.bg

Abstract

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On the roofs of arcology skyscrapers offer a specific cultivation in an autonomous environment of some oil crops – rapeseed *(Brassica napus); sunflower (Helianthus annuus),* in volume-space modules with their own roof covering. The modules allow the separation of separate technological spaces for each of them. Flowering species can be combined with areas for bee colonies, which will give residents the opportunity to consume environmentally friendly products. These bee families can be located on the roof of the complex or on the roof of the skyscraper.Irrigation takes place dripping from rainwater stored in vessels located between the columns. The modules are developed in steps of 30, 60, 90 or 120 cm. Maintaining a certain temperature regime, air and soil humidity, and air pollution from harmful particles in the space of the modules creates a favorable environment for producing clean produce. The maintenance of these indicators is carried out by a four-work control panel. The harvesting and processing of rapeseed and sunflower for the production of unrefined oil takes place in a specialized section for positive temperatures located in separate spaces of the modules, for example in the basement. Another possibility – the premises for processing of the collected raw material can be located in the last floor of the skyscraper. Soft fruit and vegetable cultivation can be carried out in positive temperature chambers or containers with transparent roof parts and walls located on some of the floors of the skyscraper**.**

Key words: innovation solution; agricultural modules; arcology skyscrapers; oil crops; soft fruits; vegetables; honey.

Introduction

The arcology skyscraper is a unique high-rise building with a high level of public service, providing disastrous agricultural produce to feed the inhabitants. Along with modules of healthcare (medical modules and sub-modules for daily medical care and for such in extreme situations (Aleksandrova, 2009; Aleksandrova, 2011; Aleksandrova, 2016) and modules of primary education**,** it is also appropriate to develop modules for adaptation of some types of production, functionally beneficial for the inhabitants, the raw material for which is grown on the roof or vertically, on floors, in an appropriate autonomous environment. For example, growing oil crops (rapeseed, sunflower) or soft fruits and vegetables. Innovative solutions for the surrounding construction of positive temperature chambers are detailed in the dissertation work of the author Yanko Aleksandrov "Innovative solutions with inventive step for elements to be used for the construction of chambers of warehouses and refrigeration warehouses", Sofia, 2014.

Agricultural biodiversity and economic productivity (Antoh et al., 2019), are an important factor in the organization of agricultural clusters and in tall buildings such as skyscrapers.

The incorporation of cluster productions / activities in the high-rise buildings of megacities are a serious prerequisite for the development of a microeconomic business environment. Responsible for creating this environment are ...

«companies with active channels for business relationships, communication and dialogue.» It should be borne in mind that ".... the national environment in which firms emerge and develop consists of three levels: the cluster, the microeconomic business environment (the M. Porter diamond) and the general business environment (Sölvell et al. 2003); (Slavova et al., 2018).

Innovative solutions with an inventive step are an integral part of the technical solutions of the technological spaces of these clusters according to their functional purpose (Aleksandrov, 2018b).

These positive temperature chambers (or containers) can be adapted to grow soft fruits and vegetables by using solar energy for this purpose. In this regard, the technical features of the two patents of the author, which are the result of this dissertation: "Moveable cold storage chamber for positive temperatures" are particularly relevant. BG111651 (A); and "System for solar heating of the cooling chamber with positive temperatures".BG111658A; (Aleksandrov, 2017b), as well as the features of the previous patent of the same author – Patent BG 63644 (B1). Built-up refrigeration chamber. Classification: E04B1/343; E04B1/74; E04H5/10; Espacenet (Aleksandrov, 2017b). Elastic protection of the walls of the chambers is provided, too (Aleksandrov, 2017a).

The subject of container use has been further developed and reflected in the Mumbai projects (Duffin, 2015. http://nbrsarchitecture.com/nbrs-projects/); (Ganti, 2015. Design/Green Architecture, September 1, 2015); as well as in (Woods, 2015).Tom Woods, www.containerhomeplans.org / 2015/04 / what-i-wish-id-known-before-building-my-shipping-container-home); (Steel city – Container Skyscrapers, Mumbai, 2015), and the topic of the arcology Skyscraper – the Hong Kong Architectural SkyScraper- 2012; (Aleksandrov, 2018a). On line 18, p. 38 Vlasarev D. notes that "the planning of agro-industrial and industrial clusters in a structural (aspect creates a new form of territorial organization..." (Vlasarev, 2018).

Taking advantage of this new form of territorial organization can be an integral part of the author's innovative steps, using combinations of known and new technical features creating a positive technical effect greater or at least equal to the effect of the world level in the field. (Aleksandrov, 2018a) This new form can be achieved without an inventive step of the solution, as certain forms adapt to the requirements of the respective functional solution of the complex.

On line 30, p. 38 by Vlasarev D., author of the monograph, (Vlasarev, 2018), it is concluded that "... agricultural clusters of the agro-food industry should be planned as a protected area to other territorial structures of clusters in relation to the sanitary classification tables. "(Vlasarev, 2018). These data may be taken into account when planning the roof area of the archaeological skyscraper as well as planning and the enclosed spaces on some of the floors intended for agricultural needs.

The detailed arrangement of the territories for buildings and complexes for storage and production of plant products is given in the dissertation "Construction of territories for buildings and complexes for storage and production of plant and animal products" (Vlasarev, 2014a).

Material and Methods

Description of the complex of modules for specific cultivaiton of certain oils

The Hong Kong Arcology SkyScraper- 2012 is proposed to include a production complex of volume planning modules for the cultivation and storage of certain oil crops (rapeseed, sunflower) in an autonomous environment, and a major production area, including their processing. So are also suitable for growing soft fruits (raspberries, strawberries, blackberrys and blueberries) and vegetables. The flowering of honey-like species (rapeseed and sunflower) is used to produce ecological honey from bee colonies, also located on the staff, a sports area with a swimming pool and dressing rooms, and a small primary school with classrooms. (Aleksandrov & Iuzeirova, 2017, International Competition Schools) or kindergarten.

Dimensions of down-mounted plants (210 + 630 + 210) x (210 + 630 + 210) = 10.50 x 10.50 = 110.25 m² included in a single complex; (Figures 1, 2, 3)

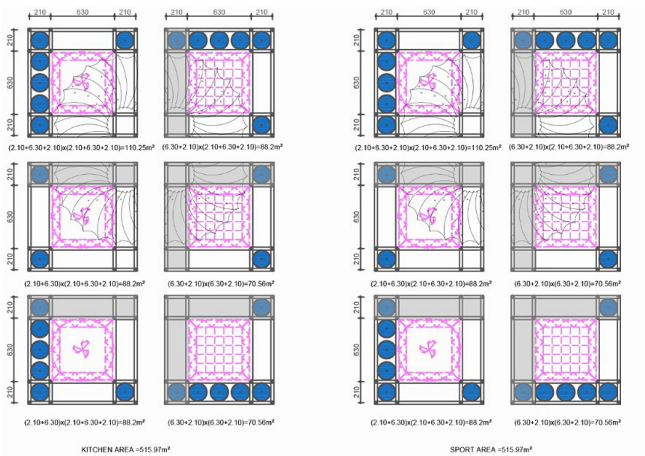


Fig. 1. Six volume planning modules for kitchen with dining room (on the left) and for sports area – children's pool with dressing rooms (on the right). Planning solution with four angled and two intermediate modules with built-in water vessels

Both the canteens and the sports premises are implemented in planning modules, inserted into the construction modules with dimensions: 210 + (3 x 210) + 210 = 210 + 630 + 210 = 1050 cm.

Four smaller squares measuring 210 x 210 cm, a larger square of 630 x 630 cm and four rectangles measuring 210 x 630 cm are involved in the shaping of each module's plan. The four angular modules include five pieces of water vessels placed in a 210 x (210 + 630 + 210 = 1050 sm) series and one water container disposed on its own in a smaller square measuring 210 x 210 cm. Their inner smaller square is without water vessels. In the two middle units in two adjacent smaller squares of 210 x 210 cm are included one water container and the other two smaller squares of the same dimensions are without water vessels.

In the form of the roof are included six pieces of pyramidal-shaped top lighting with a base of 630 x 630 sm, over three of which have domes with wind turbines.

In the two middle units in two adjacent smaller squares of 210 x 210 cm are included one water vessel and the other two smaller squares of the same dimensions are without water vessels. In the form of the roof are included six pieces of pyramidal-shaped top lighting with a base of 630 x 630 cm, over three of which have domes with wind turbines. The roof plan of both solutions is the same and includes six pyramidal top lights with three domes with three wind turbines and three horizontally positioned photovoltaic coatings. (Figure 1); (Aleksandrov & Iuzeirova, 2017, International Competition Schools).

"Mumbai has a tropical climate. When compared with winter, the summers have much more rainfall. According to Köppen and Geiger, this climate is classified as Aw. The average annual temperature is 26.8°C in Mumbai. In a year, the average rainfall is 2386 mm." (https://en.climate-data.org/asia/india/maharashtra/mumbai-29/)

Two planning solutions with four angular and two intermediate modules with built-in water vessels are shown in Figure 1. Four molded squares measuring 210 x 210 cm, a larger square of 630 x 630 cm and four rectangles measuring 210 x 630 cm are involved in the shaping of each module's plan. In the four angular modules are included five pieces of water vessels placed in a 210 x 210; (630 + 210 = 840 sm) series and one water container disposed on its own in a smaller square measuring 210 x 210 cm. Their inner smaller squareis without water vessels.

Features of the technical solution of the complex for production of the rapeseed and sunflower (Figures 2, 3, 4, 5); (Aleksandrov & Iuzeirova, 2017, International Competition Schools).

The spaces of an ellipse open on the long axis, an ellipse open on the short axis, an open circle and a closed circle (on the left) and the spaces of a closed ellipse on the long axis, an ellipse open in the short axis, and two open circles (on the right) are intended for growing in an autonomous environment of certain oilseeds (rapeseed, sunflower, etc.) (Figure 5).

Advantages of a honey of the rapeseed

Rapeseed is an oil-bearing plant from which bees collect pollen and nectar from May. Rapeseed honey is mostly produced in Europe and the United Kingdom. Honey is not very sweet, has low acidity and high pH. The highly healing properties of rapeseed honey are also known. It has a beneficial effect on the kidneys and vision. The Q3 content makes it preferred in the treatment of osteoporosis. The presence of vitamin E in it delays the aging of the skin and maintains the elasticity of the walls of blood vessels. This honey also extracts heavy metals from the human body, reduces bad cholesterol, does not cause allergies, and its content of vitamin A makes it a powerful immunostimulant.

Advantages of honey from sunflower; (Figure 4)

Sunflower areas are subjected to research and organization of experiments in order to achieve hybrid plantings. Chemical analyzes, statistical and other methods and conditions are an integral part of the applied experiments. High yields are the result of such experiments.

Honey from sunflower; (Figure 2)

Sunflower honey has antibacterial action. Bee colonies use the abundant grazing in July (when the sunflower blooms) to produce honey in the beehive. The ten largest producers of sunflower in the world are in (million tons): Ukraine 12.24; Russian Federation 10.48; Argentina 3.55; Romania 2.91; China 2.58; Bulgaria 2.06; Turkey 1.96; Hungary 1.89; France 1.62; USA 1.00. Source: FAO 2017. (https://nuseed.com/bg/)

Fig. 2. Bee gathering honey from sunflower

Results and Discussion

Features of the technical solution of the complex for prudicton of the honey (Figures 3, 4, 5).

Cultivation of the bee families is carried out in protected areas with soundproofing curtains with open windows of the

upper beacon lighting. (Figure3); (Aleksandrov & Iuzeirova, 2017, International Competition Schools). In the plans the volume planning modules are overlapped at 2.10 m. The sanitary units are separated directly behind the curtains in a separate wheelchair. Each node is served by rainwater harnesses used for irrigation and domestic purposes. Hydraulic devices are provided in the basement to provide a variable floor configuration in the natural spaces close to the natural. Four curved stairs provide access to the roof of the building for surveys of bee families when located there. Hives are located on platforms raised and lowered by hydraulic devices (Figure 3).

When processing the honeycomb honey, hives are lowered into the basement floor. Honey is collected in containers that are stored in rooms located also in the basement. Closed process cycle (honey production in the hive, dropping of the hive with hydraulic devices in the basement for honey production, elevation of the upper hive for honey production, again) is obtained. (Figure 4) (Aleksandrov & Iuzeirova, 2017, International Competition Schools). There are two other options – hives to be located on the roof of the production complex or on the roof of the skyscraper (Figures 3, 4). In these two cases the path for transporting the honeycomb to the indoor premises with the honey centrifuges is extended. After the honey has been removed, the honeycombs are returned to the hives.

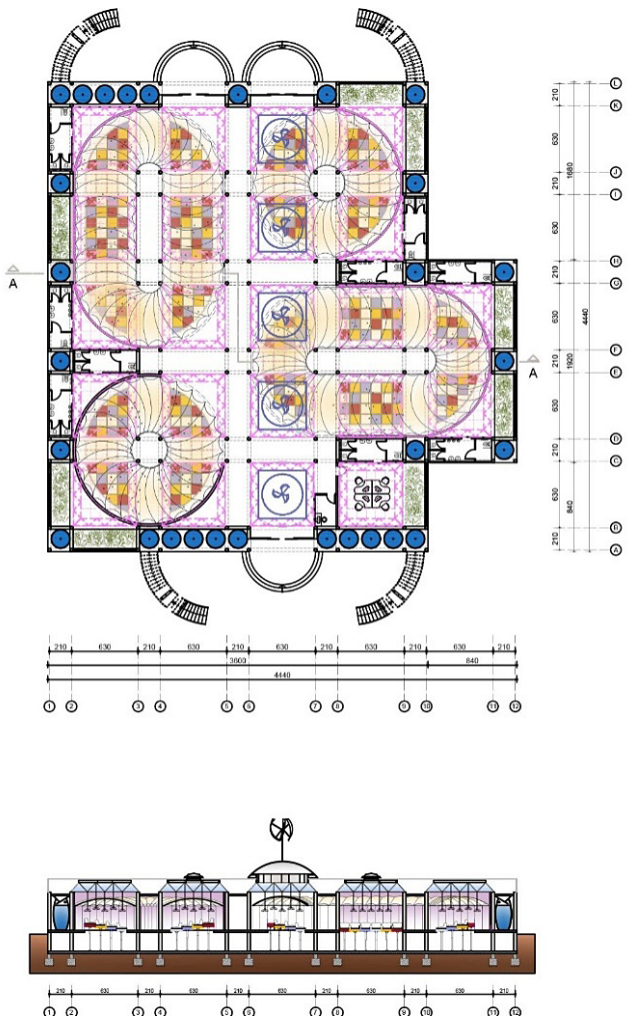
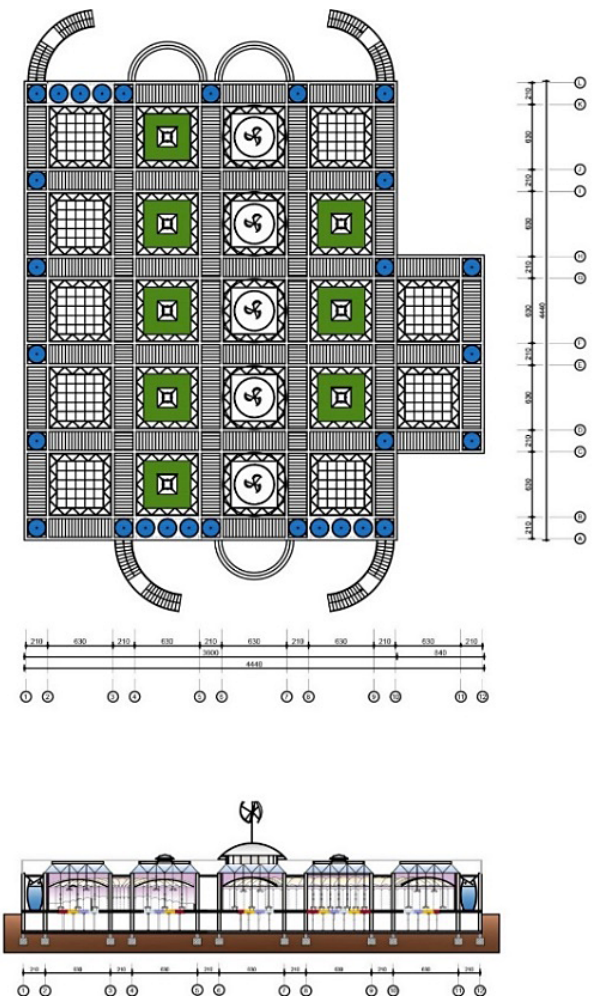


Fig. 3. A complex with two elliptical and two circular planar spaces, formed with soundproofing curtains; the floor may be raised or horizontal depending on the location of the hydraulic devices



Fig, 4. Roof terrace with green areas, photovoltaic coatings and pyramid top lighting

The foundations of the complex's modules are located in a sandbox and are jointly connected to the floor slabs below them, and through the floor slab and the supporting structure of the skyscraper. The mass of the two floors and the sandbox are involved in the quenching of earthquakes and winds. An elastic joint separates the mass of the production complex building from the rest of the roof of the skyscraper (Figures 3, 4). (Aleksandrov & Iuzeirova, 2017, International Competition Schools).

Bee families can be located on the roof. Pyramid elevation provides even distribution of light to the sunspots; wind turbines are located on the domes. Part of the pyramidal roofs is covered with green areas and another with photovoltaic elements. (Figures 4, 5); (Aleksandrov & Iuzeirova, 2017, International Competition Schools).

Fig. 5. A fragment of the roof; access of bees to hives through the upper lighting

Access to the staff canteen is provided by two entrances – the exit. An office entrance leads to the kitchen where cooked meals are prepared (Figure 6); (Aleksandrov & Iuzeirova, 2017, International Competition Schools).

Fruits and vegetables are grown by the occupants in the space of the respective modules. On the top floor of the skyscraper are containers with transparent parts for growing soft fruits (strawberries, raspberries, blackberries, currants, etc.), as well as for storage in fruit storehouses with positive temperatures. The production is intended exclusively for feeding these inhabitants. The personal labor they bring reduces their cost.A shallow pool with changing rooms provides temporary recreation for staff and primary school pupils (Figure 7); (Aleksandrov & Iuzeirova, 2017, International Competition Schools).

From the roof, water intakes fill 22 water vessels with rainwater (Figure. 8).

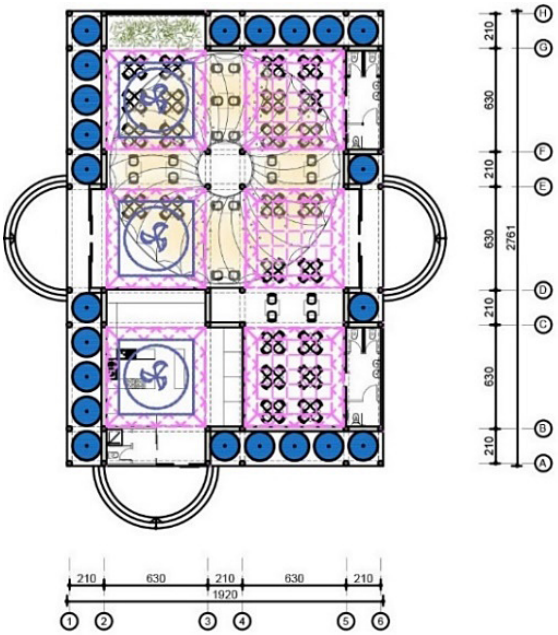


Fig. 6. Planning solution of a kitchen with a canteen of six volume planning modules; between the modules are three entrances and one vertical garden

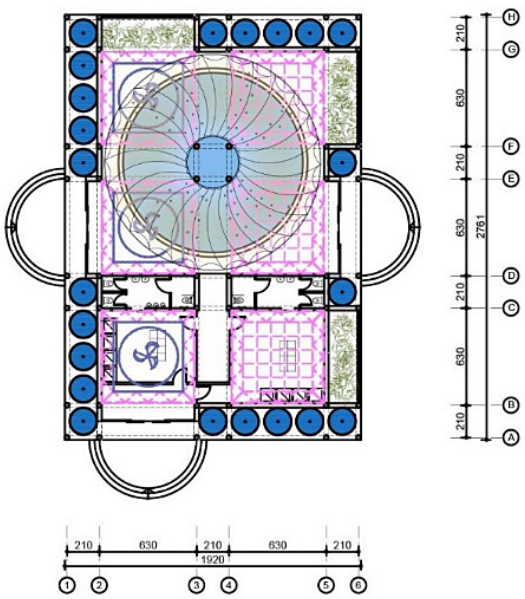


Fig. 7. Planning solution of a sports zone of six volume planning modules; between the modules there are three vertical gardens

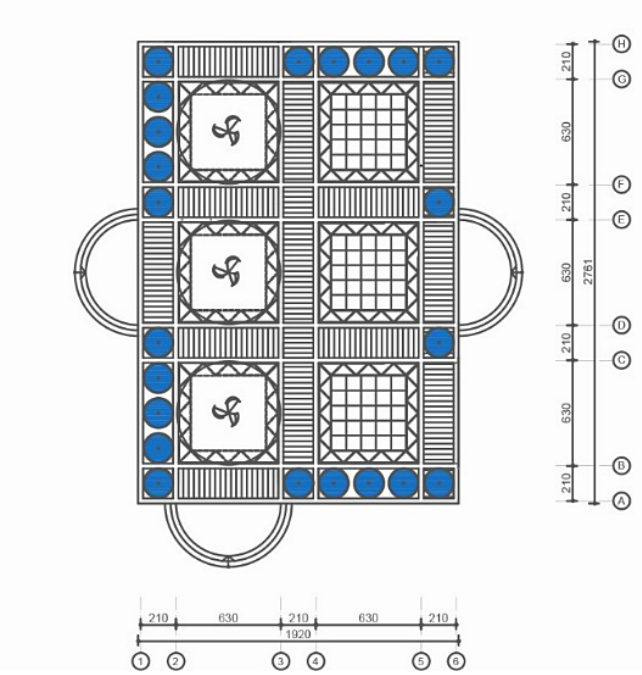


Fig. 8. Roofing with four angular and two intermediate modules with built-in water vessels

Modules for kitchen chair (Figure 9), ***a sports area with space for game; small primary school with a classrooms*** (Figure 10).

(Aleksandrov Y., Aleksandrova L. and students Aleksandrov I., Savov K., Yalchan T.) International competition, Schools, 2016). The dimensions vary from (180 + 540 + 180) x (180 + 540 + 180) cm; (210 + 630 + 210) x (210 + 630 + 210) cm depending on their functional purpose.

Fig. 9. Kitchen – dining room for the complex; measurement of the modules (180 + 540 + 180) x (180 + 540 + 180) cm; (210 + 630 + 210) x (210 + 630 + 210) cm

Fig. 10. Sports area with swimming pool and dressing rooms for the complex; measurement of the module (180 + 540 + 180) x (180 + 540 + 180) cm; (210 + 630 + 210) x (210 + 630 + 210) cm
Small primary school
with classrooms to the complex, too

Conclusions

A new solution is proposed for the implementation of an agro-food complex of modules designed for specific cultivation in an autonomous environment of some oil crops, soft fruits and vegetables in the arcology skyscraper.

By modifying these module sizes, the useful areas for raw materials collection, processing and storage can be increased in the territory of the complex. The construction elements of these modules can be transported with drones whose lifting force is based on their weight. The selection of oil-bearing crops in the arcology skyscraper is according to the preferences of its inhabitants. The agro-food complex of modules for specific cultivation in an autonomous environment is in keeping with the healthy lifestyle of the inhabitants. The cultivation of oil crops (rapeseed, sunflower) is combined with the growing of bee families to produce honey on the one hand and, on the other, for the production of unrefined oil. Hydraulic devices occupy an essential part in copper production technology. Lowering down the basement and returning it back to the upper level dramatically shortens the time consuming to the honey extraction centrifuges from the honeycombs. The grounds of this complex include a kitchen – a canteen, a sports area with a shallow swimming pool and changing rooms, and a primary school with classrooms for the children of the serving staff and for the inhabitants of the arcology skyscraper.

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