Special aspects for forming the interiors of thai shopping malls through the use of the biological approach

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Abstract. This study reviews the biological approach to Thai shopping mall’s interior design planning. The authors defined the principles of the mall’s design optimization in Thailand on the basis of the imitation of biological samples at constructive, art-compositional, organizational and ecological levels. The analysis of forming the shopping malls interiors and space-planning solutions is based on the imitation of eight basic levels of organization of living things: molecules, cells, tissues, organs, organisms, populations, ecosystem and biosphere. The examples of the direct and implicit application of biological analogues were demonstrated in the architecture and design of Thai shopping malls. In the study, the shopping mall is regarded as an open self-sufficient system with a high level of autonomy and a fortified structural organization that includes various functional components. On the basis of the analysis of existing Thai shopping malls, a list of the basic requirements for the design of the malls was compiled. This corresponds to the needs and desires of the modern customer and ensures the competitiveness of the establishment. The phenomenon of multisensory design approach that enhances the psychophysical comfort of the shopping mall visitors is described. Socio-cultural and geographical factors were identified which determine the development of biodesign in Thailand. The article reveals the potential for a combination of biology and design to enhance the aesthetics, ergonomics and efficiency of the shopping malls. The prospects within the development of this field and the possibility of applying the solutions in practice were explored.

1. Formulation of the problem
The study of design development for the shopping mall’s interiors on the basis of imitation of different levels of organization of living things is promising and relevant for today. The use of the biodesign principles in the interior design has great potential for improving the parameters of ergonomics, constructability and aesthetics. The imitation of the various bio prototypes is based on the search of new and non-standard solutions for architecture and design.

2. Analysis of latest publications
The basis for further development of the research topic is divided into two main areas: the concept of a biological approach and the theoretical basis for designing interiors.

    The biological approach to design development requires careful study, implementation and realization of biological discoveries in the design field. The biology scientist Hoffman-Kadoshnikov P.B. presents the study of the hierarchy of living systems, where he describes eight basic structural levels for the organization of living things [1]. Tsyupka V.P. explains the principles for the
organization of the living matter and its structural division to levels and sublevels [5,6]. Balaban N. E. and Bobick J. E. thoroughly describe the anatomical structure of the human body and the functional principles within its systems [8].

Marieb E. N. and Hoehn K. explain in detail the features of the anatomy and physiology of the human body [12]. Rosse C. and Mejino J. L.V. give information about the organization of the human body, its structure and activity principles at different organizational levels of living matter. [13].

Another important direction is the shopping mall’s interior design development. Features of the shopping mall’s design, requirements for planning and technical equipment are highlighted in the study of Kanayan K., Kanayan R., Kanayan A. The authors give a detailed analysis of the design process of trade enterprises and their functional features [3]. In the article of Lukash A.N. shopping malls are considered as diversified organizations with a wide range of functions. The author gives the principles of effective organization of the mall environment and space-planning decisions. He also researches the potential scenarios for trade establishments [2]. Maitland B. defines the principles of design and planning for shopping malls. The author describes the specific functions of trade establishments and their various elements. He specifies the organizational features of this work as a single mechanism [11]. Altoon R. A. demonstrates and thoroughly analyses his own and world experiences in the design of shopping malls. He clearly illustrates his examples with images [7]. Mesher L. analyses the special aspects of interior design of trade enterprises and describes the specifics of this industry in regards to the example of known world shopping malls [10].

The narrowing of the research topic to the specific aspects of the design planning for Thailand, requires an analysis of sources related to the interior design for Thailand. Sthapitanonda N. demonstrates and analyses trends in design and architecture of modern shopping malls in Thailand [14]. Inglis K. describes the process of the generation of the new Thai style in interior design, as well as its features and characteristics. The author analyses the impact of the socio-cultural heritage of Thailand on the sphere of modern design and demonstrates its manifestations. Prospects for using the style in different countries of the world are also given [9].

The closest scientific publication to the research topic is the study of Kuznetsova I.O. and Zakharchuk V.L, who analysed the special aspects of the design of biodesign objects and interiors based on the use of the structure of natural forms [4].

On the whole, the analysis of scientific publications has shown that the stated subject has been studied fragmentarily and that the conceptual expression is absent. The Aim: to investigate the design planning of interiors for shopping malls based on the imitation of different levels of organization among living things.

3. Results

Nowadays a characteristic phenomenon is the rapid development of consumerism – the culture of excessive consumption of material goods. The process of buying and selling has become not only a daily need, but also a pastime and a specific leisure activity. Shopping and entertainment centres have become important social and cultural components of the urban environment.

The main requirements for the design of shopping malls are:
− adaptability to the requirements of various social groups,
− polyfunctionality of the establishment on the basis of a combination of different zones,
− availability, ability to navigate in space easily,
− integrity, subordination of separate elements to a single expressive artistic image,
− reasonable accentuation of the exposition zones in order to increase the profitability of an establishment.

An important aspect is the economic, geographical and cultural characteristics of the region, and the customs and traditions of the population. These determine the demand for certain categories of goods and services, as well as the way products are sold. For example, in Asia, markets (including floating markets) are the most common centres of commodity exchange where a large number of food products are sold. This tendency has developed historically and has taken root in the life of local
residents. However, the last two decades have been a time for rapid development of megacities in Thailand. Among other things it resulted in the building of ultra-modern multifunctional shopping malls that serve the needs of the rich and middle class. The compromise is to place the grocery and clothing market on the first floor of large shopping centres. The diversity of the culture of trade within a single geographic region is caused by a large divide between the material wealth of various classes and the inequality of development in urban and rural areas.

Modern technology has made it possible to study in detail the organization and functional features of natural organisms at a cellular level. The obtained data can be used for perfect prototypes when designing interiors. A relevant solution is to imitate the appearance of bio prototypes. However, it is becoming popular to rather analyse their internal structures, especially the elementary principles of their order and the way they interact with each other.

It is possible to single out four main directions for the imitation of biological prototypes when designing shopping malls:
- constructive (for architectural and building solutions);
- artistic and compositional (for planning and artistic solutions);
- organizational (for the development of functional schemes and coordination of the shopping mall’s constituent elements);
- ecological (to improve energy efficiency, environmental friendliness and safety of shopping malls).

The imitation of natural forms underlies the optimization of design, because the organization of natural things and the system of their functioning is perfect. This method has made it possible to create constructions with increased strength, flexibility and functionality. These structures conform organically to each other and to the environment. Therefore, the authors of the study proposed an analysis of existing Thai shopping malls interiors’ in accordance with the special aspects of the organization of living systems.

The use of the biological approach in design is well traced and is rapidly developing in the architecture and design of Thailand. Analysis of the socio-geographical situation of Thailand determines the following causes and features of the development of biodesign in this environment:
1. A stable hot climate allows nature to enter the interior, in particular, through the use of panoramic windows and openworked facades of buildings, and the creating of outdoor terraces.
2. The Factor of culture and Buddhism calls humanity to protect, love and respect nature and to live in harmony with it.
3. A large number and variety of natural prototypes for copying, reinterpretation and implementation in design objects is available.
4. High levels of urban pollution increase the need to emphasize ecology and preservation of the natural environment.
5. High population density and the fast pace of urban development creates the need to design “green roofs” and vertical planting of facades of buildings.
6. The country is at a critical stage of development and re-formation. In this regard, there is a significant number of new stylish buildings. They are often subject to the general tendency of the world towards bionic and ecological architecture.
7. The availability of a large number of ecologically clean materials and resources.
8. A high level of development in landscape design.

The analysis of the special aspects of the biological approach application in the design of existing Thai shopping malls is made on the basis of the twelve popular shopping malls of Bangkok: Siam Paragon, Central World, MBK, EmQuartier, Emporium, Central Embassy Shopping Mall, Gaysorn Shopping Mall, Erawan Bangkok Plaza, Terminal 21 Esplanade Shopping Mall, The Mall Bangkae, Central Plaza Bangna, River City.

The formation of the interiors according to the principles of organization of natural things and systems provides a high level of: stability, reliability, quality of functioning, interaction of certain units among themselves, orderliness, and aesthetics for human perception. The most valuable ability of living organisms and systems is the ability to self-organize and self-regulate. Analysis of Thai
shopping malls confirms that their design provides for imitation of these characteristics of biological objects and maximum approximation to the autonomy of the functions of natural organisms. All shopping malls have a wide infrastructure that provides all the needs of a person and makes it possible to spend a whole day or more within the establishment, particularly if the complex includes a hotel or direct connection with it (Central World, Emporium, MBK and Terminal 21). Self-regulation and self-organization is achieved by coordinating the separate brands and companies with a single centre - the administration of the complex.

The biological system is the unification of freestanding elements, interconnected at different structural and functional levels. All living systems are exposed, so they need nutrients to generate energy and release metabolic products. Thus, each system is an integral element of the larger systems mechanism in which it takes a specific position and performs a certain function. For example, each boutique is a separately functioning unit and at the same time it is an element of a shopping mall that emerges as an integral element of the trade establishments that forms the infrastructure of a settlement.

The human body is an example of one of the most developed and complicated biological systems. It functions at eight basic levels of the structural organization of living matter: molecules, cells, tissues, organs, organisms, populations, ecosystem and the biosphere. [1, 5]. Analysis of the formation of the human body at different levels and research of its functioning features is proposed to be applied to interior design and architecture for optimization.

The molecular level analyses basic elements which ensures the implementation of important processes occurring on a shallow level and are invisible to the human eye, including the transfer of hereditary information and the synthesis of energy. The structure of various molecular compounds is a potential prototype for lattice patterns and laces. They can be used for the decoration of wall panels, facades, windows and doors. For example, the facade of Central World Mall is covered with a lattice that copies a hierarchical connection of molecules. The geometric facade of the MBC building is accented by an ellipsoidal input panel made of glass and decorated with a metal lattice. The structure of the DNA molecule is often used for imitation in architecture and landscape design. This spiral is frequently used as a prototype for the design of shopping malls atriums. The spiral motif is clearly traced in the planning of the EmQuartier atrium and in its main accent – the green chandelier. At the Gaysorn Shopping Mall, the spiral is implemented in the atrium, a spiral staircase and hanging decor is placed spirally. Molecular compounds can also become the analogies for planning of interior zones. We can consider the elements of furniture and equipment as electrons, which form a single molecular lattice and are subordinated to a single compositional centre - the nucleus. This approach is traced in the design of food courts, recreation areas, cafes and restaurants of the Thai shopping malls. It ensures the orderliness of the interrelated units and the integrity of the composition. The structure of the molecules can also be successfully used in lamp design. For example, a chandelier located in the atrium of the Siam Paragon shopping mall has the motives of this structure. The chandelier from the Emporium’s atrium looks like the molecular lattice. Imitation of the cells structure and their combinations is a relevant solution for the constructional design, ceilings and floor decoration and products of the industrial design.

The tissue level of the organization of living things covers the integration of cells of certain structures and dimensions into the tissues for a functional purpose. Animals have four main types of tissues: epithelium, connective, muscular and nervous. Plants have meristematic, protective, parenchyma and vascular tissues [12]. Their structure often serves as a prototype for the design of fibres, textiles, covering materials and furnishing fabric. The facade of the Central Plaza Bangna complex is decorated with a grid with a pattern that corresponds to the structure of connective tissue. The motifs of the muscular tissue are traced in the grid covering the facade of the Central Embassy Mall. At a constructive level of design, the imitation of the organization of various tissues of living things is traced in multilayer constructions of walls and floors that provide them with increased strength. In Thailand, concrete blocks and bricks that constitute the mass of the wall are mainly used according to the meristematic tissue of a plant. The heat-insulating materials and water-proofing layers (damp course) correspond to the parenchyma tissue and increase the energy efficiency of a building.
protective tissue i.e. epithelium serves as a prototype for different coatings and foils, that protect buildings from mechanical damage, exposure to high temperatures and humidity. The use of appropriate coatings is especially important for Thailand, as it saves the building from the destructive impact of the hot humid climate. This positively affects its endurance characteristics. The water and electric systems of "warm" floors are the analogies of the vascular tissue of plants. This solution is not relevant for Thailand.

The level of organs exposes the combination of different tissues into a single mechanism to ensure the fulfilment of a functional purpose. The organs are grouped into systems. Interrelations, like the connections of the nervous and circulatory systems in the human body, can be traced in the organization of shopping malls.

The atrium usually serves as the "heart" of the complex, since it is a central place. It collects the main mass of visitors and distributes them in different directions, just as the heart of living beings' pumps blood throughout the body. The hearts of highly organized life forms consist of three or four chambers. Accordingly, large Thai shopping malls mostly include several atriums, connected by convenient transit routes. The Terminal 21 has 6 atriums. Their interior design reflects on different significant places of the world: Tokyo, London, Istanbul, Paris, the Caribbean islands and San Francisco. This concept reflects the characteristic feature of Thai shopping malls, which is the desire for internationality and connection with western culture. This is especially popular among the younger generation. In Thailand, the design concept of atrium interiors usually plays a key role in attracting patrons, because the shopping malls serve as a social and communicative environment and tourist attractions.

The mirroring of biological prototypes in design objects and atrium installations is a popular trend in Thailand. For example, there is a swimming pool with a large-scale installation including plants and sculptures of lilies in the centre of the Siam Paragon atrium. Water is a landmark element within Thai culture, as it provides food, transportation and is a place for traditional floating markets. It is also an integral attribute of local landscapes and an element of folklore.

The green zones are “lungs” of the Thai shopping malls. They can be open or covered and, as a rule, include natural planting, recreational facilities, decorative installations, waterfalls and fountains. They perform the function of saturating the establishments with oxygen and purifying the air. The Mall Bangkae is an example of the abovementioned. It has a green zone with plants of local flora, stones and a multi-storey waterfall that falls into a pool with fish. Copying natural landscapes in the Thai urban public establishments evokes visitors’ affection, as it supports the concept of a return to nature. The reconsidered use of the motifs of water and flora is observed in the Siam Paragon mall. The ceiling of the basement floor includes green installations and ceiling fountains that serve as an element of visual zoning between different restaurants.

The prototype of the eyes can be used to design the systems providing natural and artificial lighting to the shopping mall. Windows, doors, glass ceilings and skylights correspond to the cornea of the eye and allow daylight to penetrate inside. The amount of penetrating light is regulated by the pupil, which is able to narrow and expand it in accordance with the lighting conditions. A similar principle is used for lamps with a dimmer function that can change the brightness of light. The colour of the eyes’ iris is defined by the pigment melanin. Light grey or blue tinted glass is often used for the interiors of Thai shopping malls (MBK, Central World). This solution protects the interiors from excessive lighting. The lens performs the function of light refraction. Adding light reflecting surfaces to the shopping malls interiors helps to increase the level of insolation and energy efficiency. The process of flushing waste materials and debris from the eye is carried out by the lacrimal apparatus. Most Thai shopping malls have self-cleaning windows, which, due to the hydrophilic coating, attract moisture droplets that wash away the dust. In Thailand the level of pollution is high, so these systems significantly improve the usability of buildings.

The administrative zone can be considered as the “brain” of the shopping mall. It regulates the activity of the entire complex and manages its processes. This department is responsible for the preservation of archival data (memory), analysis and statistical processing of data, the development of
marketing solutions and creative concepts to support the successful operation of the shopping mall. The administrative zone is usually in a somewhat separate location.

Most of the vital organs of a person are located under the ribs. It ensures their protection. Based on the feature of the organization of the human body, it is appropriate to ensure additional structural strength in the areas of the most important functions.

The systems of human organs are characterized by well-coordinated mechanisms of cooperation between the constituent elements and of energy exchange with the environment. The ability to self-regulate underlies the adaptability of biological organisms to environmental changes and determines their ability to respond to external stimuli and optimally adapt to current conditions.

The organization of shopping malls according to the principles of the structure and functioning of the organ systems makes it possible to improve the efficiency of the establishment.

Complex systems of lighting, ventilation and heat supply, video and audio systems, subordinated to one centre can be considered as an element of the human nervous system, which regulates the activity of the entire organism, sending impulses from the brain. The activity of the nervous system depends on the influence of external stimuli. Similarly, modern shopping malls have smart systems (i.e., the ability to function with the capacity required by certain conditions) which improve energy efficiency, economy and save resources. Like the living organisms, climate control systems can support a given temperature and humidity level by heating or cooling the air with minimal energy use. The issue of energy conservation is very important for Thailand. The reason is a hot climate that stimulates the air conditioning systems to operate at a high capacity. A specific feature of Thai shopping malls is the maintenance of a cool temperature (18-20°C) that is in contrast to the natural climate.

Transit routes of the shopping malls, including stairs and escalators, function like the circulatory system of the human body. Blood flows to the heart through the veins, and from the heart to the organs through the arteries. According to this prototype, it is necessary to separate the routes for different streams of visitors: those that move inward and those that move outward. Like the capillaries of the circulatory system the corridors should connect the main transit ways. This organization of the shopping mall transit system increases its ergonomics and security. Like the circulation of blood in living organisms, the streams of visitors should not be interrupted. It ensures the effective operation of shopping malls. To achieve this result, it’s important to create a direct connection between important zones, and convenient and consistent transit ways with understandable direction signs. There should be no obstacles on the most popular and busiest ways. It should be noted that Thai shopping malls provide a well-designed system of directional signs. The transit paths along the helix atrium of the EmQuartier mall are also accentuated by a system of LED lights. In Central World, the main traffic direction is emphasized with contrasting black lines and ribbon LED lights.

Large shopping malls require a large number of structural elements, such as columns and beams. They keep the construction and visually divide the space into separate zones. Together they represent the skeletal system of the building. Shops and boutiques form the “spine” of shopping malls, because they “support” the entire complex. Every trade brand is a vertebra. They are usually placed in a linear chain reminiscent of the human spine. The spine is divided into 5 sections. Accordingly, shopping mall boutiques are divided into groups according to the type of goods they sell (clothing, footwear and accessories, cosmetics, children’s goods, sporting goods, furniture, etc.).

In the most functionally important and busiest zones of shopping malls, it is necessary to design structural elements of increased strength. They should be made of resilient materials and coatings. Columns also serve as elements of the interior design and compliment the artistic concept of the establishment. Some columns in the EmQuartier shopping mall are decorated with vines and look like a stylization of trees. The motifs of palm leaves (in The Mall Bangkae), and stones and rocks (in Central World) are popular analogies for creative rethinking in Thailand.

All materials and coatings that constitute the mall can be considered the cover system. They determine the look of the establishment, and also perform a protective function for the structural elements. Nowadays in Thailand, both artificial and natural materials are used in shopping mall designs. The latter are usually valued more, as they fully meet the requirements of safety and
environmental friendliness. Wood, stone, natural fibres, metal and vines are renewable resources that are actively used in shopping malls buildings. The advantage of artificial materials is their increased resilience and financial feasibility. It also allows for the conservation of natural resources. Plasterboard, acrylic panels, plastic and artificial glass are some of the artificial materials widely used in shopping mall construction. Excessive use of plastic and polyethylene is a monumental problem for Thailand, which requires regulation and solution.

The system of supplying products to shopping malls, their storage, exposition and presentation, as well as the utilization of waste and unnecessary things, can be designed in a manner similar to the digestive system of bio organisms. All pathways should be simple and unhindered. Delivery systems should be divided into separate entrances for the receiving of goods.

The respiratory system corresponds to the air conditioning system as it is responsible for providing fresh air, comfort of microclimatic conditions and a favourable atmosphere for relaxing, shopping and entertainment.

The human sensory system analyses external stimuli and, by transmitting signals to the brain, makes a general impression of an environment, object or phenomenon. Multisensory comfort in Thai shopping malls significantly enhances the level of customers’ loyalty and increases the profitability of the establishment. The involvement of the five senses in the interior design engages the receptors of touch (textures), hearing (music and sounds), smell (odours), taste (food court, cafes, restaurants and coffee shops) and sight (aesthetics of the mall interiors).

Touch receptors are engaged through selection of patterns. The traditional solution for Thailand is the use of natural materials and their artificial counterparts. They are pleasant for us on a subconscious level. The textures of wood, smooth or rough stone, crystalline minerals, soft grass, leather, fur, wicker, natural fibres, sand and water are familiar to us, so interiors containing these materials are cosy. A typical solution for Thai shopping malls is to use the motifs of flora and fauna for the design of openwork panels and facades.

Acoustic comfort can be achieved by minimizing chaotic noises and filling the environment with melodic sounds. For example, the presence of fountains and waterfalls in the interior of malls adds the sound of natural landscapes to artificial scenes. Multi-storey waterfalls are the attractions of the EmQuartier and The Mall Bangkae. Bird chirping, the sound of the surf and thunder and sounds created by various living things are other popular natural sound motifs used in Thai shopping malls. A typical solution for fashion stores is playing musical compositions corresponding to the corporate style and concept of a particular trade brand.

It is a common practice for shopping malls to aromatize the premises in order to please the smell receptors. Automatic spray air fresheners and containers with volatile oils are used for this purpose. Artificial scents include an infinite number of ingredient combinations that are pleasing and attractive for a person. However, the natural ones are absolutely safe for humans and are perceived as more harmonious odours.

The Thai local population is particularly attentive to the odours of the environment, that’s why they widely use different essential oils, scented candles and sticks in everyday life. They believe it helps to reduce stress and relieve headaches and improves their well-being. The flavours of citrus and fruits, herbaceous plants, conifers and coffee beans are the most popular flavours used in Thai shopping malls. This aspect can be seen from two opposite points of view. The positive one considers the aromatization of premises as a way of providing pleasure for visitors. The negative one emphasizes the different effects of certain odours on individuals, especially in the case of an allergy. Long stay in an environment with a distinct aroma can also cause a headache, especially if flavours are artificial. The optimal solution is to ensure good ventilation of premises and to get natural fragrances from plants. Aromatization is acceptable for certain zones of the establishment, where the person’s stay is very limited.

The engagement of taste receptors is achieved through the organization of food courts, cafes, restaurants and coffee shops. Traditionally, an average visitor spends from one to several hours in the shopping mall. That’s why planning of the different dining areas provides for the natural needs and
taste preferences of customers. The process of dining plays a very important role in Thai culture. Mostly the local population follows a food cult and is used to eating every 3-4 hours, so the variety in mall’s dining establishments is an important aspect for its popularity. A special feature of Thai shopping malls for the middle class is the presence of street food spots, which are wide-spread and typical for the country.

Achievement of engagement of the sight receptors is the most complicated task, because a person receives about 80% of their information visually. The concept of aesthetics is quite abstract and is perceived by different people in different ways. The formation of aesthetic ideals is affected by the psychophysiological state of a person, the era and fashion trends as well as ethnicity and cultural preferences of a particular region. The relevance of architectural and design solutions is very changeable and is usually orientated for a certain time period and a certain audience. The imitation of biological prototypes is the key to solving this issue, since natural forms are well perceived by man. The majority of Thai shopping malls have motifs of flora and fauna used for artistic and compositional solutions. A specific feature of the colour scheme of local shopping malls is the active use of the colour gold, which is a symbol of the sun and monarchy.

The organism level of an organization considers the entire life cycle of living organisms, their ability to function as a complex mechanism, as well as at an individual level [8]. Analysing the shopping and entertainment complex at this level, it is necessary to consider the special aspects of the functionality of each individual trade or service enterprise. Each brand has its own distinctive corporate style, according to which the shop interior is made out, the showcase and advertising products that provide them with recognisability. All boutiques have a specific lay-out, design of exposition areas, and specific set of materials and equipment inherent in the establishments of the chain. The success of the functioning and profit of each individual brand of goods or services is one of the most important factors of the complex's activity as a whole. Providing comfortable conditions for the sale of products from stores and entertainment zones is an important task when designing a shopping mall. Population levels are based on research related to the structure and functional principles of organisms and their association in groups, the so-called “populations” [1]. An analysis of the principles of the interaction of biological objects within populations is similar to the study of the market of establishments of shopping and entertainment services. Competitiveness within the shopping malls is similar to natural selection, which claims that the strongest survives. Living things are specially adapted to their environment (the long neck of a giraffe, the elephant's trunk, the ability of a chameleon to change colour). It helps them to survive and compete with other organisms. The main factors of the competitiveness of Thai shopping malls are: the location with access to the BTS transport system, the presence of well-known international brands, the distinctive design of the establishment, and successful marketing solutions.

The level of ecosystems comprises the connections between the living organism and its environment and is responsible for the energy exchange process and the supply of necessary resources [5]. The mechanism of the mall’s functioning includes the process of supplying and realization of goods that allows to make profits at the end of the cycle.

At the level of biosphere living things are considered as small elements of the biosphere and have a certain role and place in it [5]. The conservation of the habitat of living things and the relationships between living and non-living things are important issues. From the point of view of the design planning of shopping malls, environmental friendliness, energy efficiency, and the rational use of natural resources are of particular importance. Safety for people and the environment is a priority. This problem is not prevalent in Thailand and requires a normative settlement. The best solutions to ensure these requirements are: the use of energy-saving heating, ventilation and lighting systems, the planning of green zones and the use of natural materials and large glass surfaces in order to get natural insulation and to save electricity. The prototypes for building artificial systems and complexes are: polyfunctionality of bio organisms, their integrity, the ability of separate elements of the system to interact with each other effectively, to self-organize and to adequately respond to external factors. The
quality of cooperation of the boutiques with different service centres, entertainment zones and management departments determines the success of a shopping mall.

4. Conclusions
Analysis has shown that the shopping mall is a complex artificial system functioning like a biological object, in particular, the human body. The conscious regulation of artificial systems in accordance with the functioning principles of their natural analogues provides significant potential for increasing the effectiveness and success of establishments.

Design planning of Thai shopping mall interiors with the use of a biological approach makes it possible to achieve higher indicators of constructiveness, functionality, ergonomics, aesthetics and economic feasibility. Imitation of the eight levels of organization of biological prototypes (molecules, cells, tissues, organs, organisms, populations, ecosystem and biosphere) in Thai malls, raises the design to a qualitatively new level. It requires a complex approach to the design process considering the special aspects of the functional cycle, design characteristics and aesthetic solutions.

Four main directions were defined for the imitation of the biological prototypes in the shopping malls design process: constructive, artistic compositional, organizational and ecological. They provide optimization of the design planning based on direct and indirect reflection of living organisms.

Motives of local flora and fauna, water, sun and landscapes are actively used in the interior design of Thai shopping malls. That’s a result of the socio-cultural and geographical features of the country.

5. Further direction for the study
The study of the special aspects for forming the interiors of Thai shopping malls through the use of the biological approach is a promising field of research, which has the potential for implementation in the construction and reconstruction projects of trade establishments.

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