

UDC 339.138; 658

RATIONAL USE OF THE «GOLDEN SECTION OF PYTHAGORAS», «GOLDEN SECTIONS OF ARCHIMEDES» AND FIBONACCI NUMBERS IN THE DEVELOPMENT OF TM AND BRAND IN MARKETING

Vladyslav Vasylyshyn

Western Ukrainian National University, Ternopil, Ukraine

Summary. The article investigates the use of Fibonacci numbers and «golden sections» of Archimedes and Pythagoras in their use in architecture, art, painting, engineering, medicine, chemistry, physics, mathematics and other spheres of human life. It is also known that in the world around us all nature is built and develops on the principles of the golden ratio of Fibonacci numbers and the golden ratio of Archimedes and Pythagoras in their increasing and decreasing series. It is also known that the whole and its parts in the living world are also built on the principle of the golden ratio. Scientists have also provem that our eye and its structure are also «designed» by nature on the basis of the golden ratio. Data transmission, which perceives the human eye is transmitted to the human brain waves also on the principles of the golden ratio. That is, what surrounds us and how we built in nature is built on the principles of the golden ratio. That is, our life is based on the principles of the golden ratio. Everything that man creates to make it rational, natural, beautiful and we like should also be built on the principles of the golden ratio and Fibonacci numbers. Since the information that we perceive by 90% passes through the eyes, and what we perceive most (about 70%) is the form, and the other 20% are colours, signs, drawings, inscriptions, in order to properly influence a person naturally and especially for «green» brands and TMs, which can be transmitted through packaging, the product or service itself, or communication, or presentation or in any other way, we must use Fibonacci numbers and golden sections. It is proposed to use the golden ratio in marketing when planning and managing an enterprise, in particular for calculating and forecasting prices, the appearance and size of packaging, as well as developing color schemes for packaging, trademarks, brands, placing goods on shelves, the shape and placement of labels on packaging and everything else related to the shape, size, color schemes, signs and symbols; calculating and looking at shelving inside and outside points of sale; developing a communications plan and implementing it, developing and managing musical accompaniment, smells and other means, which improves perception and communication, ranging from individual brands to product brands, companies, distributors, customer brands and «green brands».

Key words: Fibonacci numbers, golden sections of Archimedes and Pythagoras, Trademark (TM), brand.

https://doi.org/10.33108/galicianvisnyk_tntu2024.06.163

Received 15.11.2024

УДК 339.138; 658

РАЦІОНАЛЬНЕ ВИКОРИСТАННЯ «ЗОЛОТОГО ПЕРЕТИНУ ПІФАГОРА», «ЗОЛОТОГО ПЕРЕРІЗУ АРХІМЕДА» ТА ЧИСЕЛ ФІБОНАЧЧІ ПРИ РОЗРОБЦІ ТМ І БРЕНДУ В МАРКЕТИНГУ

Владислав Василишин

Західноукраїнський національний університет, Тернопіль, Україна

Резюме. Досліджено застосування чисел Фібоначчі та «золотих перетинів» Архімеда і Піфагора в архітектурі, мистецтві, живописі, техніці, медицині, хімії, фізиці, математиці та інших сферах людського життя. Відомо також, що в навколишньому світі вся природа побудована і розвивається за принципами золотого перетину чисел Фібоначчі і золотого перетину Архімеда і Піфагора в їх зростаючих і спадаючих рядах. Відомо також, що ціле і його частини в живому світі також побудовані за принципом золотого перетину. Вчені також довели, що наше око і його будова також

«сконструйовані» природою на основі золотого перетину. Передавання даних, які сприймає людське око, передаються до мозку людини хвилями також за принципом золотого перетину. Те, що нас оточує і те, як ми побудовані в природі, побудовано на принципах золотого перетину. Тобто, наше життя побудоване на принципах золотого перетину. Все, що людина створює, щоб воно було раціональним, природним, красивим і подобалося нам, також має бути побудоване на принципах золотого перетину і чисел Фібоначчі. Оскільки інформація, яку ми сприймаємо, на 90% проходить через очі, і те, що ми сприймаємо найбільше (близько 70%) – це форма, а інші 20% – кольори, знаки, малюнки, написи. То для того, щоб правильно впливати на людину природним шляхом і особливо для «зелених» брендів і ТМ, що може передаватися через упаковку, сам продукт або послугу, або комунікацію, або презентацію, або будь-яким іншим чином, ми повинні використовувати числа Фібоначчі і золоті перетини. Запропоновано використовувати золоті січення в маркетингу при його плануванні й управлінні підприємством, зокрема для розрахунку й прогнозування цін, вигляду та розміру тари, а також розроблення кольорових гам упаковки, торгових знаків, брендів, розміщення товарів на полицях, форма й розміщення наклейок на тарі й усе інше повязане з формою, розміром, кольоровими гамами, знаками і символами; розрахунок і вигляд стелажів у середині та зовні місиь продажу; розроблення плану комунікацій і їх проведення, розроблення та управління музичним супроводом, запахи й інші засоби, що покращують сприйняття та комунікацію, починаючи від індивідуальних брендів до брендів товару, фірми, дистрибютерів, брендів покупиів та «зелених брендів».

Ключові слова: числа Фібоначчі, золоті перетини Архімеда та Піфагора, товарна марка (ТМ), бренд.

https://doi.org/10.33108/galicianvisnyk_tntu2024.06.163

Отримано 15.11.2024

Introduction. When developing a TK, TM, brand, we must correctly position them and develop and individualise them. Due to the fact that the world around us is a system of the golden ratio and Fibonacci numbers in which the entire energy structure and transmission of information and our eyes and brain are also built and perceive information on this principle, we must develop the TK, TM, brand, product, and all operations related to it according to the rule (from resources to sales) of the golden ratio.

Review of the latest research and literature. In which the solution of the problem was initiated. The analysis of the main publications on Fibonacci numbers and golden sections by Soviet and domestic authors, including those in art, construction, mathematics, physics, chemistry, information transmission and processing, was carried out. It is clear that all these materials are of an applied nature in various fields. However, we have not found a direct application of them in the system of marketing and advertising, including in the construction and development of TK, TM, brand and other possible uses, such as layout, posters, communications, stained glass, etc.

Main purpose of the article. The main goal is the possibility of using Fibonacci and golden ratio numbers in the development of linear, planar and stereoscopic capabilities of these numbers in advertising, TM, brand and in general in marketing.

The following methods were used to solve the tasks: analysis, synthesis, generalisation, induction, analogy, systematic approach, historical approach.

Task setting. Formulation of the objectives of the article. The goal is determined by the following tasks: To carry out an in-depth analysis of existing approaches and practical use of Fibonacci and golden mean numbers in the development and management of TM, brand and their strategies and in general in the marketing of Fibonacci and golden mean numbers. Presentation of the main research material with full justification of the scientific results obtained.

Statements of main issues of the study. Fibonacci numbers (Leonardo of Pisa -1202), which grew out of the famous «rabbit problem», which is already 750 years old and is a problem in elementary mathematics, and to binomial coefficients. The famous problem of rabbits set in ancient times shows the following: in a year one pair will increase to 377 pairs) 1 pair -2-3-5-8-13-21-34-55-89-144-233-377 -in 12 months), that is, each subsequent term is equal to the sum of the two previous terms, when n=2, that is:

$$Un=Un-1+Un-2 \tag{2}$$

(2) is a recurrent equation and in this case U1=U2=1 is called the Fibonacci series, and its terms are called Fibonacci numbers. Fibonacci numbers can be used for series of even and odd numbers, for series of sum of squares, for series by the method of complete or (mathematics) induction, when using binomial coefficients for natural numbers, which in turn are used in Pascal's triangle. They are also used in the theorems of Lemma, Binet, geometric progression, Valen, Borel, Hurwitz, Gödel, Monte Carlo method. Fibonacci numbers are also used in geometry – the so-called «golden ratio in geometry» or «Golden Ratio», which is approximately equal to the number 1.6180 (i.e. everything that is proportional to this number is harmonious and pleasant to our eyes and logically complete). (An example is a square inscribed in a circle and the points of division of segments; another example is regular figures inscribed in a circle; another example is a regular pentagon and its diagonals forming a regular starry pentagon in the middle, as well as the division of rectangles into regular rectangles of the golden ratio and its further division into rectangles of the golden ratio; by analogy with the tributary rectangles, we can also talk about triangles of the golden ratio and their further division (acute-angled with angles of 36, 72, 72 degrees and obtuse-angled with angles of 108, 36, 36 degrees).

We can see all these series and Fibonacci numbers in nature (for example, in nature there are two families of spirals – clockwise and counterclockwise and the numbers of spirals of one and the other type often turn out to be neighbours of Fibonacci numbers – for example, a pine branch where the needles have two spirals, which go from right to left upwards and they also make up three spirals that go from left to right upwards), another example is coned in which the scales are placed in three spirals, gently hanging on the cone stem. They are arranged in 5 spirals, which are steeply wound in the opposite direction. In large cones there are 5 and 8 and even 13 spirals. And for example, in different flowers (chamomile or daisy) it is quite noticeable spiral arrangement of individual flowers in the inflorescence-basket in which the spirals are 13 in one direction and 21 in the other direction, or even 21 and 34 respectively... Quite a lot of spirals we can see in the arrangement of large sunflower seeds and their number in each direction with the aspect ratio of 1, 62 look pleasant for a person, so often objects are given this form (books, boxes, suitcases, matchboxes, bottles, etc.).

Various idealistic philosophers in antiquity and the Middle Ages introduced to the external beauty of rectangles and other figures of the «golden ratio» into the concept of aesthetics and even into philosophical principles and principles of life. These principles related to fractions associated with Fibonacci numbers and various mystical operations were performed. Fibonacci numbers are also used in mathematics for process optimisation, which is called «oriented graphs», and for choosing rational transitions in these graphs, which is called «jianshiji» (and the use of the concept of external and internal stability of the system). Fibonacci numbers can be used not only for stable series or aesthetic design showcases, advertising, TM layouts, but also for optimisation (economical choice of something) when building a graph or calculating and using the search theory through the identification of the «minimum point» in the function and in colour schemes. That is, we can solve all these problems not only intuitive, but also mathematically using the «golden sections» with the help of Fibonacci numbers and other theorems where they are included. Of course, it is best to be assisted by artificial intelligence where these logical, rational data will be entered.

The whole history of the Middle Ages is a story of proportions, a story of searching for the theory of harmony and beauty. All ancient aesthetics is a search for the laws of beauty and correspondence of individual parts and these parts and the whole and the selection of colours. This

ratio in form gives us the proposals of the «golden ratio and symmetry», all this was used in the construction of the pyramids of Egypt, temples, the Parthenon, the statue of Phidias and in other highly creative creations of people of ancient times. Man is the best creation of nature in terms of the «golden ratio». In a person there is a correspondence of the golden ratio both in general and in parts (proportions of the body as a whole, arms, legs, hands, fingers, heart and brain, eye structure). All this was noticed in the works of Albrecht Dürer and Antonio Stradivarius. We see the same phenomenon around in nature – animals, trees, plants, their leaves, fruits, roots, tiering. Therefore, a person has long noticed it, studied it, understood it and began to manifest it in architecture, painting and other spheres. Since of our five senses, we receive the main information through the eyes, we will deal with them. In addition, it should be said that the shape of objects takes from 50 to 80% of the treatment and memorisation by a person from the point of view of our eyes. And the other 20% is colour schemes and patterns or objects. Therefore, the form and symbolism of a TM and brand in terms of symmetry and logic and rationality will occupy up to 70% of human senses, and the remaining 30% will be irrational and irrational. We are going more and more into the irrational, but the rational still occupies more than 70% in our understanding. The rules of the golden ratio have an impact not only in the linear plane, they have an impact and work in form in general, in colour and are used not only in architecture, but also in the design of machines (ergonomics), in mathematics (Fibonacci numbers and laws related to them), and we want to apply them in marketing from advertising and TMs and brands to shelf placement to building marketing strategies – because these are the rules for building not only a single but also a whole composition, not only in art. «A person cannot have an attitude to an object, a feeling, an emotion, until the brain has «measured» and compared this object with something similar already known in the memory» -I. Kepler. Everything in the world is geometry, and it is the geometry that is inherent in us at the genetic level. «Geometry has two diamonds: one is the Pythagorean theorem, the other is the division of a segment in the middle and extreme ratio» – I. Kepler. All this is quite clearly related and subordinated in music and in colours (wave theory), although we do not consider this in our article. E. Shpara wrote a lot about the use of the golden ratio in his book «Technical Aesthetics and Fundamentals of Artistic Design» and in the book «Principles of Proportion» by I. Sheveleva.

First of all, we need to turn to mathematics and to the definition of «proportion» – this is the equality between two ratios of four quantities that are equal. If the segment is divided in half, then these ratios will be equal. But you can also find a proportion (harmony), when there is a proportion with unequal parts. In this case, the whole segment is so related to the larger part of it, as the larger part itself is related to the smaller part. In another way, a smaller segment is so related to the larger one, as the larger one is related to the whole segment. That is why the famous astronomer Johannes Kepler called the golden ratio, the one that continues itself to infinity, because two younger terms of this ratio in the sum give the third term, and any two consecutive terms, if added together, give the next term and this proportion is preserved to infinity This is the principle of the golden ratio.

Therefore, a series of segments in the golden ratio can be built, both in the direction of increase and decrease. In the simplest version, this ratio of a straight line is 0.62 and 0.38 of the whole. (That is, if the segment is taken as 100 parts, the larger will be 62 parts, and the smaller 38 parts). The same proportion is made not only along the length but also along the width of the figure. In most cases this is done by intersecting the diagonals from the whole length to the whole in height (width) and at the intersection with segments 0.62 and 0.38 we get the points of the golden section in the middle, that is, in this way the whole corresponds to the golden section and in the middle we also have a golden section and in our case we can use it for advertising and for TM. This division is often used by landscape artists. From all this, a descending series of proportions of the golden ratio is mathematically derived: 100-62=38; 62-38=24; 38-24=14; 24-14=10. That is, 100, 62, 38, 24, 14, 10 is a series of values of the

golden ratio expressed mathematically. In practice, this simpler tool (the mathematical series of the golden ratio) is called a proportional ruler, which can help us to draw a TM advertisement. This is often used by artists and they know it well. In addition, the rhythmic alternation of equal and unequal values in the proportion of the golden ratio is defined by the «rhythmic system», which is also often used by artists. This method of using the rhythmic structure and proportional ruler is called the method of the artist V. Skubak. Such solutions when using the method of V. Skubak lead us to the construction of the «golden rectangle».

Quite often in technology and other sciences a close relationship to 62:38 60:40, which also has harmony, or the human eye and mind still perceives it as a golden ratio and harmony (academician A. M. Laptev wrote about this in his work «Some issues of composition»). It should also be said that different schools saw different proportions in paintings in their own way, so the Slavic schools in Tsarist Russia made this division from the proportion of dividing the width and height from the number 10 (that is, 6 and 4), and for example, Munich schools from the integer 5 (both the bottom and top were divided from the proportion 3 and 2). In my opinion, both of them correspond approximately to the golden ratio, but a person thinks in tens, at least this is how civilisation has taught him to think, so dividing by a whole 10 is more correct and proportional, although it is not exact in our case, for the artificial intelligence to build pictures of TM advertising, it is necessary to use more accurate values -61.803 (61.8) and 38.196 (38.2). In the practice of artists, the following descending rows of the golden ratio for 4 rows (pentagram) are visible, namely first row - 100, 60, 40, 20; second row - 100, 62.38, 24, 14, 10; for the third row - 100; 61, 8; 38.2; 23.6; 14.5; 9.0; 5.5; 3.5; 2.0; 1.5; for the fourth row – 100; 61, 803; 38, 196; 23, 606; 14, 589; 9, 017; 5.572; 3, 444; 3.128; 1, 315; 0.813; 0.502; 0.311, etc. д. [p. 17, tab. 1] These pentagrams are used to build golden figures inscribed in a circle (for example, a quadrilateral to a polygon and different figures inscribed in them; thus, different golden figures are built – triangles, stars, etc.) hat is, the golden ratio corresponds to symmetry and our understanding of the beautiful and natural.

Almost all known paintings and icons correspond to it and even ancient plates and as all said all archaeological temples and their paintings, ships, weapons, armour correspond to symmetry and the golden ratio. Historically, the beginning of the history of the golden ratio is described in the book of Euclid's «Beginnings» (1st century BC), then in the Middle Ages it is the monk Leonardo of Pisa (Fibonacci), then the artist Piero della Francesca, then the books of Leonardo da Vinci («God's Proportion») and the books of the monk Luca Pacioli, then Albrecht Dürer (with his proportional circular), then the astronomer I. Kepler (not only the universe and stars, geometry, but even the growth of plants and trees in biology)The golden ratio was rediscovered in 1855 by the German professor S. Zeising in his work «Natural Research». He conducted statistics on the measurements of about three thousand people and about two thousand Greek statues and discovered the golden ratio -13:8= 1, 626. He also confirmed the Fibonacci series, which was forgotten at the time.

This design later spread to furniture, cars, weapons and everything else. In 1954, at the ninth exhibition of the «Triennale» in Milan was completely devoted to «God's proportion» and is a tribute to the golden ratio «the ancient road of mankind, indicated by Pythagoras» (Le Corbusier)The second golden ratio (often called the golden ratio of Archimedes) is the ratio 44: 56, which is derived from the main section. By studying the golden ratio, Archimedes deduced a form and formula of nature called the «Archimedes spiral» or «logarithmic spiral». Goethe called the spiral the «curve of life». This phenomenon was scrupulously studied by S.M. Einstein and showed its direct connection with the world, nature (example of human DNA, hurricanes, animals running away in a spiral, many amphibians and their form of conservation, plans of ancient cities, especially in India, sleep and wakefulness of a person,

plant growth (chicory), heartbeats and its rest, blood pressure) all this is a manifestation of the golden ratio with a step of 10, 14, 24, 38, 62 (and here we basically have a proportion of 62 to 38). Pierre Curie in his research proved that the symmetry of any body in nature corresponds to the symmetry of the environment. The academician I. I. Shifransky proved that everything in nature has symmetry around us. This permeates the Earth and the Universe.

These patterns are not only in mathematics or physics or chemistry or biology, they are also in the energy transitions of elementary particles (i.e. in waves), they are in biorhythms and the functioning of the human and animal brain and in our case marketing and branding and in human perception of shape and light and colours and in stereometry, and psychoanalysis and neuromarketing. That is, all this takes place both at the organic and inorganic levels, and at the molecular and wave levels. That is, it is a proportion of life, its optimum and effective functioning, and it applies to the whole and its parts. For a correct understanding of the processes of receiving and processing information, we must talk about our eyes, through which we perceive more than 90% of information.

We should probably mention what our famous scientists and important people in history have said about this. Leonardo da Vinci said that the human eye can see all the beauty of the world. The Italian painter Giorgiano Vasari said that the eye is the best user and evaluator and measure of beauty. Other artists of the Renaissance also understood that all art is based on the law of colour sensation. The whole and its middle are also built according to the laws and proportions of the golden ratio. This was first proved by the French physicist Edmund Mariot in 1668, and the blind spot of each eye and the «central fossa» with the centre of the lens and the yellow spot with a large number of cones and the size of the proportions of the golden ratio. All the proportions of the field of view between the fundus elements are also the golden ratio. The blind spots of both eyes are mirrored relative to each other and also in the structure of the eye are in the golden ratio in relation to the whole. Therefore, the eye prepares information for the brain not only in a sequence corresponding to the clarity and clarity of perception, but also in the proportions and rhythms of the golden ratio (in which the brain itself works) [2, pp. 35–36]. That is, we have an automated biological process of perception and transmission of information to a person from nature - eyebrain-action and all this in the pulses of the golden ratio. That is, the basic system (the nature in which we live) is created in the system of the golden ratio, the human being as a whole, who is in this system as a whole, is also created according to the principles of the golden ratio, the human eye as a whole is created according to the principles of the golden ratio and all perception and transmission of information and actions go from the eye to the brain according to the principles of the golden ratio.

All this was investigated in the laboratory of bionics of the Institute of Physics and Technology by Professor A. Sokolov. In this case, the beta wave dominates in the brain and it is the main wave in the brain with an average geometric frequency of -22.13 Hz, and the other bands are equal to 8.13 and 12.87 Hz. and again we have the familiar Fibonacci numbers -8, 13, 21. And this beta wave can probably be called a Fibonacci wave both from the eye to the brain and in the brain itself in the middle. Therefore, we can see very clearly that not only the whole nature is a golden ratio, the human body is a golden ratio, but also the brain, the eye, the heart are also a golden ratio. Therefore, what we create and communicate should be a golden section. And since we are talking about a brand and understand it as both material through TM and goods and image and emotions on the other hand (i.e. from the point of view of physics and chemistry these are waves), both the first and the second should be at least close to the golden section. If the first (material) can be projected by artificial intelligence and intuition according to the golden ratio, then the second (moral, ethical and psychological qualities), in my opinion, should be assessed with the help of neuromarketing and other social sciences, and their education and inculcation in society (which is what the UN programmes until 2030 are aimed at).

The research and opinion of I. M. Sechenov on the concept and nature of «efective world impressions» are interesting. The scientist proved that «the sensations of pain, hunger, thirst, fatigue, taste, smell, hearing, we feel an external cause that causes our sensation. It is felt by us as our change in the body However, we do not see an external object, but its image, drawn on the retina, brought out to the outside. In the case of clear vision, we see our image of them on the retina and bring it out to the place where the external object is». That is, in other words, I can translate it in such a way that the golden ratio in a person works in the opposite direction, from a person to an object, but this object is our desires and feelings, which we ourselves have created. Ears work in the same way. Therefore, to improve the effect of vision and hearing, artists often bring the object to the line of the golden ratio. Therefore, quite often a sketch is made in the golden section, and then a composition is quickly sketched, which is also built according to the laws of the golden section, quite interestingly described in the book by E. V. Shorokhov «Composition», which is based on the laws of form preservation in nature and art (in our case it is packaging and advertising, various tools, the product itself – all this must comply with the golden symmetry). E. I. Kirichenko was also deeply involved in these issues. And before the First World War, the German biologist Ernst Haeckel (1834–1919) and the French painter and graphic artist Eugène Delacroix (1798-1863).

In our science, there are five laws of composition: the law of the whole; the law of proportions; the law of symmetry; the law of rhythm; the law of the main thing as a whole. Artists consider 28-37 degrees to be the optimal viewing angle for any painting or drawingBut the designers also know about the use of the golden ratio in the composition of light tones, especially in holography, that is, practically to see and convey the colour of nature. Holography allows us to understand that every object has colour, and nature has colour. it makes it clear that the colour seems to lie on the object and changes with the angle of view or shading. we see only light in the range from 380 to 760 nm. Light waves are not homogeneous. An object that reflects all waves is white to us. Our eye is a light analyser. At a reflected wavelength of 730 nm we see it as red, 520 nm as green, and 400 nm as purple. The human retina can clearly distinguish seven colours: red, orange, yellow, green, blue, blue and violet.But it also sees up to 130 intermediate sensations, the names of which we do not know, so we must use double names: red-orange, yellow-green, blueviolet, etc. The scale of light tones is divided into three groups: light, medium, dark. With a scale of 12 tones, each group includes 4 tones. In addition, there is light, penumbra and shadow according to the law of three-component. V. M. Shugaev. It is believed that the three-component colour gives a good effect of perception, but it is not always and not for all forms. But the twocomponent tones quite strongly reduces the perception and this principle is called the convergence of relations. Quite often, when designing stained-glass windows for advertising or other purposes, the triple golden ratio is used. This is the connection of the external with the internal. Also, the colour circle of V. M. Shugaev is used, which consists of 16 colours and is aimed at the correct use of colour and general colour background. At the same time Shugaev proceeded from 4 main colours: yellow, red, blue, green. Each of these colours is self-sufficient and independent. Each next colour was obtained by adding 1/4 of the next colour. Although Shuga's method was developed for fabrics, further practice has shown that it is applicable in other industries. In addition, Shuga introduces the concept of native and contrasting and native-contrasting colours and their possible application. Therefore, the pairs of native and contrasting colours are the most harmonious and these are pairs: 2-8, 3-7, 4-6, 16-10, 15-11, 14-12, 16-2, 15-3, 14-4, 12-6, 11-7, 10-8. Just as a musician knows what sounds are produced by a major and minor scale, so an artist knows what colours will create a «positive» moodIn Shugayev's circle the symmetry of colour is clearly expressed In addition to colour, symmetry and asymmetry play a great role, according to what we want to convey.

So Delacroix discovered the law of colour contrast, and he said that everything in nature is contrasting. Therefore, when building a colour scheme can be used: one paint of one colour (monochrome); made on the basis of «family or native colours»; on the basis of nativecontrasting colours; or on contrasting colours. Of course, in our case, to build everything from business cards or a website to the development of advertising, including TMs or brands, you need to use the knowledge and tastes of professionals or try to experiment with artificial intelligence and test it all with neuromarketing methods. In this case, we can use a single, double or triple golden ratio. Here we understand that the golden sections of form and colour have to be translated into a mathematical basis and tested in practice psychologically, in Figure 89 [7, p. 116] we have a diagram of the theory of art, where nature, the human mind, its eye and colour are combined with each other and through the Fibonacci series go to the composition through the first and second golden sections and the Zholtovsky function. In reality, these tasks should now be solved by artificial intelligence. It should also be noted that when developing a brand or TM or TK, especially for «green» brands, you can use symphonies and signs of Ukraine in the food and processing industry of Ukraine, which are also built on golden sections in both shape and colour.

Conclusions. A literature search of theoretical foundations and practical use of Fibonacci numbers and golden seasons of Archimedes and Pythagoras for various sectors of the national economy and applied sciences was carried out. It is revealed and recommended that this knowledge be used in marketing and the construction and management of TK, TM, brand, advertising, layouts, communications in linear, planar and sereoscopic developments.

Thus, it is advisable to use the golden ratio in the marketing system when planning and managing an enterprise, in particular for calculating and forecasting prices, appearance and size of packaging, as well as developing color schemes for packaging, trademarks, brands, placing goods on shelves, the shape and placement of labels on packaging and everything else related to the shape, size, color schemes, signs and symbols; calculating and looking at shelving inside and outside points of sale; developing a communications plan and implementing it, developing and managing musical accompaniment, smells and other means, which improves perception and communication, ranging from individual brands to product brands, companies, distributors, customer brands and «green brands».

References

- 1. Kornienko V. S. (1991). Pro zakony krasy [On the laws of beauty]. Kharkiv, 1991. 320 p.
- 2. Gavrilyuk P. I. (1991). Problema estetyky i teorija upravlinnja [Problem of aesthetic and theory of management]. Kyiv, 1991, 350 p.
- 3. Volkotrub I. T. (1991). Osnovy khudozhnjogho konstrujuvannja [Fundamentals of artistic design]. Kyiv: Higher School, 1991. 420 p.
- 4. Sheveleva I. (1928). Pryncypy proporcij [Principles of proportion]. Kyiv, 1982, 356 p.
- 5. Sokolov A. (1978) Tajemnyci zolotogho peretynu [Secrets of the Golden Section], no. 5, pp. 41–44.
- Shubnikova A. V., Kotsyk V. A. (1972). Symetrija v nauci ta mystectvi [Symmetry in science and art]. Kyiv, 450 p.
- 7. Dmytrenko M. (1994). Ukrajinsjka symvolika [Ukrainian symbols] Kyiv: Editorial office of the journal "Narodoznannya", 125 p.
- 8. Kovalev F. V. (1989). Zolotyj peretyn u zhyvopysi [The Golden Section in Painting] Kyiv: Prosvita, 87 p.
- 9. Kozlov V. N. (1976). Osnovy ornamentaljnoji kompozyciji [Fundamentals of ornamental composition]. Kyiv, part 1, 234 p.
- 10. Gurska A. (2003). Mova i ghramatyka ornamentyky. Navchaljno-metodychnyj posibnyk [Language and grammar of ornamentation. Educational and methodological manual]. Kyiv: Alternative, 114 p.
- 11. Lazareva M. (2019) Positioning Matrix as an Assessment Tool for Security Level of a Product Portfolio Competitive Position. Marketing and Management of Innovations, 4, 82–97. DOI: https://doi.org/10.21272/mmi.2019.4-07
- 12. Dooly R. Art, the Golden Mean, and the Brain. Available at: https://www.neurosciencemarketing.com/blog/ articles/ goldenmean-brain.htm. (accessed: 03 September 2024).

 Tabatabaei, M. (2016) The use of the Golden Ratio in the management for increased efficiency of resources. Available at: https://www.researchgate.net/project/The-use-of-the-Golden-Ratio-in-the-management-forincreased-efficiency-of-resources (accessed: 03 September 2024).

Список використаних джерел

- 1. Корнієнко В. С. Про закони краси. Харків, 1991. 320 с.
- 2. Гаврилюк П. І. Проблема естетики і теорія управління. Київ, 1991. 350 с.
- 3. Волкотруб І. Т. Основи художнього конструювання. Київ: Вища школа, 1991. 420 с.
- 4. Шевельова І. Принципи пропорцій. Київ, 1982. 356 с.
- 5. Соколов А. Таємниці золотого перетину. 1978. № 5. С. 41-44.
- 6. Шубнікова А. В., Коцик В. А. Симетрія в науці та мистецтві. Київ, 1972. 450 с.
- 7. Дмитренко М. Українська символіка Київ: Редакція журналу «Народознавство», 1994. 125 с.
- 8. Ковальов Ф. В. Золотий перетин у живописі Київ: Просвіта, 1989. 87 с.
- 9. Козлов В. Н. Основи орнаментальної композиції. Київ, 1976. Ч. 1. 234 с.
- 10. Гурська А. Мова і граматика орнаментики. Навчально-методичний посібник. Київ: Альтернатива, 2003.114 с.
- Lazareva M. (2019). Positioning Matrix as an Assessment Tool for Security Level of a Product Portfolio Competitive Position. Marketing and Management of Innovations, 4, 82–97. DOI: https://doi.org/10.21272/mmi.2019.4-07
- 12. Dooly R. Art, the Golden Mean, and the Brain. URL: https://www.neurosciencemarketing.com/blog/articles/ goldenmean-brain.htm. (accessed: 03 September 2024).
- Tabatabaei M. (2016) The use of the Golden Ratio in the management for increased efficiency of resources. URL: https://www.researchgate.net/project/The-use-of-the-Golden-Ratio-in-the-management-for-increasedefficiency-of-resources. (accessed: 03 September 2024).