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science@uard.bg www.uard.bg www.science.uard.bg

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PERIEGETISM, TOURISM AND TRAVEL MOTIVATION THROUGHOUT THE CENTURIES

Maria Manola[a], Stylianos X. Koufadakis[b], Maria Sapountzaki[c]

[a] University of West Attica, Department of Tourism Management, Athens, Greece
Email: marmanola60@gmail.com
[b] University of West Attica, Department of Tourism Management, Athens, Greece
Email: stelios@ecom.gr
[c] Hellenic Open University, School of Social Sciences, Patras, Greece
Email: msapountzaki@yahoo.gr

Abstract: This study aims to capture the main definitions found in academic studies of tourism, and mainly to attempt a historical review of the concept of travel and tourism as forms of human mobility, from a time when transport systems were limited, to modern times. The travel motives of people since ancient times, the reasons-causes of human mobility during the history of the civilizations of the Mediterranean, Asia, Egypt, Rome and Greece, as well as accessibility, as a factor in the choice of a destination, are topics that are analyzed in the context of the interaction between the aforementioned concepts.

Keywords: periegetism; tourism; travel; history of human mobility; travel motivations; tourism and development.

JEL Classification: L83, J60, Z32

1. Introduction

Tourism is a social, cultural and economic phenomenon, involving the moving of people to countries or places outside their usual environment for personal or business/professional purposes. The people who move are called 'visitors' (who may be either tourists or excursionists, residents or non-residents) and tourism is related to their activities, some of which involve tourism expenditure.

The definition above comes from the World Tourism Organization (UNWTO)[1], the main international institution of the United Nations system that aims to disseminate sustainable tourism development, particularly in developing countries.

On the other hand, a 'tourist' can be defined as a person who spends at least one overnight stay in a place far from their actual place of residence (Leipe, 1979).

With the aim of capturing the basic definitions found in academic studies of tourism, it is considered necessary for the concepts of "tourist" and "traveller" to be distinguished According to Mehmetoglu (2004), the etymology of the word "travel" is rooted in the French noun "travail" meaning "suffering" (or torment).

Consequently, according to Buzard (1993), travel had the character of a test that implied endurance skills. According to the author, the word 'tourist' became synonymous with the word 'traveller' at the end of the eighth century AD.

Cohen (1974) states that the Oxford Dictionary describes a tourist as 'a person who tours'. The motives for touring could be recreational, cultural, or out of interest in the place of visit itself.

Boorstin (1964) explains that in the beginning the term 'tourist' had an undefined (neutral) meaning, but was subsequently used to reflect more of a tourist behaviour, which was distinct from the character of the traveller. Expanding on the differences, the author describes the tourist as the person who is motivated by the acquisition of pleasure from the activity of travel. On the other hand, the traveler has the goal of seeking experiences and adventure through travel.

Within the academic bibliography, tourism represents the set of movements generated by the search for places and activities that are different from the usual (business) and not economically motivated (Miossec, 1976; Cohen, 2004). According to the definition above, tourism depends on the coexistence of at least three conditions: a) a displacement from the place of residence to a different place, b) an overnight stay (at least twenty-four hours to be considered a tourist), and c) an incentive other than work that triggers the movement.

Thus, the origin, duration and motivation of the move are the three main variables by which tourism is defined and classified.

Such a definition underlines that 'mobility' is essential for tourism.

2. Interaction Between Tourism and Mobility

Whatever the definition or distinction between the typologies of tourism, it is undeniable that there is a close relationship between tourism and mobility. The development and evolution of tourism has been intrinsically linked to the development of the transport system: it is well known that the railways and then the aviation system contributed decisively to the development and spread of tourism as a 'mass' phenomenon in a relatively short period of time. The importance of transport appeared to be decisive in the planning phase of tourist activities, while accessibility to a place has a strong influence on the choice of a destination and, under the commercial conditions of tourist competitiveness, can be an important differentiating factor.

In the current era of mobility (Urry, 2007), characterized by global access to information (Bock 2015; Rifkin, 2000), the global dynamics of tourism are constantly changing, while at the same time tending to continuously shape the structural changes of cities (Clavé, 2019).

The interaction between mobility and tourism is becoming increasingly complex, while both transport systems and the infrastructure of tourist areas tend to change around the world. People are travelling more and faster than ever before between cities.

As a result, mobility analysis has emerged as an elementary analytical dimension of today's society that is constantly in a state of constant change and movement (Cresswell, 2006).

In fact, under the conceptualization of 'mobility' (Sheller and Urry, 2006), it is argued that social, economic and cultural systems cannot be analyzed without paying particular attention to

[1] UNWTO: Understanding tourism, basic glossary (http://media.unwto.org).

the mobility flows that take place around fixed elements of a region (e.g. construction, buildings, roads, infrastructure, etc.) (Cresswell, 2012; Smith and Hetherington, 2013).

In this context, the development of cities as tourist destinations is combined with globalization and transformation processes which turn cities into global players competing with each other, in order to attract investment and more tourists (Colomb and Novy, 2017).

The arrival of tourists and their behavior in the tourist destination is therefore embedded in the functional dynamics of cities, which are variable both in time and space. However, tourist mobility is not only limited to that of tourists alone, but also includes the mobilizations carried out by all actions directly or indirectly related to tourist activity, such as the labour market, the housing market or the supply of leisure services.

Consequently, the existence of (seasonal and concentrated) touristic activity reshapes the urban system's hierarchies and patterns (Miravet et al. 2021). As a result, a set of challenges for sustainable mobility management within destination cities arises, which need to be addressed in a rational way.

The importance of tourism mobility has not been diminished in tourism circles. On the contrary, we are witnessing the transformation that has taken place regarding the understanding of tourism dynamics, with "tourism as a social dynamic" (Higgins - Desbiolles, 2006) at one end and tourism as an industrial product at the other. In fact, Ayikoru et al. (2009) point out the fact that the dominance of neoliberalism to such an extent that the understanding of the tourism need as a moral right has been limited.

It would be more likely to understand the opposite reality, whereby the tourism phenomenon has adopted the philosophy of being a powerful profit accumulation engine, without foreseeing the serious consequences created by the overexploitation of touristic areas.

Nevertheless, in contemporary approaches, understanding the tourism industry is achieved through the social approach to mobility. Under this conceptual framework, Hall (2008b) notes that tourism can be seen as a lifestyle component, which is reflected, either through voluntary travel, or a short-term and willing change of residence, on a temporary basis. As the author explains, the above dimension of tourism helps us to understand its dynamics in relation to time and space, as well as in relation to the number of travel destinations visited by a traveller.

Adopting Hall's (2008b) approach, we can see the complexity of the tourism sector in the modern era, which extends - without being limited - by short-term leisure, business travel, medical travel, travel to dangerous areas, cultural travel, etc.

Hall (2008b) has at the same time tried to reposition the conceptual constitution of tourism by theoretically approximating tourism mobility with mobility of other forms (e.g., commercial activities, etc.). Hall (2005a) tells us that he considers tourism as one of the key components of mobility over a temporary time horizon.

Furthermore, he stressed that apart from the most common tourism activities (for example, leisure trips, business trips or visits to people in the friendly environment), the following forms of tourism can be added to the environment of the modern tourism product:

- Travel supporting personal career goals.
- Tourism for educational purposes.
- Medical Tourism.
- Trips to visit a second residence.
- Migratory journeys with the characteristic of repatriation.

3. Migration Mobility

Another dimension of voluntary mobility is the "forced" movement of people, which is - for example - motivated by despair. As a result of widening socio-economic inequalities in various regions of the world, demographic tensions find an opportunity to be defused by wars or local conflicts. This as a result creates migratory or refugee flows from minorities in the new place, who seek different opportunities in areas far from their homelands.

Governments have already begun to address the problems arising from refugee flows, while also studying the mobility of populations driven by environmental climate change (White, 2011). Relevant reports of population movements have already been noted, such as the residents of the Yup'ik village of Newtok, Alaska[2]. Specifically, the 380 residents of the village located on the Bering Strait were forced to relocate to another area, having to deal with melting ice due to climate change.

Cases of entire communities in the Arctic (e.g. Tuvalu and Kiribati) being displaced from their homes have already been made public, thus swelling the ranks of environmental refugees.

Although the cases above are not sufficient to capture the overall picture of mobility cases, they allow us to reflect on the differences between tourism mobility and the mobility of other vulnerable population groups, when considering the solutions to degrowth in different areas.

It is worth noting that the right to take tourist trips dates back to the twentieth century, when in developed countries there were struggles to institutionalize workers' holidays. In the 1930s in Europe and in the wave of political institutions that had begun their democratic renaissance, holidays with compensation from the employer were first institutionalized and became a universal right for workers from then on.

Such established forms of travel rights were subsequently the "Universal Declaration of Human Rights" in 1948, the "International Covenant on Economic, Social and Cultural Rights" in 1966, the "Declaration of the Rights of World Tourism" and the "Tourism Code" in 1985, and finally the "Global Code of Conduct for Tourism" in 1999.

But it should be mentioned that before the universal global recognition of the rights to tourist travel existed, there was a clear division between the developing and developed worlds on this possibility, which has over the years stimulated debates on more equality. As an example, we can cite a passage from the "Manila Declaration" (UNWTO, 1980) which emphasizes "world tourism has the potential to contribute to the establishment of a new international economic order aimed at eliminating the widening economic disparities between developed and developing countries...".

In 1999, with the prevalence of neoliberalism, the World Tourism Organization (UNWTO) formulated the "Global Code of Conduct for Tourism", through which the responsibilities and roles of those involved in tourism (e.g. governments, operators, tourists, etc.) were distinguished.

The liberal rhetoric of the World Tourism Organization (1999) emphasized the unlimited potential for profit from the tourism industry, which had to operate in a favorable environment under free market conditions, creating wealth and employment.

At an academic level, Bianchi and Stephenson (2014) exploring human mobility and travel rights concluded that liberal rhetoric on tourism seems to further diminish tourism as a product of freedom. At the same time, the extreme liberal consumerist philosophy (in every sector of activity) according to Bianchi and Stephenson (2014) leads to undermining efforts to normalize inequalities in relation to people's right to travel freely.

More critically, Higgins-Desbiolles (2018c) points out that the institutionalization of conditions for free mobility in the field of human travel does not seem to be able to smooth out social differences, rather than making it even easier for privileged travellers. At the same time, she does not hide her concern about the changes in the environmental map or the insecurities faced by those living in areas of conflict, anticipating greater activity in human mobility.

[2] Welch, C. (2019). Climate change has finally caught up to this Alaska village (https://on.natgeo.com/3KcQftP)

4. Mobility and Tourism

Throughout the history of civilizations, there are constant references to human mobility for different reasons each time. For example, it was common for ancient people to exchange goods, which implies the necessity of moving from one place to another in order to carry out this commerce transaction (Thompson, 2006).

During the third and fourth centuries BC in Central and Eastern Asia, as well as in the wider Mediterranean region, long-distance commerce was already an important motive for human mobility, while the Mediterranean empires (such as the Greek, Egyptian, etc.), under the cloak of their expansionist or defensive military conflicts in which they were involved, forced a large part of the populations to a necessary movement (Bielenstein, 2005).

With reference to the commerce movements of ancient people, we can point to the Silk Road (between 120 BC and 1500 AD) as an example, which covered a vast commerce network that extended to Europe, East Africa and all the regions west and south of China (i.e. to states that included the entire known Asian continent, reaching as far as the Mediterranean countries) (Timothy and Boyd, 2015). As the authors note, the Silk Road played a catalytic role in the transfer and exchange of culture, knowledge and technology among the connected peoples around it.

In a later period, the movement and admixture of cultures due to the first Arab conquests between 622 and 750 AD, provided the opportunity to spread cultural and religious elements to a wider geographical environment stretching from the Iberian Peninsula to the Middle East (Agoston, 2005).

At the same time, the colonialism of some European states (e.g. Spain, the Netherlands, Great Britain, etc.) triggered a series of interactions at all levels between the main countries and their remote colonies, not forgetting the huge -forced- mobility through the transatlantic slave commerce of human beings between Africa, Europe and America (Coles and Timothy, 2004). This two-way mobility of populations between colonial countries and their colonies, which fostered the exchange of products, language, culture, ideas, etc., is considered to be a relevant exemplar of modern mobility. For example, the economic crisis of the last fifteen years or so has - among other things - led to high levels of unemployment on a global scale, thus generating continuous migratory flows between countries. Such a phenomenon is discernible in Europe, which, having a corresponding need to fill various job vacancies (e.g. in the health or technological sectors), has put together a package of proposals to attract populations of workers from third countries[3].

In the nineteenth century, the Industrial Revolution proved to be a major influential turn of events, which gave a new boost to human mobility (Stearns, 2013). Technological innovations in manufacturing and transportation reduced both time and cost in the process of producing goods and in travel time in general. In particular, however, these technological advances have been enough to reignite global commerce on a different basis, as well as provide new momentum to human mobility. The subsequent advances in the transport sector, which emerged with the use of steam on railways, significantly reduced both costs and travel time. This development enabled travel over longer distances, making it more accessible to more sections of society[4]. Azarya (2004) even mentions that the impact of industrial development on the tourism industry was also shown by the creation of new tourist destinations in areas that previously had few visitors (e.g. arctic regions, or deserts).

Studying the tourism phenomenon from a historical perspective, there seems to be a relative disagreement among researchers regarding its historical roots.

For example, Casson (1974) argues that the origins of tourism go back to the mid-nineteenth century AD because of the progress made by the transport industry, taking also into

[3] European Commission (2022). Attracting skills and talent to the EU. (https://ec.europa.eu/commission/presscorner/detail/en/QANDA_22_2655)
[4] Kaelble, H. (Humboldt University). Industrial Revolution in Europe. (https://bit.ly/4123KVF)

account the leisure factor that was gradually recovered by that generation of people. According to anthropologists (Turner, 1982) in the earlier archaic societies there was no distinction between leisure and working time and everything was intertwined in a continuum. Leisure time appears in the (post) industrial period and is therefore consistent with the emergence of tourism.

Cunningham (1980), more specifically, states that during the nineteenth century, on the one hand, the end of the Industrial Revolution gave the opportunity for a large category of cultural, socio-economic and technological developments to emerge with rapid intensity, and on the other hand, the 'Leisure Revolution' made its appearance.

Thus, Cunningham's (1980) conclusion that "there is nothing in leisure today that was not visible in 1880" seems to reflect the homogeneity perhaps of the active use of leisure time both at that time and in modern lifestyles.

The changes in the availability of workers' leisure time seem to have been the result of the new processes that began to be introduced in industrial production in the nineteenth century.

New opportunities for an improved management of the leisure time that industrial workers now had in excess came to the surface, as a result of the new structures of production that improved employment patterns in the factories of the time. One could also comment that much more than the 'liberation' of leisure time through the efficiency of work, a decisive role was contributed by the cultural shift in society on the one hand and the implementation of capitalism on the other, which wanted to distinguish leisure time from working time in order to commercialize the individual activities that were beginning to develop.

Another widespread view that could underpin the development of tourism activity is based on the "Grand Tour". According to this view, European aristocrats or wealthy young people travelled in search of cultural pilgrimages or insights into the customs, traditions and ways of life of other countries during the 17th and 18th centuries. This tour therefore had the character of cultural edification for the nobles and wealthy of the time, who, with their visits mainly to Italy and Greece, enriched their knowledge and experience of the most important cultural history of Europe.

It is also useful to note that -travel- tours, which we could compare with the modern tourism, seem to have been practiced in the ancient historical periods as well. According to the Hellenic Literary and Historical Archive[5], the impulse of people to travel as a need to search for new places seems to have had its roots thousands of years ago, reaching back to the Paleolithic and Neolithic periods. The mobility of that era was the result of meeting basic living needs, such as finding food, protection from climatic conditions, or discovering new protected areas to build their habitats.

Later, visits to religious sites, travel to participate in sport activities, visits at distant tourist attractions, or simply as an experiential adventure to discover new -unknown- geographical areas, far from their places of residence, became a common choice in Hellenistic or Roman times. Gyr (2012) even confirms that travel for the purpose of entertainment and education was already familiar in the Greek classical period (480 BC - 323 BC), citing evidence that the "search for experience, relaxation and entertainment" are described among the travel motivations of the period. In the same vein, Casson (1974), argues that decisions to travel for leisure, or motivated by curiosity, are mentioned as late as 1,500 BC.

5. Mobility and Tourism Over the Centuries

According to Vukonić's (2012) conclusions, it is not easy to dispute the existence of tourism in earlier historical periods. He supports his view with the concept of leisure time as one of the basic conditions for the development of tourism and points out that the mid-nineteenth

[5] Hellenic Literary and Historical Archive: From Antiquity to the Modern World (http://www.elia.org.gr/research-tools/hotels/introduction/ancient/)

century is the most appropriate time to consider the emergence of tourism as a modern phenomenon.

Chambers (2010) on the other hand points out that tourism in its modern form is a consequence of the opportunities for leisure that began to emerge in Western states, building on the conclusions of earlier academic research regarding the historical dimension of tourism. The same scholar considers that there is little evidence to support the view that leisure opportunities have increased continuously with changes in social organization and economic development. Instead, he argues that many pre-industrial peoples may in fact have had more leisure time.

However, Andriotis (2009) notes that there is a category of scholars who consider the tourism phenomenon to be relatively recent, basing his view on the fact that the links between tourism research and the study of history are not yet strong.

On the other hand, Walton (2009a) believes that searching for traces of tourism history will take us deep into the past, because tourism phenomena that in modern times may be considered recent, actually stem from much older times.

Studying the historiography of tourism, Page and Connell (2009) take us back to the time of the ancient Greeks and Romans, during which they note the movement of the elite of the time to locations far from their homes, seeking pleasure and relaxation, without professional obligations. In line with these accounts of the leisure management of the ancient Greeks and Romans, Korstanje and Busby (2010) link the search for pleasure through travel to the concept of holidays.

From our side, we will try to capture the 'traces' of tourism and mobility in general over the centuries, from various historical sources.

5.1. Mobility in the Years 1200-300 BC (Eastern & Southern Mediterranean, Southern Asia)

In this period of time it is reported that in the wider areas of the Tigris and Euphrates rivers, people created the first city clusters, developing the first undivided nation on the banks of the Nile River in present-day Egypt. There is no doubt that the social pattern of that period gave rise to the development of new forms of movement. The occupations of individuals in the commercial sector, the movements of state officials to carry out their administrative responsibilities in various geographical locations in their country, or the participation in sacred festivals in early urban centers by rural people, could be considered as an early mobility of a travelling nature.

Although travel activities at that time were relatively geographically limited (i.e. in the complex of areas around the plains of present-day Palestine and Syria), however, shipbuilding opened up new geographical destinations over longer distances (e.g. to the Persian or Indian Ocean, the Mediterranean, etc.) (Casson, 1974).

Of course, in areas where maritime transport was not feasible due to mountainous terrain (e.g. the Syrian or Palestinian regions), the mobility of travellers at that time relied on walking or the use of animals (donkeys, oxen, horses, etc.) which pulled heavy wagon structures.

Another key point to remember is that the lack of organized roads was the most essential reason why commerce exchanges were not so regular between the cities, because the carts with goods could not move on rough dirt roads that only supported the heavy wheels that pulled the primitive animal wagons.

5.2. Mobility in Greek Territory

As far as the Greek area is concerned, the movement of people and goods seemed to be more intense, mainly in the Minoan period (3000-1450 BC) in the area of Crete, and in the Mycenaean period in the Peloponnese, as well as in other parts of Greece. One of their common features was an extensive road network that allowed them to move between regions with greater ease.

As Boys-Stones et. al (2009) state, social status and occupation were the main driving forces that gave impetus to the travel opportunities of the ancient Greeks. As a result, a significant proportion of the archaic Greek population made trips to the wider Mediterranean region, both to sell their products and to visit a religious pilgrimage, to attend sporting events, or even to experience historical sites in other ancient cities far from their place of residence by travelling.

On the other hand, travel activities in ancient Greece were not exclusively related to commerce or recreation, as mentioned above, but there were also categories of travellers who changed their places of residence for completely different reasons, such as soldiers, mercenaries, or political envoys from the scattered Greek kingdoms (Harris, 2000).

5.3. Basic Travel Motives in Ancient Times

Although modern tourism could not have existed in previous centuries, in no way can one claim that "tourists" did not exist in the ancient past. For example, travel related to education (gaining knowledge) or entertainment was already known both in the period of the Pharaohs in Egypt and in the later classical world (Gyr, 2012). In these periods there is evidence of travel stemming from a luxurious lifestyle and the search for experience, entertainment and relaxation.

Also, according to Casson (1974) obvious signs of tourism, i.e. travel for leisure and curiosity, can be traced back to the New Kingdom period in Egypt, circa 1500 BC.

On the southern side of the Mediterranean, in ancient Egypt, in general, the concept of travel differed greatly from our modern understanding of the term, which is largely associated with tourism.

In all periods of Egypt's history there have been various motives for making a journey, the main one being search for food and supplies. At the same time, another secondary reason for travel was the expansion of a kingdom's (or state's) territory into new geographical areas, due to demographic pressure or as a consequence of military motives.

Noting the factors that prompted someone to undertake a journey, we can note the need for commerce and the quest for profit, the need to find and supply raw materials, the supply of luxury goods or exotic products. We also should not overlook the human curiosity that drove a long journey, as well as the medical reasons that motivated some people to visit other regions (states or cities) in search of treatment. Köpp-Junk (2013) respectively adds that other categories of travel had reference to religious reasons (e.g. for pilgrimage visits), or for social reasons (e.g. marriages). The author also considers that some of these travel motives are attested for ancient Egypt, while others are not.

Following the author's conclusions regarding mobility in ancient Egypt, it is worth noting that the search for food is not considered to be a substantial factor in travel at that time, although some records will point to the mobility of foreign travellers, such as the Nubian records, who visited the island of Elephantine in search of work.

On the other hand, military motivations seem to be supported by various military campaigns, such as those described in the Annals of Thutmose III. Köpp-Junk (2013) goes on to argue that the Egyptian journeys to Punt or Byblos were economically motivated, while Harkhuf's journeys were caused by a mixture of economic and military reasons.

From Pharaonic times there is little evidence of travel for leisure, or what we would interpret as 'tourist' travel today. However, business travel seems to have been predominantly immersed in the nature of official travel. Thus, commerce delegations from various countries visited the Nile Valley to exchange the products of their cultures (Mark, 2009). According to the author, it is also worth noting that depictions of Egyptian travellers are rare in Pharaonic Egypt. Occasionally, Egyptian means of travel and transportation appear in frescoes and reliefs on tombs and temples.

Köpp-Junk et al. (2017), describe the high mobility level attested in Egypt since ancient times. Expeditions are witnessed in the Predynastic period (up to about 3050 BC). It is worth noting the diversity of the travellers, who belonged to different social strata of Egyptian society, practicing various professions, i.e. not belonging to missions. In addition to these professionals who required a high degree of mobility (such as merchants, messengers and members of the army), there is documented evidence of many other travellers (travelling doctors, architects, scribes, craftsmen, workers and priests) who were often (but not always exclusively) members of expeditions.

A fairly large number of travellers represented the lower levels of the population (such as ordinary workers recruited for the construction of the pyramids and other large-scale state projects, as well as soldiers or unskilled laborers), reflecting the existence of a high rate of mobility, which was not restricted to the elite.

Conversely, most of the travellers seem to have been men, while women are rarely mentioned in the historical records (Bunson, 1991) and only indirectly can their mobility be confirmed according to the author. In particular, he cites as an example of women's mobility the Egyptian wedding customs, according to which after the wedding women followed the husband home.

Nardo (2014) argues that from the written historical sources it can be inferred that the ancient Egyptian traveller never travelled randomly, but always had a fixed destination. "Curiosity" as a travel motive is attested in various imprints, such as the temple on the island of Philae, in which there are inscriptions of visitors who show interest in ancient buildings.

The 'desire for education' as a stimulus for starting a journey is very rare in ancient Egypt, according to Nardo (2014). It is evident, for example, from New Kingdom school excursions to temples and other monuments, as attested by the inscriptions of visitors.

Similarly, religious travel is attested in Ancient Egypt from the earliest times. Nardo (2014) identifies that pilgrimages (as the relative meaning of the word is attributed to them) were already familiar during the New Kingdom, or rather the Middle Kingdom period in Egypt, where religion seems to have had an important say in the daily life of the people of that time, and with the favor granted to economic development by a vast river like the Nile, which made travel anywhere in the country relatively easy, we may conclude that such events set huge crowds in motion.

In Mesopotamia, as well, commerce seems to have flourished from ancient times. Caravans were a common sight on the roads, loaded with goods that were sold in the wider region of the kingdoms of that time (Casson, 1974). Casson (1974) reports, respectively, that a century and a half BC we can also discern in Egypt some signs of tourist travel for the purpose of mere curiosity or pleasure. In the author's view, these forms of travel basically appeared in the Nile Valley and not in Mesopotamia, because the areas near the Nile offered an abundance of building stones which the pharaohs began to use for their magnificent tombs, pyramids and temples as early as 2700 BC.

On the walls of these monuments we find messages left by people of that time who had made a special journey to visit these impressive historical witnesses of their time (Lorna and Gahlin, 2003).

5.4. Mobility During 1200-500 BC

Historically, around 1300-1200 BC, major changes occurred in the eastern Mediterranean, with the Iron Age following the end of the Bronze Age (Joshua, 2019). A series of events involved both natural disasters (earthquakes, climate change, etc.), as well as wars, invasions or political instability in various regions of the eastern Mediterranean.

By listing the events of that period as a chronological sequence, the author concludes with the fall of the Mediterranean people civilization. He mentions, that a series of earthquakes resulted in the destruction of cities, while the occurring climate changes resulted in poor harvests, which in turn led to famines, social and political instability (due to the prevalence of famines) and social uprisings as a result of the chain of poverty. These factors then forced the expulsion of large populations from their lands, seeking new migratory areas in the Mediterranean region to settle. All this search for new areas of settlement according to Joshua (2019), brought turbulence to the lives of existing populations that ultimately resulted in the decline of Mediterranean civilization.

In this new era, sea travel is still the fastest way to get from one place to another. At the same time, the great maritime powers of the previous millennium (Minoans, Mycenaeans, Egyptians) have now been replaced by a new nation of traders, the Phoenicians, who, since 1200 BC had monopolized the Mediterranean for about four hundred years until the Greeks learned the ways of the sea well enough to successfully challenge them (Ilieva, 2019).

The year 500 BC or so marks the moment when the Near East, the focus of ancient history for a long time, gave way to the west, to the Greeks and Romans.

According to Casson (1974), by this time, the general outline of the ancient journey had been broadly defined. At sea, merchant ships provided communication between the major ports of the eastern Mediterranean.

Describing this period, Casson (1974) goes on to say that on land, the main centers were connected by roads. The technique of paving had been developed although it was used sparingly. Travellers had their choice of wagons, carts, donkeys, horses or camels. Along the long routes there were inns, while in the towns travellers found inns and taverns.

Among the regular users of the sea routes and roads, official and commercial travellers, the traveller for whom the journey is made, the tourist, is beginning to stand out.

Lascaratos' (1978) view supports the existence of genuine tourists also in the period of ancient Greek antiquity, giving the character of travel narrators to historians such as Herodotus, Pausanias or Strabo. He believes that the list also includes all the ancient Greek writers and philosophers who were known for their travels abroad in order to familiarize themselves with the wisdom and culture of other peoples.

Walton (2009b) also notes that there are many issues to be debated regarding the origins of 'modern' tourism, particularly in relation to earlier phenomena such as pilgrimage, or the extent and significance of identifiable forms of tourism activity in the ancient Mediterranean.

On the other hand, Verhoeven (2013) is skeptical about simply drawing parallels between tourism in its current form and the patterns that existed in the pre-modern era, giving as examples the Grand Tour, medieval pilgrimages or Roman travel. This alignment of recent and earlier tourism patterns is, in his view, completely simplistic and rather anachronistic, although it is adopted by some scholars who study tourism science from a social point of view.

Moreover, Vukonić (2010) criticizes researchers who, in his words, often end up looking for their study in the ancient past, or those who have tried to attribute the characteristics of present phenomena to the past. In turn, he sees this as "imposing history" and wonders if there is any point in it at all.

However, Lowenthal (1999) argues that our relations with the past can neither be forbidden nor prescribed, because they are linked to all our ideas and institutions. Thus, a better understanding of a person's behavior and trajectory in relation to a particular phase of their life can only be achieved through the existence and evaluation of our historical knowledge, he argues. In this pattern, the thought of the Danish existentialist philosopher and social critic Kierkegaard (1813-1855) that "life can only be understood by observing the past" seems acceptable.

Of course, the same reasoning applies to the tourism sector. In other words, despite the fact that there are different approaches, the aim of exploring its historical journey will always remain to understand its change over the years. It is this distinctive view that shapes the contribution of history to tourism studies, in parallel with Towner and Wall (1992).

5.5. Travel and Tourism in the Greco-Roman Era

With references to ancient times, travel can be seen as a complementary part of people's mobility in terms of aspects of their social life.

Ancient peoples such as the Egyptians, Babylonians, Phoenicians, Cretans, Cretans, Jews and Greeks, for example, although they were more entrenched in their own culture (e.g. the ancient Greeks believed that the sanctuary of Apollo of Delphi was the 'navel of the world'), over the years they decided to visit other peoples in their own countries, both for commercial purposes and to exchange experiences and culture.

Page and Connell (2009) note that in the ancient cultures of the Greek and Roman social elite, there are reports that 'early' tourists sought pleasure and relaxation in areas far from their main cities, supporting the epitome of modern tourism: the pursuit of pleasure in a location far from their daily lives and the use of their leisure time for non-business purposes. As Korstanje and Busby (2010) describe, the ancient citizens of the Greeks and Romans gave due importance to 'leisure, pleasure and travel' (Korstanje and Busby, 2010).

The first great travelers were the Greeks, people eager to share their discoveries and observations with the rest of the world, unlike the Phoenicians who jealously guarded their findings, even spreading false information to maintain their commercial monopoly (Maksimović, 1951). Thus, the Greeks had travelling pursuits, both seeking simple pleasure from visiting another place, but also aiming at cultivating trade, fulfilling their religious obligations, or seeking medical care.

As noted in Herodotus, some Greeks went to Egypt, some simply to visit in order to see the country, others to trade (Herodotus, as cited in Dillon and Garland, 2010). The fascination that Egypt held for the classical world is well known, at least as can be confirmed by the historical visits of ancient Greek philosophers, such as Solon or Pythagoras.

As far as ancient Greece is concerned, it was known that the hospitality of strangers was an act of virtue. A number of gods, such as Xenius Zeus, the goddess Athena (Xenia) as well as the Dioscurians Castor and Polydeuces were charged with protecting foreigners.

According to the customs of that time, every stranger was part of a ritual that followed the act of hospitality, and indeed without any distinctions among the visitors concerning their social classes.

Some city-states, such as Corinth or Athens, welcomed foreigners willingly, taking into account the economic benefit that indirectly resulted from their stay in the city and a way to build their "reputation". In this respect, warlike and xenophobic Sparta was an exception: foreign visitors were only reluctantly accepted and at times summarily expelled: foreign ideas must be kept out at all costs' (Kitto, 1950).

Due to its favorable geographical position in the north of the Peloponnese, Corinth was a thriving commercial hub with two docks (one in the Ionian Sea and the other in the Aegean) and a special infrastructure for transporting ships across the land (i.e. the Diolkos), around 600 BC.

It is even reported that the city had become famous for its prostitutes (courtesans), whose care involved the personal service of travelling merchants visiting the area for trade. And as it is claimed (Strabo, 8.6.20), it was because of these women that the city became crowded and wealthy.

Unlike Corinth, where a traveller could indulge in carnal pleasures, a visit to the city of Athens was primarily a cultural challenge.

When, in the 5th century BC, Pericles' Athens gained a reputation for intellectual, artistic and material excellence (of which the most prominent feature was the newly built Parthenon on the Acropolis), it became attractive to visitors. In addition to the cultural experience, Athens offered a lively and enjoyable time to those who visited to take part in the great festival called "Dionysia" (Kitto, 1950).

It is known historically that Greek culture had a very strong influence on the Roman Empire, recognizing that the traditions and customs of the Hellenistic heritage had been appropriated by the Romans. Nevertheless, the oldest historical tradition of the period seems to have belonged to Egypt, which was also a possession of the Roman Empire. According to Lomine (2005), Egypt was for the citizens of Rome a place with exotic destinations, with a way of life very different from that hitherto common in the rest of the Roman Empire, with a particular cultural life, with distinct archaeological sites, to which they could relatively easily escape as travellers.

The Roman travellers of that period of Hellenistic times used to visit both the regions of Greece and Egypt, since the geographical distance between the three countries offered relatively easy travel.

According to Pliny the Elder, the average journey from Puteoli (the port of Rome) to Alexandria with a good wind was at least twelve days (Friedländer, 1965).

Classical Rome gave impetus to travel and special forms of holidays. Holiday travel became more frequent due to the development of infrastructure. Around 300 AD, there was a road network with 90,000 km of major arterial roads and 200,000 km of smaller rural roads (Gyr, 2012). In combination with the transport system, three other factors contributed significantly to 'tourism' during the Roman Age: common currency, language and the legal system (Hudman and Jackson, 2003).

Then there were 'seaside resorts' where the upper classes and masses flocked each summer to escape the overcrowded and unhealthy conditions in Rome (Page and Connell, 2009). Tourists in the Bay of Naples, located about a hundred miles from the capital city of Rome, were able to rent rooms in the existing pensions clustered near the shore, and could enjoy culinary delights in the area's seaside restaurants and wine shops (popinae) (Perrottet, 2003). Wealthy Romans thus spent a lot of time on the beaches of Egypt and Greece. Hence, Feifer (1985) states that the first civilization to produce truly mass tourism, both in letter and spirit of the term, was the Empire of Rome.

'Roman tourism' reached its peak in the 2nd century AD due to the Pax Romana, which provided more stable political conditions for travel. At that time, a large number of Roman visitors travelled to Greece because of the mythology, monuments, the Olympic Games and other festivities. Hadrian, the most well-travelled of the Roman emperors (Casson, 1985) restored and enlarged 'Athens of Theseus', adorning it with new and stunning buildings, still verified by the inscription on the triumphal arch built in his honor.

The Romans, like today's tourists visiting numerous European churches and cathedrals, visited each temple individually. The sacred plateau of the Acropolis was filled with people-not only Roman tourists (worshippers and their guides), but also officials and religious officials, astrologers, priestesses, preservationists, porters, and even police officers to protect the temple's precious artifacts (Perrottet, 2003).

Ancient travellers had many of the characteristics of their later counterparts. In the same way as today, ancient tourists carved their marks (graffiti) on the stones of Egyptian pyramids or other monuments as evidence of their visit, while local stonemasons made similar inscriptions for high-class visitors, such as those found in the necropolis of Thebes. 'Tourist behavior' included buying souvenirs as travel souvenirs, shopping for friends and relatives and, as with a mass gathering of today's tourists, waste management (Casson, 1974).

Herodotus' counterpart who lived six centuries earlier, in the second century AD, was Pausanias, a travel writer who, by all accounts, travelled throughout Italy, most of Asia Minor, Syria, Palestine and Egypt, and described the Greek lands in ten volumes. Today, we have only a small excerpt of the "Tour of Greece", which in those ancient times could have been used as tourist reading. His lines clearly state that he was primarily attracted to the sanctuaries, but he also notes many other attractions that are not of a religious nature. Pausanias' work thus informs us about the fact that, not only that there was tourism in Roman Greece but also that visits to sanctuaries as tourist - and religious - destinations were prevalent (Stark, 2009). His intentions were to describe the sights with a particular emphasis on those worth seeing and which even in his time could be said to be of particular interest (Mee and Spawforth, 2001).

There have also been guides mentioned on many occasions in Herodotus' Histories. They lived and worked not only in Egypt, but also in Greece, where they were also mentioned by Pausanias. He refers to them as "exeggii", with the name of one of the guides marked ("Aristarchus, the guide to the sights of Olympia"). They guided people, pointed out the notable sights (temples, altars and statues), described local rituals, explained customs and told the traditional stories of historical and mythical events related to the place. Thus according to Lomine (2005) the guides also had an important function as brokers of culture.

Therefore, there are views that in the last centuries of the Roman Empire tourism really existed. Although tourists were a minority and not the majority of travellers, one cannot deny the recreational or cultural aspect of these ancient journeys.

6. Travel and Commerce

In the Greek era, commercial travel was mainly by sea. It can be argued that the sea broadened horizons and ensured that the Greeks would not be isolated from each other: Eventually, their ships reached the central and eastern Mediterranean and established the overseas contacts that would prove so fruitful (Mee and Spawforth, 2001). These voyages were made far safer by the time of Pericles due to the control the Greek navy gained after the Battle of Salamis (480 BC) and the establishment of the Athenian-led Delian Alliance. Ships could sail without any fear of pirates with dangers lurking only on the high seas. Ships set sail and sailed by day at a close distance from the mainland as navigation at night was unsafe due to the lack of high quality charts, compasses and beacons (Flacelière, 1979).

The most common reasons for mobility in the ancient world involved participation in wars, for commercial activities, for reasons related to politics, or to fulfil religious duties. For all of the above reasons, modes of mobility, at least on land, were carried out using carts, sub-carriages (mules or horses), or on foot (hiking). With regard to wagons in particular, two-wheeled or four-wheeled wagons were most efficient in moving goods (Garland, 2007).

Moreover, as can be understood from the difficulties of road travel at that time and despite the fact that there was an extensive road network in most of ancient Greece that connected even the most remote geographical locations, a long journey must have required a significant cost for its realization. Consequently, the possibility of using horses was mainly the privilege of the wealthy of the time, while the rest of the people who had to travel by road from one place to another covered the distances by walking. To get from Athens to Olympia, which in Crowther’s (2007) words was a huge, time-consuming, and dangerous undertaking, took about five or six days of walking.

Travellers also had to face a series of dangers and difficulties during a journey, ranging from the existence of bandits, to road obstacles (e.g. rivers without bridges, etc.) which made it difficult for them to move from one place to another. Thus, travellers carried only the basic necessities, while travelling in groups or accompanied by their slaves. During Roman times, especially from the second century BC onwards, bandits attacked, kidnapped and even killed travellers during their raids, and the evidence shows that ordinary people sometimes travelled at great risk.

Travellers rarely had the opportunity to stay in inns and so they looked after their own self-sufficiency. Garland (2007) using the words of Aristophanes, stated that the suitability of accommodation was not necessarily to the point where they could cater for the accommodation needs of travellers. Thus for example, it is reported that in Piraeus, the inns there had a negative reputation for the inconvenience and bedbugs they offered their customers, along with their use as a place of prostitution, among other things.

In Roman times, the number of accommodation facilities was much greater, especially in cities, but most inns were probably of the third class" (Friedländer, 1965). It does not seem at all surprising that what was widely believed in ancient nations, namely that travel was a "necessary evil", bearing in mind the conditions of travel, where they spent the night, the food and the means of transport available to them (Vasoli, 1967).

7. Archaeology of Religious and Sports Tourism

One of the most frequent and common reasons for people to travel, since the antiquity, was to visit religious sites. The most popular religious pilgrimages in ancient Greece included the sanctuary of Apollo at Delphi, Delos, or a visit to the temple of Isis in Egypt.

According to Stark (2009), because the nature of this category of travel involved the expression of religious worship, visitors could be described as 'pilgrims'. At the same time, the author states that since the ancient Roman era, activities that could be described as belonging to the category of tourist behavior were already mentioned, as were their modern counterparts.

The majority of pilgrimage journeys in Greece during the Archaic period were made by individuals who for various reasons visited a particular holy place, but Jonkers (2012) suggests that the organization of 'official pilgrimages' may have developed more gradually. Herodotus in his 'Herodotus Historiae' records the custom of organizing religious events in honor of the gods, both in Greece and Egypt.

Four festivals stood out for their importance in ancient Greece: the Olympic Games in Olympia, the Pythian Games at Delphi, the Isthmian Games on the Isthmus of Corinth and the Nemean Games held in Nemea, bringing together athletes, artists, officials and spectators from all over the Greek world. Various festivals in ancient Greece, such as the Dionysia or Panathenaea, attracted visitors from various cities of Greece, on the occasion of the performances organized by famous ancient writers.

Even tyrants from Sicily and Greek kings from Cyrene regularly sent chariots to compete in the Olympics and Pythia (Dillon and Garland). A different concern is raised by Scullion (2007), who doubts that there were religious motives for travellers to visit from one place to another, pointing out that each Greek city had its local sanctuaries. In particular, he wonders why some wealthy individuals travelled to Greek shrines in other cities? Why would they not be satisfied with the local rituals? Was there a compelling religious motive for traveling to Olympia, Epidaurus, or Delphi, or was it the main attractions, the wider fame, the greater prestige, or the better performances that motivated them to make that trip?

Delphi was visited not only by Greeks but also by numerous foreigners. Among the visitors were kings and military leaders and several Roman emperors, representatives of cities and masses of ordinary people. All tended to visit this spiritual center of Greece to receive the advice of Apollo, whose wisdom was offered to the people through the oracle of Delphi, in order to participate in the Pythian Games in his honor (named after the snake, Python, whom Apollo killed). They also had the opportunity to admire a unique 'exhibition' of architectural and artistic achievements. In fact, nowhere in Greece could one see such gold and confirmed glory in one place (Casson, 1974) in the setting of a spectacular mountainous landscape.

Scullion (2007) believes that the supremacy of Delphi was certainly not based on specific religious elements, but on the antiquity and high reputation of the oracle, its impressive setting and rich mythology, but mainly on the political capital it had accumulated.

In contrast to the 'cosmopolitan air' of Delphi, Olympia was intended for 'national gatherings'. The Olympic Games, in which only free Greeks participated, created a heightened awareness among Greeks that although they were separated by geographical borders, political systems, mountains, seas and very often engaged in mutual wars, they all belonged to the same Greek world.

Towards the end of the nineteenth century, archaeologists discovered in the area of Olympia what was left of the sanctuary of Zeus, the site of the Olympic Games.

This particular ancient sporting event dedicated to the god Zeus was one of the most important cultural events of the entire Greek territory. As a competitive activity, the area attracted athletes and visitors not only from the Greek region but also from the Greek colonies, in a period between 776 - 393 BC.

There is no doubt about the crowds of visitors during the sporting event of the Olympic Games, who stayed in unorganized campsites around the area. Although the number of visitors cannot be accurately calculated, rough estimates suggest that around 45,000 travellers gathered in the area during the games.

The temple of Zeus in ancient Olympia, which began construction in 470 BC, was dominated by the gold and ivory statue of the god, which was twelve meters high and created by Phidias, and was one of the Seven Wonders of the World. In the Games site, there was an adequate sports infrastructure with numerous facilities such as the stadium with its earthen banks (without seats).

For the hospitality of the dignitaries, there was the guesthouse "Leonidaion" near the sanctuary of ancient Olympia, which was a gift of the Naxian architect Leonidas (Phoca and Valavanis, 1999).

Apart from the large crowds of visitors, most of whom were spectators of the games, the Olympic Games created a new level of competition related to the presentation of musical and poetic games (Crowther, 2007).

In the Roman period that followed, the cultural monuments of ancient Greece (e.g. temples, statues, etc.) became a major attraction for visitors (Casson, 1974). Even the site of Olympia continued to be a place of tourist visit, considering that it had the character of an important educational experience enlightened by the glory of antiquity.

So if the history visits of Roman tourists to the ancient Greek cultural monuments according to Friedlander (1965) were a basic motive for travel between the two states, some travellers simply continued to visit them with religious motives, sacrificing or making offerings to honor the ancient Greek gods. Stark (2009) even confirms the character of this category of visitors, since their motives were not only limited to the tourist tour, but also to fulfilling pilgrimage needs.

8. Conclusions

Although Vukonić (2012) suggests that the period of ancient times is not suitable for studying the historicity of tourism, it can be argued that all of the preceding references in the previous paragraphs reveal many similarities with today's tourist travel motivations and behaviors.

Similarities between the ancient inhabitants of Rome and modern tourists are distinguished at an academic level by Lomine (2005) taking into account the factors of entertainment.

Similarly, Romero (2013) summarizes that among the main motivating factors for ancient travellers were religious reasons, cultural needs and sporting events.

Due to the context in which they took place, the inherent characteristics of ancient journeys were physical challenge, diversity, authenticity, experience of local culture and lifestyle, mixing with the locals, etc., which are concepts that are still attributed to tourism today (Krippendorf, 1986; Poon, 1993). Their ancient predecessors probably did not always perceive them as a pleasure, given the hardships and the enormous physical effort related to travel at that time.

Over the years, the continuing growth of the transport sector has provided a similar dynamic to the growth of the tourism sector. Despite the fact that during the last century a number of serious obstacles have at times had an impact on the touristic product (wars, economic crises, pandemics, etc.), tourism has nevertheless moved from local communities to international markets. Technological progress and social networking tools have added important options for tourism service providers on the one hand, and for the final consumers of travel products on the other.

The modern inventions (of the last century) in the means of tourist transport (aviation, trains, roads, etc.) have significantly changed the tourist activity in relation to the past. The reduction in the cost and time of travel has made travel possible for all social classes, not just the wealthy.

If our intention is to list the most important factors that have reshaped tourism development in recent years, we can mention the following: the long-term rise in the income level of households, the expansion of travel choices at a global level, the proliferation of regions offering tourism experiences, the reform of tourism legislation in order to protect tourism service providers and consumers, the development of specialized studies on tourism, the development of the tourism industry and the development of the tourism industry, the development of the tourism industry and the development of the tourism sector.

Modern technological infrastructure and advances in information and communication management now offer a significant dynamic to the tourism industry. E-tourism has now changed the way travellers are informed, enabling them to search through a multitude of global sources for the information they need to compare and choose their destination and accommodation. Tourism operators, on the other hand, can manage their supply chains more efficiently in terms of procurement, financial transactions and reporting.

It is worth noting that one of the main changes that has also been observed in recent years in the tourism industry is the shift in the desire of travelers from simply seeking beautiful places for holidays to seeking new experiences. The modern tourist seeks to be more active in acquiring tourism experiences, actively and interactively participating in this goal. Since he/she has innovative technological applications at his/her disposal, he/she has radically modified the way he/she shapes his/her tourist experiences. Social media interacts with his/her desires and needs in order to influence his/her decisions about tourism experiences.

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THE USEFULNESS OF INFORMATION ABOUT THE ENVIRONMENTAL POLICIES OF LARGE ENTERPRISES IN BULGARIA

Pavlina Dimitrova
University of agribusiness and rural development, Plovdiv, Bulgaria

Abstract: The development examines issues related to the environmental policy of public interest enterprises and the usefulness of its disclosure in the required non-financial declaration.

The regulatory framework in the context of the environment is discussed. Conceptual views were defined according to certain eight criteria. The latter are specified on the basis of the guidelines drawn up in the Ministry of Finance Directive in connection with the implementation of Chapter Seven "Annual Reports", Section III "Non-Financial Statement" and Section IV "Consolidated Non-Financial Statement" of the Accounting Law.

The criteria determine the risks that can reduce the sustainability of the global economy. It emphasizes the concept of long-term profitability combined with social justice and environmental protection. An empirical study of a representative sample of companies in various sectors has been carried out, and specific results have been disclosed.

Keywords: social policy, non-financial information, public company, quantification

Introduction

It is indisputable that human activity and the activity of a significant part of enterprises have an impact on flora and fauna. Climate change is a consequence not only of changes in natural objects - the Sun, volcanoes, etc., but also as a result of the negative impact of man on soil, air, water. This is precisely why regulatory changes regarding disclosure and disclosure elements of corporate environmental policies have become necessary.

The article will examine the content of these policies and attempt to quantify the usefulness of the non-financial information that is publicly disclosed.

Materials and Methods

The normative acts aimed at controlling the activity of the enterprise in the aspect of environmental prevention are various Directives, Laws, Resolutions, Decisions, etc. The legal requirements are aimed at: air quality; Waste Management; water quality; protection of nature; ndustrial pollution control and risk management; chemicals; genetically modified organisms; noise from machinery and equipment; nuclear safety and radiation protection; civil protection[1].

According to the requirements of the Environmental Protection Act, (Environmental Protection Act, last amended 2020, Art. 19) information concerning ecology can be primary, available pre-processed and purposely processed. Anyone can access this data, which is categorized as follows:

- ✓ the state of the components atmospheric air, atmosphere, waters, soil, subsoil, landscape, natural objects, mineral diversity, biological diversity and its elements and the interaction between them;
- ✓ the factors damaging nature: natural and anthropogenic substances and processes; different types of waste and their locations; risky energy sources - noise, vibrations, radiation, as well as some genetically modified organisms. Activities and/or measures, including administrative measures, international treaties, policy, legislation, including reports on the implementation of environmental legislation, plans and programs, that have or are capable of having an impact on environmental components can also be presented upon request;
- ✓ the state of human health and the safety of people, insofar as they are or can be affected by the state of the components of the environment or, through these components, by the factors, activities or measures specified in the previous point;
- ✓ objects of the cultural-historical heritage, buildings and facilities, insofar as they are or may be affected by the state of the components of the environment or, through these components, by the factors, activities or measures specified in item 2;
- ✓ analysis of costs and benefits and other economic analyzes and assumptions used within the measures and activities specified in item 2; emissions, discharges and other harmful effects on the environment.

Directive 2014/95 of the EU of 22.10.2014. recognizes the importance of social and environmental policy disclosures. In this way, the risks that can reduce the sustainability of the global economy are determined. It emphasizes the concept of long-term profitability combined with social justice and environmental protection. In this context, "the disclosure of non-financial

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[1] Environmental Protection Act, SG No. 91/2002, ... final change SG No. 54/2020;
Convention on environmental impact assessment in a transboundary context, SG No. 86/1999, last amended. No. 5/2018;
Directive 2014/52/EU of the European Parliament and of the Council of April 16, 2014 amending Directive 2011/92/EU on the assessment of the impact of certain public and private projects on the environment; Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the impact of certain public and private projects on the environment; Ordinance on the conditions and procedures for carrying out an environmental impact assessment, SG No. 25/2003, last amended. SG No. 67/2019; Order No. 183/28.02.2020 of the Minister of the Environment and Waters on access and the procedure for completing, updating and entering information in the Public Registers under Art. 102 of the Environmental Protection Act. The Framework Directive 96/62/EU for the assessment and management of ambient air quality; Directive 99/30/EU concerning standards for sulfur dioxide, nitrogen oxides, dust particles and lead in atmospheric air; Directive 92/72/EEC on atmospheric air pollution with tropospheric ozone; Directive 99/32/EU to the minimum sulfur content in gas oil.; Directive 94/63/EU on the reduction of emissions of volatile organic compounds (VOCs) released into the atmosphere from stationary sources; Directive 97/68/EU on measures to limit atmospheric air pollution from engines installed in off-road machines Waste management; Directive 75/442/EU on waste; Directive 91/689/EEC on hazardous waste; Regulation EEC/259/93 on the monitoring and control of the transport of waste within, to and from the EU; Directive 94/67/EU on the incineration of hazardous waste; Directive 99/31/EC on waste disposal; Directive 91/157/EEC on batteries and accumulators containing certain hazardous substances;

information helps to monitor, measure and manage the results of the activities of enterprises and their impact on society" (Directive 2014/95, (3)).

The directive requires the preparation of non-financial information by certain large enterprises, which information concerns employee and social issues (including respect for human rights), corruption and environmental protection.

By disclosing non-financial information, the following goals are achieved:

- Consistency of information - reflected in the determination of "rough" criteria (rough framework) for reporting;
- Comparability of information - possibility to compare information between companies operating in the same industry;
- Highlighting the most likely reasons for the realization of specific risks in order to inform all users of reports and to correct initial intentions in relation to investments in the given reporting unit;
- Reflecting the corporate social responsibility policy. The latter is "a concept in which companies integrate, on a voluntary basis, their environmental protection and social initiatives into their business strategies and in interaction with all stakeholders" [9].The concept has been supplemented, perceiving that it is "the responsibility of an organization for the impacts of its decisions and activities on society and the environment; social responsibility is realized through transparency and ethical behavior and contributes to the sustainable development, health of society [10].
- Access to this type of information (for investors) is seen as a step towards achieving market and political incentives to favor business investment and efficiency.

The exemption of enterprises (according to accepted criteria) from the preparation of the Non-Financial Statement is determined with the aim of reducing the overall regulatory burden and is of the "think small first" type.

When providing information, businesses can use the Eco-Management and Audit Scheme (EMAS) in addition to the national frameworks. It is natural that the organizations until the adoption of EMAS used other informal systems - environmental management systems (EMS). It should be specified that this system is voluntary and is used by those companies that have made a commitment to evaluate and improve their environmental performance.

The reasons for the development of this type of system is both the need for optimal use of resources and the need for their recovery.

The characteristic features of the new system can be summarized as follows:

- It is applicable to all sectors of the economy;
- Simplified methodology, which makes it possible for both small and medium-sized enterprises with limited financial resources to use this standard more willingly;
- Stricter requirements for measuring and evaluating environmental results, compared to previous standards;
- Unified environmental indicators, on the basis of which it is possible to compare the environmental protection activity of an enterprise in a different time horizon, as well as between different enterprises within the same reporting year;
- Disclosure of information to the entire public through an environmental declaration.
- Performing an internal environmental audit, which as a type of control repeatedly minimizes its costs compared to the accumulated benefits for the reporting unit and for society. It is assessed whether the management system corresponds to the objectives and policy of the organization;
- High degree of participation of workers and employees in the system - conducting an open dialogue with all of them in relation to the company's activities;
- Performance of external control of the activity - a type of independent inspection by a certified body.

Before the proposal of this type of system as an environmental standard, ISO 14001 was normatively regulated. The latter is not repealed, rather the EMAS system builds on new requirements and it is obvious that it can be categorized as the most reliable and sustainable system.

When disclosing environmental information, it would be good for companies to be guided by the Principles enshrined in the UN Global Compact, which are specified in the following guidelines in the section on environmental activities [11]:

➢ support for preventive approaches in environmental protection. From the point of view of the fact that prevention is significantly more effective (it is even economically more profitable to prevent an action that destroys nature than to look for methods to restore normal flora and fauna, as well as for human health), then solving known problems can be helped by a combination of mitigation and restoration measures.

➢ taking initiatives stimulating the assumption of greater responsibility towards the environment. In this context, Vaclav Havel's words are particularly relevant: "We are still not able to understand that the only common pillar of all activities - if they are to be moral - is responsibility. Responsibility is something higher than my family, my country, my company, my success."[12].

The welfare of society should come first. Only then can personal good be reached.

➢ promoting the development and dissemination of environmentally friendly technologies. According to an empirical study [13] only for the territory of our country, companies invest in "green economy" for the following reasons:

✓ compliance with the regulatory requirements for environmental protection;
✓ increase in profits;
✓ cost reduction;
✓ increasing the company image;

The initial view that investment in such technologies is high, are not confirmed. The benefits are environmental and social, and operating costs are comparatively lower.

In order to harmonize Bulgarian legislation with European legislation, specific changes were made to the Accounting Act [28]. Section III Non-financial statement and section IV Consolidated non-financial statement were introduced to Chapter VII Annual reports. The highlights regarding the publicly disclosed information are defined as [28, art. 48, paragraph 2]:

➢ brief description of the business model of the enterprise - purpose, strategy, organizational structure, infrastructure, products, followed policies regarding the main and auxiliary activities of the enterprise and others;

➢ a description of the policies that the enterprise has adopted and follows in relation to environmental and social issues, including the activities it has carried out during the reporting period and their results;

➢ the objectives, risks and tasks ahead in terms of environmental and social policies, including a description of such activities, that would result in an adverse impact on the environment, employees or other social issues;

➢ description of the main indicators for the results of activities related to environmental and social issues.

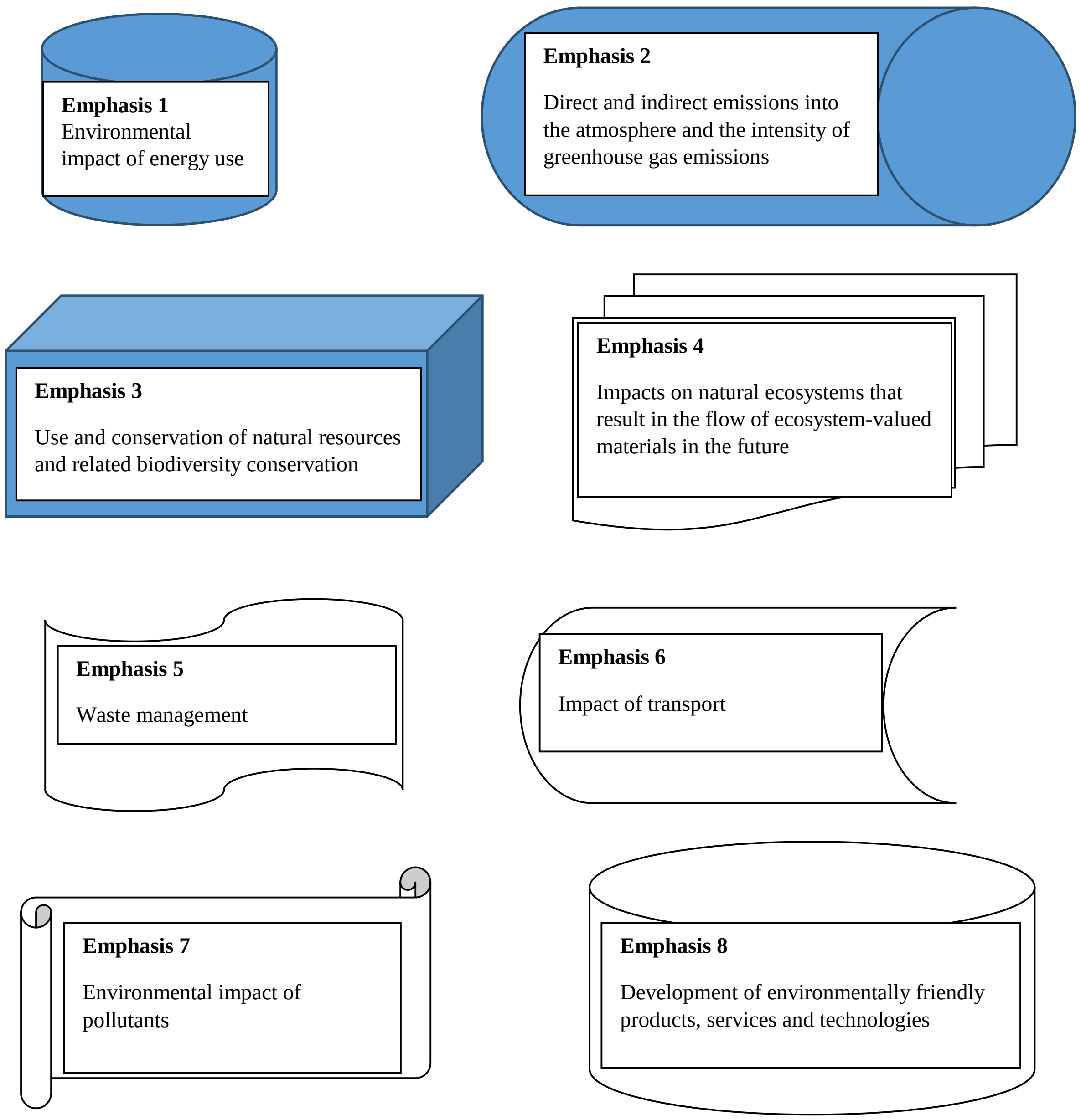
The declaration is prepared specifically by those enterprises of public interest, which for the reporting period as of 31.12 report an average number of personnel over 500 people and are classified as large enterprises.

Partial information on disclosure of environmental protection measures adopted and reporting of costs in this regard can be found in IAS 1 Presentation of Financial Statements, IAS 41 Agriculture, IAS 6 Exploration and Evaluation of Mineral Resources, IAS 37 Provisions, Contingent Liabilities and contingent assets, etc.

According to a Ministry of Finance Directive from 2017, companies must disclose their environmental policies in the following directions:

1. current and foreseeable impact of the activity on the environment, as well as on the health and safety of workers;
2. the use of energy from renewable and/or non-renewable sources;
3. emissions of greenhouse gases;
4. water consumption;
5. air pollution.

These main emphasises are represented by the scheme:



Scheme 1. Conceptual emphasises regarding environmental policies of enterprises

Source: Instruction of the Ministry of Finance regarding the implementation of Chapter Seven "Annual Reports", Section III "Non-Financial Statement" and Section IV "Consolidated Non-Financial Statement" of the Accounting Law. Internet resource: www.minfin.bg

In the following lines, the main highlights will be explained in order to highlight their key role as part of non-financial information.

Regarding how the use of energy affects the environment (**emphasis 1**) - an EU report in the Environment sector [29] strongly advocates the opinion that it is not possible for a primary energy source during its processing not to have a harmful impact on nature.

Energy is obtained from certain raw materials. "In the European Union, 56% of energy is obtained by burning fossil fuels (coal, natural gas and oil). Nuclear energy (35%) and renewable energy resources (9%) are also used” [29].

In Central and Eastern Europe, about 80% of the energy is obtained by burning fuels - nuclear fuel provides 12%, and renewable energy resources - 8% [29]. Primary energy sources are non-renewable (fossil solid fuels, crude oil, natural gas) as well as renewable raw materials (hydropower, geothermal energy, biomass, wind and solar energy). Primary energy sources can be classified according to their greenhouse effect into high-carbon and low-carbon fuels (biomass) and carbon-free fuels (wind, solar, hydro-geothermal and nuclear). .

Enterprises must disclose the types of fuels they use for energy production.

Regarding **emphasis 2** - During the burning of solid fuels, emissions of CO2, SO2, NOX, dust and solid particles are released. CO2 is the main culprit of the greenhouse effect, while SO2 and NOX help to form acid rain and, together with dust, worsen air quality. It is necessary to publicly disclose the quantities of harmful emissions as well as the policy for reducing greenhouse gases.

In relation to **emphasis 3** - one of the objectives of the Strategic Plan for Biodiversity (2011-2020) is that by 2020, but no later, incentives, including biodiversity-damaging subsidies, have been eliminated, phased out or modified in order to minimize or avoid their negative impact and to create and implement positive incentives for the conservation and sustainable use of biodiversity, under and in accordance with the Convention and other relevant international obligations, taking into account national socio-economic conditions.”[30]

In relation to **emphasis 4** - measures taken to improve ecosystems - afforestation, cleaning of riverbeds, etc. are taken into account.

Regarding **emphasis 5** - management should be carried out in the directions of prevention, extended responsibility of the producer, proximity and self-sufficiency (waste should be destroyed as close as possible to its occurrence).

The purpose of disclosure of **emphasises 6 and 7** is similar to that of the previous highlights. In relation to **emphasis 8** - it is necessary to determine how socially responsible the enterprise is in the performance of its activity.

An empirical study

The scope of the surveyed companies includes those that:

a/ meet the criteria for large enterprises. According to the Accounting Act [28], the following must be fulfilled for them:

- as of 31.12 of the current reporting period, they exceed at least 2 of the following indicators: balance sheet value of assets - BGN 38,000,000; 2. net revenue from sales - BGN 76,000,000; 3. average number of personnel for the reporting period - 250 people.

b/ fall within the scope of the so-called enterprises of public interest - they are specified in § 1, item 22 of the Additional provisions to the Law, they include:a) enterprises whose transferable securities are admitted to trading on the regulated market in a member state of the European Union; b) credit institutions; c) insurers and reinsurers; d) pension insurance companies and the funds managed by them; e) investment intermediaries, which are large enterprises according to this law, etc.

c/ exceed the criterion for the average number of employees as of 31.12. of the current one reporting period of 500 people.

Companies should be selected from the register of enterprises of public interest. After a thorough review of this registry, it appears that:

- The list is current as of 01.11.2016 (published on the website of the Commission for Public Supervision of Registered Auditors) [15];
- 569 companies that are recognized as enterprises of public interest have been disclosed;
- From the total number, 12% already in 2016 are declared bankrupt;
- Toward the end of 2020, after a personal inspection, it was found that there are actually 70 companies with a staff list of over 500 people;
- A sample of 37% of the companies (26 enterprises) will be investigated, regardless of the fact that even with a significantly smaller number specific results can be derived.

Table 1. Researched companies

№	Name of the public company	Economic sector
1	Kozloduy NPP SSK	Production, transmission and distribution of electrical energy
2	Bulgartransgaz SSK	Production, transmission and distribution of gas
3	ViK Burgas SSK	Collection, purification and delivery of water
4	ViK Plovdiv SSK	Collection, purification and delivery of water
5	Evrohold Bulgaria SK-Sofia	Financial and insurance activities
6	Bulbank SK	Financial and insurance activities
7	Bulgartabak holding SK- Sofia	Industry of tobacco products
8	NK Jelezopatna infrastruktura	Repair, maintenance and operation of railway infrastructure
9	DSK SK	Financial and insurance activities
10	Gejnenerdji Bulgaria 1 SK	Supply of electrical energy
11	Evrohold Bulgaria SK -Sofia	Financial and insurance activities
12	Bulstrad Viena Insurance Group- Sofia	Financial and insurance activities
13	M+S hidravlik SK	Production of hydraulic pumps, hydraulic and pneumatic motors
14	Monbat SK	Chemical industry
15	Neohim Sk - Dimitrovgrad	Chemical industry
16	First investment Bank SK	Financial and insurance activities
17	Petrol SK	Trade in motor fuels and lubricants
18	Raifajzenbank SK	Financial and insurance activities
19	Sinergon holding SK	Financial and insurance activities
20	Sofarma treyding SK	Pharmaceutical industry
21	Spidi SK	Postal and courier services
22	Stara planina hold SK	Financial and insurance activities
23	Sofijska voda SK	Collection, purification and delivery of wate
24	Trejsgrup hold SK	Building industry
25	Jury Gagarin SK	Printing activity
26	Eurobank SK	Financial and insurance activities

The research will be conduct in several directions (the specified 8 emphases in environmental policy will be used as criteria):

1. What types of criteria every company must disclose information (for example, if a company does not emit greenhouse gases during its activities, it cannot provide data on this);
2. Is information disclosed according to the required criteria;

3. Is the information sufficient or is it reflected pro forma - with one or two sentences each;
4. Is it available on the companies' websites?

The study uses MS Excel. Binary variables from 0 to 1 help summarize the results. The attempt to quantify non-financial information - Bulgarian and foreign - has been thoroughly reviewed by Dimitrova, P. [31].

Results

The overall result for the three studied years (2018, 2019, 2020) shows that the highest coefficient was reached for the criterion "Waste Management" - 0.84, and the same number was reported for the criterion "Impact on the environment from polluting substances" (for 2018, 2019, 2020). The level of disclosed information is the lowest for the criterion "Environmental impact from energy use" (for 2018 only). By year, the results show the following picture:

For 2018, the highest result was reported under **criterion 5 "Waste management"** for sectors: Production, transmission and distribution of electric energy, as well as for the Chemical industry; Collection, purification and delivery of water; Repair, maintenance and operation of railway infrastructure (for all units). 70% of companies provide specific information about their waste management. BRC certification is announced in the packaging and packaging materials section, as the delivered packaging is FSC-certified - with guaranteed origin for responsibly managed wood sources. Most of the envelopes available for package packaging are made of polyethylene with an additive for accelerated degradation using Epi Global's polydergalax technology. Work is also underway to reduce the volume of paper used. So, for example, Paperless solutions for electronic management of the work process have already been developed and successfully implemented in Speedy Ad. One of the innovations is a professional signature pad. Its main feature is that it drastically reduces paper consumption for making deliveries. In addition, unlike tablets, it only serves to accept signatures, which provides greater security to customers and reduces the possibility of errors.

Copiers are also implemented, identifying how much paper each employee uses, and containers for separate collection of paper are placed in the administrative buildings.

Separate waste systems: separate collection, minimization, recovery and recycling of production and household waste, as well as concluded contracts with waste transfer companies, are declared by more than 82% of companies.

Separate waste management programs are used, but as part of the Environmental Management System (EMS). Fines imposed for non-compliance with the legislation are not disclosed, incl. The Waste Management Act.

Over 55% of the enterprises have built sites for waste storage, incl. for hazardous waste: oils, batteries, filter elements. 25% of all companies built these sites more than 10 years ago, i.e. extreme construction is not required due to a change in the regulatory framework. Regarding both **2019 and 2020**, the results are the same.

With a score of 0.86, it is also the second-to-last seventh **indicator "Environmental impact of polluting substances",** which is largely contributed by the sectors "Supply, transmission and distribution of electric energy", "Print activity", "Chemical industry", "Trade in automotive fuels and lubricants", "Construction industry" - all with a coefficient of 1.

As for air pollutants - these are dust particles, nitrogen dioxide and ozone near the earth's surface. They affect the human respiratory system to the greatest extent. Exposure to these pollutants regularly causes bronchitis, asthma, allergies and can even lead to premature death. Over 80% of Europe's urban population is exposed to pollutants in concentrations higher than permissible limits. For example, fine particulate matter (PM2.5) in the air reduces life expectancy in the EU by more than 8 months.

The indicator worsened in the sectors Pharmaceutical industry and postal and courier services - respectively 0.52.

The criterion "Development of environmentally friendly products and services" ranges from 0.71 (for 2018) to 0.72 for 2019 and 2020.

The leading sectors are the chemical industry, postal and courier services, financial and insurance services, hydraulic pump and hydraulic pneumatic motor manufacturing.

More than 37% of the companies take practical steps to reduce the costs of natural resources - new machines and equipment with reduced environmental pollution, including activities to optimize the circular use of purified water and a closed cycle of cooling water.

Funds have been invested in terminal reconstructions; floating tank roofs to limit evaporation; new trestles for bottom filling of tankers, etc. ISO 9001:2015 certification is declared.

The introduction of automatic shipment stations with their environmental efficiency is perceived as an innovation. The machines themselves are energy efficient, with monthly electricity consumption between 20 and 30 kWh.

A positive result of the implemented environmental policy is ensuring and simultaneously achieving efficient business, effective cost control, energy saving and reduction of harmful emissions.

20% of companies do not disclose information according to this criterion (for 2019). There is not even a declaration regarding the fact that the enterprise does not have the possibility or does not intend to carry out activities in connection with this.

For 2019, there is no change with what was announced by the enterprises for 2020.

For 2018, the information (non-exhaustive) in the field of courier services is less well presented. There is no change in the other sectors.

The **criterion "Impacts on natural ecosystems that lead to a flow of materials valuable to the ecosystem in the future"** ranges from 0.74 to 0.76. By year, the indicator changes as follows: for 2018 - 0.74, for 2019 - 0.72., 2020 -0.76.

It is consciously emphasized that the activity of each enterprise affects at least one component: air, soil, water. Even those that are not in the realm of polluting chemical activities, just through the use of paper documents, affect the reduction of forests and hence climate change.

Environmental inspections have been established in about 5% of companies - they control, coordinate and lead environmental activities. Detailed information is presented on green energy production covering up to 98% of the needs of demanding treatment plants.

Direct and indirect emissions into the atmosphere and intensity of greenhouse gas emissions for all three years have the same score of 0.80.

All fields are excellent, except for the gas production sector and the pharmaceutical industry.

In the printing activity, monitoring of the sources of emissions of harmful substances in the atmospheric air from stationary sources of pollution from established sampling points was carried out. No deviations from the norms were found. As a recommendation, it could be presented - to specify information about the amount of sampling points - whether they are sufficient and evenly distributed.

Accredited laboratories monitor certain processes, such as checking air content.

In the mining industry, they specifically disclose the air pollutants that are monitored in a controlled manner - emissions of dust, sulfur dioxide, nitrogen dioxide, ammonia, hydrocarbons, carbolic acid.

Naturally, the railway company reports air pollution only during repairs and construction. However, there are no specific figures for the repairs carried out for all three monitored years, as well as an analysis of the specific volume of emissions. Only environmental impact assessment procedures have been declared.

5% of companies mention that the CO2 emissions report has been successfully verified by the Ministry of Environment and Water. No complaints have been filed by citizens and legal entities against any of the companies for uncontrolled polluting activity.

Most businesses have described the main risks they face as:

- non-compliance with environmental norms and the established quality control system and non-implementation of activities to reduce pollution of the production area;

-increase in the amount of generated waste;

-need for a systematic review of the quality control system.

A company provides data on reducing pollution by reducing emissions of released pollutants. A project to reduce the use of natural gas per ton has also been implemented.

Emissions of waste gases in the atmospheric air from Phytochemical plants and Plants for solid medicinal forms are measured annually.

Effective water purification is carried out with a reduction in the volume of chemicals and reagents. Water emissions are monitored for temperature, oxygen content, lead, copper, zinc, phosphates and more. Soil monitoring is about nitrate, ammonia, phosphates, zinc, lead.

The next **criterion "Usage and conservation of natural resources and the related conservation of biological diversity"** is also key in order to protect the flora and fauna. Indicators range from 0.68 to 0.7. Narrow limits, which means that almost every year it is announced by ch.t. of volume and quality of the same type of information.

16% of the companies have less affected data according to this criterion. They either lack information entirely or it is summarized in 1 sentence. Chemical industry, courier services can be mentioned as sectors.

Contingency action plans have been developed at 13 companies. Every year, risky situations are replayed, as a result of which no significant risks have been identified. There have been no complaints from the public regarding environmental pollution.

In the nuclear power industry, all safety standards for radioactive waste storage are adhered to. Nuclear fuel is stored in special pools and special storage for this type of fuel.

When operating nuclear facilities, the principles of radiation protection, defined in the Ordinance on basic norms of radiation protection, are observed. A long-term radiation monitoring program is presented.

For the criterion **"Impact on the environment from the use of energy"** it is important to clarify that:

- ts highest overall value is 0.63 and its lowest is 0.58;
- For 2019, five companies did not provide specific data;

The leading industries in terms of volume and quality of information are the chemical industry, production, transmission and distribution of electrical energy, financial and insurance activities, postal and courier services.

The data are most comprehensive for 28% of the companies;

With a coefficient of 0.5 are 29% of the companies;

For 2019, a positive increase of 5.17% (compared to 2018) is recorded in total according to the criterion. This is mainly due to the more comprehensive information disclosed in the print activity. Again, the most useful is information released by companies in the same sectors as in 2018.

For 2019, a positive increase of 3.28% compared to the previous year stands out. The reason for this is the improvement of the indicator in the sector of financial and insurance activities.

Since 2020, two enterprises have been certified for energy efficiency - ISO 50001:2011 with an efficiently operating energy management system - a systematic approach to continuously improve energy performance, incl. and for energy efficiency. Periodic external and internal audits are carried out, declaring that the extent to which the objectives of ISO 50001:2011 have been achieved has been reached. The data for the degree itself is not available. The need for changes to the EMS has been announced, without specifically framing what they should be.

Reducing the use of energy - declarativeness - by purchasing machines that use less energy; how it affects the transport of company cars, trucks, etc. it is not mentioned - are they used with any European standards.

The main conclusion that has been announced is that the increase in energy efficiency leads to a reduction in the use of natural raw materials and a reduction in the amount of waste from them, rational redistribution of products, separate collection and disposal of waste.

Good energy efficiency practices are followed. There is a permanent tendency to reduce the energy used (for 3% of the companies), the period for buying back the investments. The plans regarding energy saving are in the guidelines:

• Determination of the annual amount of energy savings, taking into account the mutual influence of individual measures;

• Technical-economic evaluation of the proposed energy-saving measures and improvements;

• Analysis and evaluation of the annual amount of saved carbon dioxide emissions as a result of the developed measures to increase energy efficiency;

• Report on the results of the survey;

• Summary of the report on the previous point.

Measures to increase the energy efficiency of industrial systems must be brought into line with the current regulations.

Energy sources used for these 3% companies are mainly non-renewable energy sources in strict compliance with the implemented procedures for the purpose of control and rational use of natural resources.

Regarding the "**Impact on transport" criterion**, the following emphasises stand out:

➢ Light-duty and heavy-duty vehicles for courier services at the end of 2019 totaled 850 units. The practice of increasing the share of LPG cars is also increasing in 2019. Thus, the consumption of LPG reached 548,682 liters, of diesel – 1,711,243 liters, and of gasoline – 169,601 liters. An additional environmental benefit from the increase in LPG consumption is determined by the lower emissions of fine dust and nitrogen oxides from these cars. This is particularly good news for larger cities where there are many issues of this type to be resolved. Electric cars and electric tricycles are introduced. An important project is the construction of a network of automatic post offices. Vending machines have a number of advantages both for customers and in terms of the pursuit of environmental protection. Currently, the machines are located in key locations, many of which are retail locations, and allow customers to benefit from access to the machines during extended hours, as well as to combine sending and receiving packages with other tasks such as shopping.

➢ At the "Railway Infrastructure" company, 4 types of transport are announced: land, rail, sea, air, working with forwarders certified to carry out this activity. Freight forwarders have the necessary equipment to transport dangerous goods;

➢ 28% of enterprises (for 2018) do not disclose how transport affects the environment, as well as what policies they apply to limit the impact;

➢ For 2019 and 2020, we have a positive growth of 16.78%, which means that more companies rather make some declarative statements, but the information provided is not useful for consumers;

➢ 42% publish extensive data on the types of transport and their policies to reduce pollution from this factor;

➢ The remaining 30% have a coefficient of 0.5, which means that the information is not comprehensive.

Conclusion

As a result of the conducted empirical research, the following conclusions and recommendations can be made:

- Certain difficulties were found in determining the scope of companies that should prepare the Non-Financial Statement. There is no unified register for enterprises of public interest with more than 500 employees;
- There is no single sector that comprehensively discloses information on all the listed criteria;
- Apparently the most significant criteria adopted by the companies are "Waste Management" and "Environmental Impact of Polluting Substances". The information is presented comprehensively, specifically listing all pollutants related to the companies' activities.
- The overall coefficient according to criteria has the lowest value of 0.59 (ie it is not below 0.5), which means that the companies strive to inform the public, according to the requirements;
- The declarativeness of the type "all legal requirements are fulfilled" can be considered as a negative moment; "risks are observed" etc. It would be more useful to present specific data, e.g. per item sampling points, number of replaced diesel cars with ecological ones, etc.
- There is no doubt that it is extremely useful for consumers to be informed about environmental policies. Rather, however, questions can be raised about the method of disclosure (type of declarativeness or a certain degree of detail) from ch. to the fact that the information must be comparable. Otherwise, it loses its value.
- As a result of the above, it would be more useful to prepare a single methodology for quantifying the information, and this methodology needs to be consistent with the recommended nature of disclosures according to criteria;
- It is more appropriate for the criteria in the field of ecology to be unified by industry, and not generally according to the "size" of the companies - number of personnel, total amount of assets and net sales revenue. This is due to the fact that businesses, e.g. in the chemical industry, create many times greater risk to the environment than insurance companies.

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HOW DID INFOMATICS BEGIN?

Konstantin Tsvetkov
Shumen University "Bishop K. Preslavski", Faculty of Mathematics and Informatics
Summary, Bulgaria

Abstract: Informatics is a science for researching methods and processes for event, storing, treatment, analysis and estimation of the information, giving of opportunities to use it for taking decisions. It includes disciplines, concerning processing of information in the computers and computer networks. It learns: the information from a point of view of its structure, numerical characteristics, shapes and ways of reviewing; the information processes, as a composition of the main information events, also the methods and the instruments for their automation.
Keywords: informatics, etymology, informatics structure, information resources, Sumerian abacus, calculating watches, Pascaline, jukebox, electro-mechanical digital computers, computer Z1, British Colossus, Computer Atanasoff-Berry, ENIAC, Generations of computers.

Introduction

Explorative topics concerning the informatics: What can and what cannot execute in programs and database, how finds solution about specific calculation and informational tasks with maximum effectiveness, in what format should be safe an restore the information from definite type (structure and database), as programs and the people who have to communicate each other (user interface with program languages, review of knowledge) etc.

The Informatics' origin is tightly connected with mathematics, linguistic, the electronic engineering, and other sciences. During the last third of XX century it is approve as a own discipline, processing own methods and terminology.

1. Etymology

The concept "information" is primary concept, and its name comes from the Latin word "information" [1]. For the ancient Romans this word mean "imagination", "notion". Distinguishing to our days, its meaning changes to "message", "sending the message", to become a "measure of identity". In most open sense, the word "information" means records for the surrounding reality, for the processes and the events, which are around us. The term "information" is using in different areas of the human knowledge. The psychology is interested from the information and its meaning in the way of communication. The cyberneticists saw the information from the process point of view and the controlling and its meaning during making of different managing decisions. In the communication systems is significant the quantity and measuring of the information. The already assumed information allows opening the learning about the different objects and processes. In his theory Cloth Shannon looks the information as an instrument which decrease the inconclusiveness of the things.

The word "informatics" is made from "inform", "information", and "ethics" from "automatics". In English, French, Russian and German languages in 1960 year starts a tendency of replacing the term "documentation" with terms, which have in their base the word "Information" [2]. The term in German "Informatik" was integrated by the German specialist Karl Steinbuch in his article "Informatik": Automatische Informations verarbeitung (Informatics: Automatic informatics processing) 1957 year. [3]

In English the term for "documentation" as is defined from the executing burro of the association of the special libraries of the USA, is understanding that creating, sharing, and using of documents – storing information, on aperture cards, microfilms, magnetic tape [4]. It was replaced by the term "science information" (informatics sciences). It is believed, that the term "informatics" independently of the other researchers is integrated by Walter F. Bower, founder of "Informatics Inc".

It is important for us to know, that in this district is reign by factionalism. Until now, the meaning of the subject "computer sciences" (because is using the modern scientific and methodological literature) is still not confirmed and settled by the community. This is a historic record, dating since the time of appearance the computers.

For now is settled that in Europe "computer science" is called "informatics", but at this moment in USA with this word are connected, applied calculations or data and their redaction in the context of other areas [5] as bio informatics, and geo informatics.

The concept of the science is also so difficult for the common definition, as a difference for example we can give the conception of the mathematics. This is a science of applied researching, as in the area of interdisciplinary researching, and is also academic.

Despite the fact, that the informatics is comparatively new science, its origin is fastened with the work Leibnitz.

2. Informatics structure

The informatics is separated on several sections.

2.1. Theoretical informatics

It teaching of the theory about the formal languages and automats, the theory of calculable and complexity, theory of columns, cryptology, logics (including predicative logic), official semantic and also is also securing the developing of the programming languages, compilers.

2.2. Practical informatics

The practical informatics gives the basic conceptions for solving standard problems as storing and managing of information, using databases, constructing of algorithms, models of solutions of common and complex tasks. Examples for this are the algorithms for sorting and fast transforming of Fourier.

One of the centered topics of the science is the practical software engineering. This is a systematic process of developing of the idea of the ready software.

2.3. Technical informatics

The technical informatics occupies the hardware and the computer technologies, and serves as a platform of microprocessors, computer structures and distributing systems. On this way, it provides a connection with the electrical engineering. A computer informatics is a science, which studies the concept of building computers. It defines and optimizes the interaction between microprocessor, memory and peripheral controllers. Other accent is the connection between the machines. This gives electronic data exchange between computers, and therefore is a technical fundament for the Internet for developing of routers, switches and firewalls. This discipline includes developing and standardizing of the Network protocols as TCP, HTTP or SOAP for data exchange between the different machines.

2.4. Applied informatics

The applied informatics integrates specific applications of the computer sciences in different areas of the fiction or productivity, for example: business informatics, geo informatics, computer linguistic, bio informatics etc.

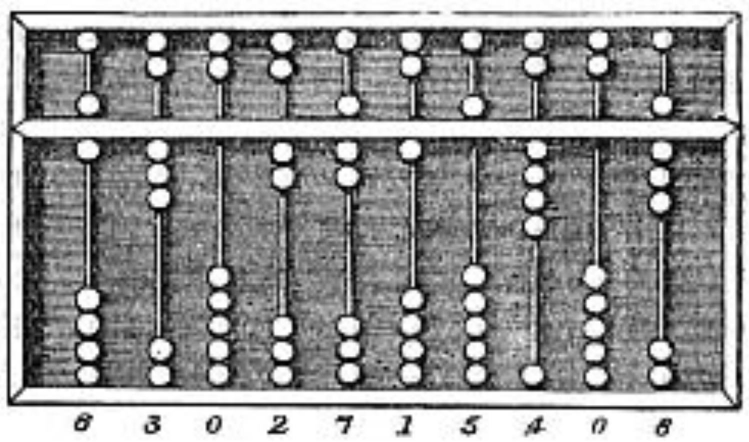
2.5. Natural informatics

The natural informatics is a science tendency and the researches are pointed in processing of the information in the nature, the brain and human society. It lays on such classic researching areas as theory of evolution, morphogenesis and developing of the biology, systems of scientific researching, brain testing, DNA, theory for control and behavior in a social group, history etc.[6].

3. Calculating devices

3.1. Early calculating devices

First calculating instruments are probably sticks, which still are using in many schools at the beginner grade for count. During the time they become more complicated, for example, like Phoenician clay figures which are intended to visualize the amount, as a convenience are situated in special containers.



Pic. 1. Abacus

The Sumerian abacus appeared between 2700 and 2300 BC. It held a table of successive columns which delimited the successive orders of magnitude of their sexagesimal (base 60) number system [7].

These devices (*plural* abaci or abacuses) are using by the merchants and the counters before. Gradually, from the simplest devices for counting are born a lot and more complicated machines: the Abacus Logarithmic ruler, the mechanical computer.

The Antikythera mechanism (/ˌæntɪkɪˈθɪərə/ AN-tih-kih-THEER-ə) is an Ancient Greek hand-powered orrery, described as the oldest known example of an analogue computer [1-3] used to predict astronomical positions and eclipses decades in advance [4-6].

It could also be used to track the four-year cycle of athletic games which was similar to an Olympiad, the cycle of the ancient Olympic Games [7-9].

Pic.2. Derek J. de Solla Price (1922–1983) with a model of the Antikythera mechanism.

Despite the simplicity of the earliest computer devices, an experienced counter can achieve a result of simple count even faster, than an owner of a modern calculator.

Of course, the productivity and the speed of the modern computer machines is a long out of the capacity of the famous human calculators.

In 1623 in Germany Wilhelm Schickard is created such called “calculating watches, which is marked as the first automatic calculators. In the letters sent to Johannes Kepler he explains, how is possible to use the device for counting of astronomical tables. The machine of Schikard, is able to add and deduct 6 letters code, alarming with sound after overfilling. In 1960 on the base of the survived sketches is made a copy of the calculator, which confirms its existence and functioning.

In 1642 a machine which helps with the calculating of numbers is invented by the great French scientist Blaise Pascal. “Pascaline”, as the creator is called it, is a mechanical device, which represents a box, full with a number of elements and has worked with typing the numbers 0-9 and has calculated with the help of a rolling handle.

Pic. 3. Summing machine of Pascal

During 1673 other famous scientists – Gottfried Wilhelm Leibnitz is producing a mechanical calculator which allow easy to be done operation as deducting, multiplying and division. In 1723 the German mathematician and astronomer Kristen Ludwig Gersten uses the base of the Leibnitz work and creates an arithmetic machine.

Around 1820 Charles Xavier Thomas creates the first successful and mass produced mechanical calculator – The Aritmometer of Thomas, with whom you are able to add, multiply, deduct and division. As a rule, the device is based on the work of Leibnitz.

The mechanical calculators which count decimal numbers have been used until 1970.

3.2. 1804: Rising of the aperture cards

In 1804 Joseph Marie Jacquard developed a loom, in which model uses the aperture cards. The series of cards can be replaced, as this replacement of the model does not demand any changes in the mechanic parts of the machine. This is important moment in the history of programming.

Pic. 4. Aperture cards on a music automat (jukebox)

3.3. 1835 – 1900s: first programming machines

The already developed in 1823 machine of Charles Babbage is intended for calculating of mathematical tables, using the principles of programming of Joseph Marie Jacquard.

On the ground of the invention of Babbage and his advises helped on the Swedish inventor Georg Scheutz, to build in 1854 some calculating machines and during 1859 he even sold one to the English Government Agency.

In 1890 the American Herman Hollerith elaborates an electrical calculating system, which has been used during counting the population of USA between 1890 – 1900. Many computing decisions for the aperture cards are used afterwards until the end of 70es of the past century.

Pic. 5. Differential analyzer, Cambridge, 1938

3.4. Appearance of analogue calculators in the postwar years

Before WWII the mechanical and the electrical analogue computers are the most modern machines and much people believed that this is the future of the computers.

The analogue computers use the advantage from the fact, that the mathematical properties of small size, as a wheel, position, tension, and electricity – are identical as in math, like in the other physical phenomena, ballistic paths, inertia, resonance, carrying of energy, inertia moment and etc. Physical phenomena using values such as voltage and electricity.

3.5. First electro-mechanical digital computers

3.5.1. The first electro-mechanical digital computers – Z series Konrad Zuse

In 1936 the young German engineer Konrad Zuse starts working on his first calculator from Z series, which have a memory and limited programming. During 1938 Konrad Zuse is built his first calculating device called Z series in the apartment of his parents. This is beta model with fully mechanical programming digital computer. The data and command input are doing with the help of a keyboard, and the exit with the help of a little lamp panel. The memory of the counter is organized from the platform of condensers. In the very same year Zuse is approaches to developing of Z2, but his plans are destroyed during the bomb attacks in the WW II.

Pic. 6. Reproduction of the computer Z1 in the museum of the technics, Berlin

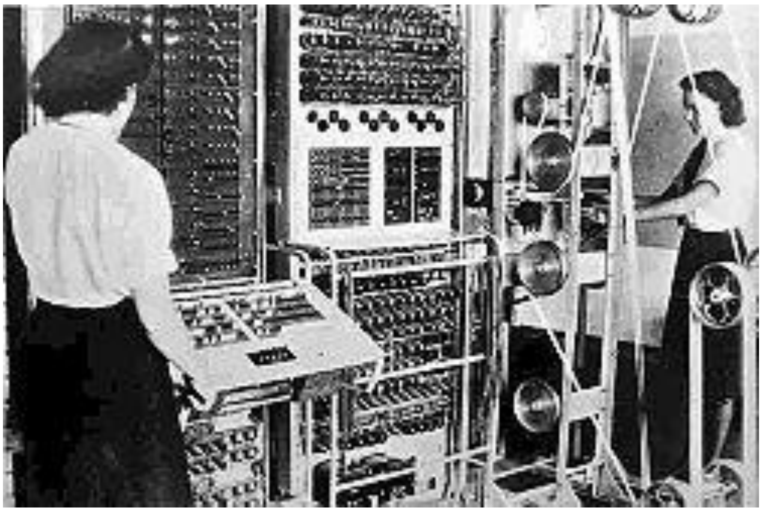
The work continues and during 1941 Zuse creates the first calculating machine, which owns all attributes of the modern computer – Z3. It is built on the platform of telephonic relays and works completely satisfactorily. On this way, Z3 is the first working computer. In many aspects, Z3 is similar like the modern machines, and for the first time it works with calculations consisting a floating comma. The complicated decimal system is replaced with binary, which is more promising and this is one of the reasons which makes Zuse to succeed there, where Babbage cannot. The programs of Z3 are stored on the aperture card. During 90-es is proved and theoretically, that Z3 represent universal computer (if the size on the physical memory is ignored).

The war interrupts the work over the machine. On September 1950 Z4 is finally completed and delivered to ETN Zurich. On this time it is the one computer in Continental Europe and the first in the World, which was sold. It left Mark I with 5 months behind and UNIVAC with ten 10 months behind. The computer works in ETN Zurich until 1955, after that was transferred in the French Aerodynamic Research Institute near Basel, where he worked until 1960.

3.5.2. The British Colossus

During the WW II, Britain has achieved some progress in destroying of encrypted German messages and this is due to the project called "Colossus". The main idea of for the machine is elaborated by Alan Mathison Turing and Gordon Welchman, and the specification for it is worked out by Professor Max Neumann and his colleagues. The assembling of the machine is made in Research laboratory of The Post Department in London and it takes 11 months from the time of Tommy Flowers and Dr. "Colossus" is the first completely digital calculating device, despite is impossible to execute every calculating function.

In Colossus are used a lot of vacuum lamps, and he input data is entered with aperture cards. The machine can be configured on such way to execute different operations on Boolean logic, but this is not a fully Turing's machine. Despite Colossus Mk I, there are other nine models Mk II. The information about the existence of this machine is kept in secret until 1970. Winston Churchill signed by himself the order for destroying the machine to a stage which cannot overpass the size of human hand. Thanks to its secret, Colossus is not mention in many labors of the history of the computers.



Pic. 7. Colossus

3.5.3. The American treatment

In 1937 Cloth Shannon makes the connection between the conceptions for the Boolean logic and some digital schemes, which now is commonly used in the digital computers. While working in the Massachusetts Technological Institute in the platform of his jobs, he demonstrates that the electronic communication and the keys are part of the Boolean algebra. On November 1937 George Stibitz finalizes computer called "Model K" in Bell Labs, following the relays keys. On 8^{th} of January 1940 is developed Complex Number Calculator, which can execute calculations with complex numbers. On 11th September 1940 in Dartmouth College a demonstration made during the conference of American Mathematics Society, Stibitz send remote computer commands, on telephone line from teletype.

Pic. 8. Model K

This is the first case on remote using of computing commands. Among the participants and the witnesses of the demonstration are John Von Neumann, John Mouchli, Norbert Wiener, who writes what they have seen in their memoirs.

The following developing of the computers is connected with the name of John Von Neumann, who in 1945 defines the basic conception for storing the program in the memory of the machine. Principles for building a computer – formulated by John Von Neumann:

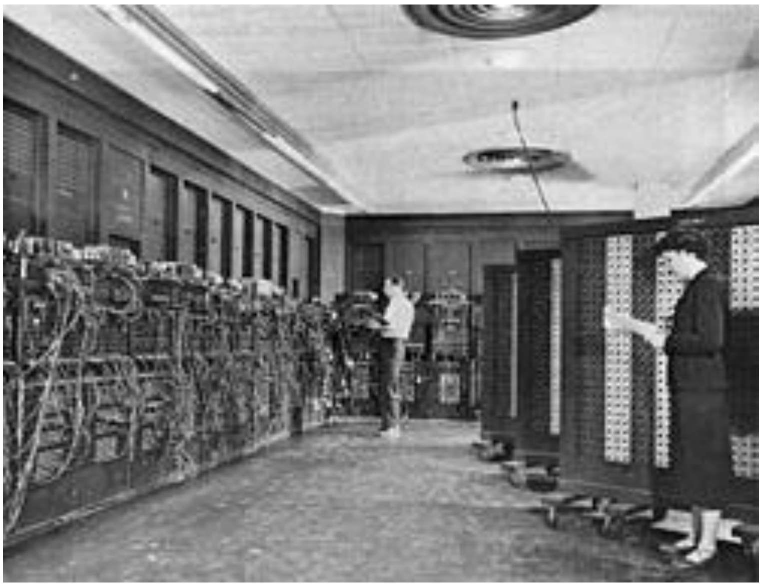
- The computer is an electronic device which uses a binary code.
- The computer works under the control of a program, based on instructions, which are stored in one same linear, one-dimensional and consecutively directed memory.
- The memory is directing using numbers of the separate cells without to take in mind the type of the data in them.
- There is no clear difference between the data and the instructions of the programs in the memory, the identification of their sturgeon during executing of the programs. The Computer executes the instructions consecutively, after reading the memory.

3.5.4. The Computer Atanasoff-Berry

In 1939 John Vincent Atanasoff and Clifford Berry from the University of the State Iowa developed Atanasoff-Berry Computer (ABC). This is the first electronic digital computer in the World. The construction counts more than 300 electric-vacuum lamps, and the role of memory is taken by a rolling drum. Despite, that the machine ABC was not a programming device, it is the first which uses electric lamps in the adder.

John Vincent Atanasoff is an American physician, mathematician and electric engineer from Bulgarian origin, creator of the first electronic computer.

During the WW II is built the computer ENIAC (Electronic Numerical Integrator and Calculator) with the purpose to calculate ballistic tables for the needs of the American army. Finalized in 1945 from John Mauchly and John Prosper Eckert is believed that this is the first computer until 1973.



Pic. 9. ENIAC

4. Generations of computers

From the beginning of the 50’es to the end 90’es years the main influence over the developing of the computers causes the level of electronic technics. At this point it can be marked 4 generations of computers:

The First Generation digital computers (1951-1959) are constructed with electronic lamps and works only on machinery language. The control of their calculating process is executing by a human operator.

Second Generation computers (1959-1969) are constructed with transistors, a high level programming languages as (Basic, FORTRAN) are integrated in them.

Third Generation computers (1965-1971) are constructed from integral schemes with low stage of integration. In them there are a lot of innovative decisions for this time – higher level of programming languages (Pascal), the first finalized operation systems (OS), providing the control of the computers with minimal intervention from the human operator’s side.

Fourth Generation computers (after 1975), are constructed with huge and enormous integral schemes and microprocessors which allows integrating of microcomputers in such areas, where it was impossible earlier. The modern computers are elaborated on the platform of the universal microprocessors with possibilities for working at the very same time of 32 or 64 ranks binary numbers. Continuously their possibilities are improved.

The Fifth Generation Computer Systems (**FGCS**) was a 10-year initiative begun in 1982 by Japan's Ministry of International Trade and Industry (MITI) to create computers using massively parallel computing and logic programming. It aimed to create an "epoch-making computer" with supercomputer-like performance and to provide a platform for future developments in artificial intelligence. FGCS was ahead of its time, and its excessive ambitions led to commercial failure. However on a theoretical level, the project spurred the development of concurrent logic programming. The term "fifth generation" was intended to convey the system as being advanced: In the history of computing hardware, there were four "generations" of computers. Computers using vacuum tubes were called the first generation; transistors and diodes, the second; integrated circuits, the third; and those using microprocessors, the fourth. Whereas previous computer generations had focused on increasing the number of logic elements in a single CPU, the fifth generation, it was widely believed at the time, would instead turn to massive numbers of CPUs to gain performance.

Future Generation Computer Systems is a monthly peer-reviewed scientific journal covering all aspects of computer engineering. It is published by Elsevier and the editor-in-chief is Michela Taufer (University of Tennessee). According to the Journal Citation Reports, the journal had a 2019 impact factor of 7.187.[17]

Conclusion

The Informatics is a young subject, which studies the questions, regarding searching, collecting, storing, transforming and using an information in different areas of the human activity. Genetic, the Informatics is connected with the computer sciences, the engineer sciences, the computer systems and networks, because it allows the computers to generate, store, and process the information automatically in such volume, the science approaching of process the information become necessary and possible together.

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INTEGRATIVE THERAPEUTIC METHOD FOR SARS-CoV-2 INFECTION COMBINING FLAVONOID-BASED TRADITIONAL MEDICINE AND SILVER NANOPARTICLES

Dimitar Yakimov[1], Vessela Baltova[2], Wolfgang Lupke[1], Valentin Stoyanov[3], Bogdana Mateva[3]

[1]University of agribusiness and rural development, Plovdiv, Bulgaria
[2] Center for Holistic Health and Detox “HomeoArt” – Sofia
[3] Center of Nutrition and Integrative Phytotherapy "Herbalkan" – Berkovitsa

Abstract: There are evidences that flavonoids bind to and affect neutrophiles, eosinophils and macrophages. In SARS-CoV-2, the cellular immune response, especially in the first two to three weeks after infection, is expressed by the accumulation at the infection site of at most white blood cell eosinophils, neutrophiles, and monocytes/macrophages.

There have been numerous in *vitro* and *in vivo* studies on the antiviral activity of silver and copper nanoparticles, including in coronavirus infection. The our theoretical idea is that the silver nanoparticles or silver cations are transported by chelation from flavonoids to those white blood cells of the Cell-mediated immunity which are directly involved in the infection.

It was obtained and studied on Covid-19 infection a therapeutic mixture made by a controlled combining of wild basil (*Clinopodium vulgare* L.) tincture (66%, v/v) and other extracts of herbs rich in flavonoid and chlorogenic acid derivatives with a colloidal solution of silver nanoparticles and cations. It was found that the passing of the symptoms typical for the infection is for 3 to 10 days after the start of the treatment course. The highest percentage of patients with passed symptoms was reported from day 4 to day 6 (incl.) after initiation of dosing if therapy was initiated from day 1 to day 4 of the first symptoms. Based on this study, a Utility model "Composition for the treatment of coronaviruses" was registered with the Patent Office of the Republic of Bulgaria.

Keywords: flavonoid chelate complexes, silver nanoparticles, silver cations, SARS-CoV-2, cell-mediated immunity.

Резюме: Съществуват доказателства, че някои флавоноиди се свързват и взаимодействат с неутрофили, еозинофили и макрофаги. При Covid-19 клетъчният имунен отговор, особено през първите две до три седмици след инфекцията, се изразява с натрупване на мястото на инфекцията най-много от белите кръвни клетки еозинофили, неутрофили и моноцити/ макрофаги.

Има многобройни in vitro и in vivo проучвания за антивирусната активност на сребърни и медни наночастици, включително при коронавирусна инфекция. Нашата теоретична идея е, че сребърни наночастици или сребърни катиони се транспортират чрез хелатиране от съединения на флавоноидния ред до онези бели кръвни клетки от клетъчния имунитет, които са пряко участващи в инфекцията.

Беше получена и изследвана при инфекция с SARS-CoV-2 терапевтична смес, направена при контролирано комбиниране на тинктура (66%, v/v) от котешка стъпка (*Clinopodium vulgare* L.) и други екстракти от билки, богати на флавоноиди и производни на хлорогенна киселина, с колоиден разтвор на сребърни наночастици и катиони. Установено е, че преминаването на характерните за инфекцията симптоми е от 3 до 10 дни след началото на курса на лечение. Най-високият процент пациенти с преминали симптоми е отчетен от ден 4 до ден 6 (вкл.) след започване на приема, ако терапията е започнала от първи до четвърти ден след първите симптоми. Въз основа на това проучване в Патентното ведомство на Република България е регистриран полезен модел „Състав за терапия на коронавируси".

Introduction

Following the SARS-CoV pandemic and the efficacy of plant extracts containing large amounts of flavonoids, phenolic acids and other phenols, interest in their potential therapeutic use is focused on the SARS-CoV-2 virus (Russo, Maria *et al*., 2020). Given the impact of the COVID-19 outbreak in China, it was expected that Traditional Chinese Medicine (TCM) could play a major role in the treatment of SARS-CoV-2 infection or at least in alleviating its symptoms. In this regard, by February 22, 2020, along with standard drug treatment, another treatment through TCM against COVID-19 was carried out in China in 60,107 patients. It was found that 92% of those infected with TCM reduced the recovery period by about 2 days, depending on the degree of development of the disease. Patients with mild clinical manifestations were in most cases treated with TCM alone. Only 5% of patients showed worse clinical signs (Publ. Dep. of the People's R. of China, 2020).

The Qingfei Paidu Decoction (QPD) formula is one of the most applied in this national study involving several thousand doctors. As a result of its effective effect, QPD is established as a prescription by the National Health Commission of the Republic of China in the sixth edition of the "Guide to Diagnosis and Therapy in Covid-19". This formula consists of 21 components – herbs and minerals. Its administration showed an effectiveness of 92% in patients at all stages of disease development, including people cured and discharged. And in cases where clinical symptoms have disappeared, people remain stable without deterioration or significant improvement (Yang *et al*., 2020). The beneficial effects of QPD are evident after 6 days of treatment with results of chest computed tomography in which the tracheobronchial shadow is normal, and the inflammation is also suppressed, following the theory and practice of QPD application (Ren *et al*., 2020). In an attempt to identify the main components of QPD and investigate its pharmacological mechanism against COVID-19 infection, Yang *et al.* (2020) applied an integrated multidisciplinary approach – *in silico* method, which includes a pharmacological network and a molecular network of chemical analysis data. The UPLC-MS team identified in QPD 129 compounds grouped into 14 groups, where flavonoids accounted for about 45% of all groups, 15% glycosides, 10% carboxylic acids, 5% saponins and less than 3% terpenoids.

The action of various representatives of the flavonoid subgroups to suppress the development of viral infection by SARS-CoV 2 may be manifested by various cellular and biochemical mechanisms. One of them is the suppression of enzymes in the coronavirus cycle of infection. One of the main enzymes providing functional (non-structural) components of the virus is thought to be PL ^{pro} in SARS-CoV 2 and 3CL^{pro} in SARS-CoV (Dai *et al.*, 2020). Other significant non-structural proteins of SARS-CoV-2 for its reproducible cycle are RNA-dependent DNA polymerase (RdRp) and helicase (Li and Clercq, 2020). SARS-CoV 2 PL^{pro} was found to be significantly inhibited by the flavonoids tomatine A-E (IC50 = 5.0-14.4 µM) (Cho *et al.*, 2013), bavachin, neobavaisoflavone, isobavachalcone, 4′ -O-methylbavachalcone, psoralidin, corylifol A (IC50 = 4.2-38.4 µM) (Kim *et al.*, 2014), quercetin, gallocatechin gallate, epigallocatechin gallate (IC50 = 47-73 µM) (Nguyen *et al*., 2012), papyriflavonol A (IC50 = 3.7 µM) (Park *et al*., 2017), Xanthoangelol E (IC50 = 1.2 µM) (Park *et al*., 2016) and other flavonoid representatives (Russo *et al*., 2020). NTP-ase/helicase possesses dsDNA looping activity as well as ATPase activity, allowing the helicase to translocate with nucleic acids by hydrolyzing ATP. According to Lee *et al.* (2009) quercetin, at IC50 = 8.1 µM, inhibits SARS-CoV NTP-ase/helicase-based double-stranded DNA looping. And myricitin and scutularin are effective inhibitors of ATP-nitrogenactivity of helicase at IC50 values 2.71 and 0.86 µM, respectively (Yu *et al.*, 2012). Miricitin and several glycosides of quercetin, as well as other phenolic compounds, exhibit both ACE2 and ACEIn inhibitory action (Kumar *et al*., 2013; Patten *et al*., 2016; Joshi *et al*, 2020; Khaerunnisa *et al.,* 2020; Antonio *et al*., 2020)

So far, evidence of inhibition of different stages of the coronavirus cycle of reproduction has been provided. In addition, studies have been carried out on dozens of compounds by *computer* molecular scanning for their potential impact of certain cellular mechanisms in coronavirus infection. TMPRSS-2 is already known to be involved in inoculation and replication of the virus influenza, SARS-CoV, SARS-CoV-2. Through the *in silico* method, several authors have suggested that several flavonoids have the potential to bind to TMPRSS-2, with particular reference to silibin /flavonolignan from milk thistle (*Silybum marianum* L.)/ (Pandit and Latha, 2020) and isogemichalcone B /(e.g. in representatives of the genus breadfruit (*Artocarpus)* / (Rahman *et al*., 2020).

Theoretical prerequisites for the establishment of the therapeutic approach

Many of the representatives of flavonoids have anti-inflammatory, antihypertensive, antiangiogenic, hepatoprotective, antioxidant, neuroprotective and other actions in humans and animals (Kumar and Pandey, 2013). Particularly effective in viral infections, incl. Influenza A, subtype (H1N1, H5N2, H7N3 and H9N2) (Pantev *et al*.), SARS-CoV (Jo et al., 2020), SARS-CoV-2 (Cherrak *et al.,* 2020; Russo *et al*., 2020). Respiratory Syncytial Virus, Herpes simplex virus type 1 and 2, etc.[28,29,30] are the subgroups flavonols, flavones, isoflavones, chalcones (Zakaryan *et al*., 2017; Jo *et al*., 2020; Zandi *et al*., 2011).

It is appropriate to present at least some aspects concerning the pharmacokinetics of flavonoids when interacting with certain leukocytes and their involvement in the cellular immune response. In the small and large intestine, flavonoids enter in their glycosidic or aglyconic form. Aglycons passively cross the intestinal barrier, while the transfer of flavonoid glycosides takes place via sodium-glucose-counter transporter-1 (Murota and Terao, 2003). Aglyconic forms were administered orally in native form or converted to such forms by enzymes hydrolyzing and releasing the glycoside residue. These enzymes are excreted by enterocytes and microbial flora in the gut (Murota *et al*., 2018). In enterocytes or hepatocytes, aglycons are metabolised into glucuronidated, sulphated and/or methylated flavonoids (Day *et al*., 1998). Glucuronidated forms of flavonoids are the most common representatives of flavonoids in lymphatic flow and blood plasma (Murota *et al.*, 2013). The lymphatic components and the flavonoids merge into the bloodstream through the thoracic canal. Quercetin has been reported to accumulate in rats in their lungs (Boer *et al*., 2005). There is credible evidence that flavonoids bind to and affect neurophiles (Amirova *et al*., 2019; Tordera *et al*., 1994; Kaneko *et al*., 2017), eosinophils (Weng *et al*., 2008; Middleton, 1998) and macrophages (Mendes *et al*., 2019).

In SARS-CoV 2 (Covid-19), the cellular immune response, especially in the first two to three weeks after infection, is expressed by the accumulation at the infection site of at most white blood cell eosinophils, neutrophils, and monocytes/macrophages (Qin *et al*., 2020; Gómez-Rial *et al*., 2020; Sambataro *et al*., 2020; Baker an Rogge, 2020)˙. Neutralisation of the virus is induced there, as well as inflammatory and other reactions. At the same time, a decrease in the amount of these types of leukocytes is reported in the blood plasma in most cases. (Qin C *et al*., 2020; Gómez-Rial *et al*., 2020). This predominant reduction in blood samples of some types of white blood cells occurs in the majority of cases, and there is often a reduction in the first days after infection of other leukocytes, e.g. basophils.

The mechanism of action of different flavonoids on white blood cells may be different. Metabolic processes (in terms of pharmacodynamics) proposed to reflect flavonoid-mediated immunomodulation of macrophages include a decrease in glycolytic activity observed for all flavonoids tested; increased antioxidant protection; anti-inflammatory reprogramming of the Krebs Cycle (mainly by quercetin); osmotic regulation (by naringin) and membrane modification (by naringenin) (Gómez-Rial *et al*., 2020). It is also essential that several isoflavones bind to macrophage's estrogen receptors (Mendes *et al*., 2019; Kaneko *et al*., 2015) as well as B cells, CD4+ T cells, CD8+ T cells, NK cells, plasma dendritic cells, monocytes and monocyte-derived dendritic cells (Kovats, 2015). The estrogen receptors of macrophage of are characteristic in both women and men (Bhatia *et al*., 2014).

The chemical composition of the herb wild basil (*Clinopodium vulgare L.*) collected in the Rhodope Mountains and/or in the vicinity of the town of Sofia at the stage of butonization – beginning of flowering shows a high content of flavonoids and other phenol compounds (Nikolova, 2011; Dagnon *et al.*, 2018). Flavones, rosmarinic acid, flavonols (Dagnon *et al.*, 2018) add chlorogenic acid (Bardarov, 2016; Amirova, 2019) predominate.

There are also studies that chlorogenic acid derivatives: caffeic acid, rosemary acid, chicoric acid, etc. have antiviral properties against Herpes simplex virus (HSV), Influenza A and immunodeficiency virus (HIV) (Utsunomiya H *et al*., 2014; Langland *et al*., 2018). However, the results of studies reported that the antiviral activity of caffeic acid increased more than 100-fold by adding cations such as Fe^{3+} or anions such as molybdate and phosphate (Langland *et al*., 2018). Tests for cellular toxicity of coffee acid chelates have shown that they have low toxicity. Coffee acid in chelate form with Fe^{3+} has been tested against eight strains of viruses, including from different families. Coffee acid chelates are mostly effective against HSV-1 and HSV-2, but also exhibit moderate activity against Vaccinia virus and VSV-Ebola pseudotyped virus.

Data on the high chelating ability of many subtypes of the flavonoids with metal ions, such as Cu^{2+}, $Fe^{2+,}$ Fe^{3+}, Zn^{2+}, is presented in many sources (Malešev and Kuntic, 2017). These cations are themselves oxidizers. However, most of their chelate complexes with flavonoids have higher antioxidant activity than the same flavonoids that are not bound to cations (Bravo and Anacona, 2001; Mishra *et al*., 2005; Dolatabadi, 2011; Malešev and Kuntic, 2017).

There have been numerous in *vitro* and *in vivo* studies on the antiviral activity of silver (Galdiero *et al*., 2011) and copper nanoparticles, including in coronavirus infection (Jagaran and Singh, 2021; Jeremiah *et al*., 2020).

In addition to metal cations, however, there is also evidence that some flavonoids also form complexes with metal nanoparticles through their free π-electrons and a carbonyl group. Quercetin and centin have the strong chelating ability with copper nanoparticles (Din *et al*., 2017). Quercetin can also bind, cover and stabilize already obtained silver nanochatics (Shujahadeen *et al*., 2019). The same applies to flavonoid-rich flax seed extract (*Linum usitatissimum L.)* (Ajum and Abbasi, 2016; Hussain *et al.*, 2017). and coral vine extract (*Antigonon leptopus*) (Ajum and Abbasi, 2016).

The aim of this investigation is to obtain and study on Covid-19 infected people the therapeutic mixture obtained by a controlled combination of wild basil tincture and other extracts of herbs rich in flavonoids with a colloidal solution of silver nanoparticles and cations.

Material and Methods

Silver nanoparticles and herb extracts

The silver colloidal solutions as a mixture of NP and cations are obtained by electrolysis and are a product of the company The Colloidal Company, England. The aqueous colloidal solution (25 ppm) is a mixture of silver nanoparticles (NP) and silver cations in a ratio of about 50:50 and is labelled as "silver water". The intake is according to the daily dose specified by the manufacturer, which is 2 times 8 ml per day.

Wild basil (*Clinopodium vulgare* L.) and the herbs contained in the extract with a trade name AI10HERB are collected in the region of Berkovitsa town. The ratio of dry herbs to ethanol-aqueous extractant is 1:10. AI10HERB consists of ethanol-water extract (66%, v/v) from Elderberry (*Sambucus nigra*), White thistle (*Silybum marianum*), Hoary willowherb (*Epilobium parviflorum*), Common nettle (*Urtica dioica*), Medical marsh mallow root (*Althaea Officinalis*), Ginger root (*Zingiber officinale*), Broadleaf plantain (*Plantago major*), Curcuma longa (*Curcuma longa*), Mead wort root (*Filipendula ulmaria*).

Preparation of chelate complexes

To 8 ml of silver water add 20-30 ml of distilled water heated to 60-70 degrees Celsius. Immediately afterwards, 35-39 drops of 66% tincture of Wild basil are added and after 15 minutes of stirring periodically 40-45 drops of tincture AI10HERB of the company Herbalkan Ltd., are added. The described doses are for one intake. Daily intake is two doses.

Treatment study

The two-stage study was conducted: I experimental period (stage) – 20.10-20.12.2020; II experimental period (stage) was additionally conducted because of validation experience – 15.01-28.02.2021.

Stage I: Randomized 37 volunteers in the study group (cohort) and 23 in the control group were enrolled. The effect of the therapeutic method was reported by clinical symptoms characteristic of the virus. An RT-PCR test was performed in all 37 patients and a positive test result was found. Volunteers are between 14 and 65 years old. Except for one participant at 14, the rest are in the range 32-65 years – an average of 43 years. In all participants, the use of this method was started between the first and the fourth day of the first symptoms, with *two or more of the following: fatigue, muscle pain, fever, decreased sense of smell, cough, anaemic-like symptoms*. It is reported on which consecutive day of the beginning of the treatment all the symptoms have passed established at the beginning of the course.

Volunteers between 26 and 63 years were enrolled for the control group – 44.5 years on average. An RT-PCR test was performed in all 23 patients.

Participants from both the control group and the experienced treatment group sought medical examination at the first symptoms, which was predominantly from the Family practice doctors. All subjects were assigned outpatient treatment according to the following model, which was administered equally in the experimental and control groups: zinc glucuronate, selenium methionine, vit. C, vit. D3 and probiotics in the recommended daily doses specified by the manufacturer; also 3 pcs. (1 morning and 2 evenings) Aspirin Protect 100 mg in case the patient does not take other anticoagulants. The patients in the control group who had continued symptoms until day 9, on our recommendation, sought rehabilitation and some of them were hospitalized. Most of the patients in the two consecutive control groups received inpatient treatment according to a treatment protocol from that hospital. We cannot give a specific figure for the number of hospitalized patients. According to the model /protocol/ for therapy presented in this article, applied in the trial group, only out of hospital treatment under periodic supervision by a doctor has been carried out. There were no fatalities in the experimental or control groups.

Stage II: Randomized 87 volunteers in the trial group and 25 in the control group were enrolled. An RT-PCR test was performed in all patients The experimental group had an age range of 21-73 years (average 47 years) and the control group – 19-68 years (average 43.5 years). Again, in the experimental and control groups, an identical treatment protocol is applied as for Stage I. It is reported on which consecutive day of the beginning of the treatment all the symptoms have passed established at the beginning.

The statistical processing – by student's t-test using SPSS statistics (Kim, 2015) with Ms Office Excel 2010.

Results and Discussion

Passage of the symptoms of the participants in the trial group at experimental period I is for 3 to 9 days after the start of the treatment course. From the data in table 1, the highest percentage of patients with passing symptoms was reported to be from the 4-th to the 6-th day (incl.) after the start of dosing – 70.3% (26 people), and the total for the period from the 3-rd to the 6-th day was about 75% (28 people). On the 7-th and 8-th days without symptoms were 21.6% (8 people) and on the 9-th day – 2.7% (1 person). *For the 10 days of therapy, only a positive effect in terms of the passage of COVID-19 typical symptoms in subjects was reported.*

In the control group, the participants with passed symptoms, except for 2 patients, was between the 13-th and the 26-th from the start of therapy, assigned by the respective attending physician whom they chose to visit. The majority of the symptomatic control group were 17-24 days. A reliable difference of the experimental sleep control variant is reported at $p \leq 0.001$.

Passage of the symptom of the participants in the trial group of the II experimental period is for 4 to 10 days after the start of the treatment course. The data in table 1 reported that the highest percentage of patients with passing symptom was from the 4th to the 6th day (incl.) after the start of dosing – 60.9% (53 people); for the 7th-8th day without symptoms were 33.3% (29 people) and for the 9th-10th day – 5 people. A reliable difference of the experimental sleep control variant is reported at $p \leq 0.001$.

Table 1. Time by number of days from the beginning of the therapeutic course to pass the symptoms characteristic of SARS-CoV-2

	I experimental period		**II experimental period**	
	Trial Group Participants with resolved symptoms, n=37	**Control group** Participants with resolved symptoms, n=23	**Trial Group** Participants with resolved symptoms, n=87	**Control group** Participants with passed symptoms, n=25
3rd day	2 (5.4%)			
4th - 6th day	26 (70.3%)		53 (60.9%)	
7th - 8th day	8 (21.6%)		29 (33.3%)	
9th - 10th day	1 (2.7%)		5 (5.7%)	1 (4.0%)
11 -16 day		2 (8.7%)		4 (16.0%)
17 - 22 day		15 (65.2%)		13 (52.0%)
23rd - 26th day		6 (26.1%)		7 (28.0%)
Mean day in order from the start of the Symptom Pass, Mean ± SD	*** 5.9 ± 1.25	20.4 ± 3.50	*** 6.4 ± 1.44	19.1 ± 4.34

Legend: $p \leq 0,05$ *(* *);* $p \leq 0,01$ *(* *);* $p \leq 0,001$ *(* * *)*

Our idea is that the elements effectively acting against the virus silver or copper (whether in the form of nanoparticles or free ions) are transported by chelation from compounds of the flavonoid order to those white blood cells of the cellular immune response that are directly involved in the infection and are in direct interaction with the virus. In addition to the effect, non-metal bound flavonoids have been shown to limit the replication cycle of the virus, as well as anti-inflammatory and other related actions (see introduction). We found that the pH of the mixture tincture of feline step + colloidal water in the given proportion is slightly above 7 and it is suitable for the formation of stable chelate complexes. The rationale for establishing this treatment method for certain aspects of the pharmacokinetics of the administered agents are also presented in this material.

Passage of the symptoms of the subjects in the experimental group at experimental period I is for 3 to 9 days after the start of the treatment course. The highest percentage of patients with resolved symptoms is reported from the 4th to the 6th day (incl.) after the start of the intake – 70.3% and the total for the period from the 3rd to the 6th day is about 75%. In the II experimental period, the passage of the symptoms is for 4 to 10 days, with the highest percentage for the 4th to 6th day after the start of the intake – 60.9%. Our opinion is that the applied mixture according to the author's method gives convincingly good results for claiming that it is suitable for significant assistance in the treatment after Covid-19 infection. The opinion is based on the percentage of infected patients with passed symptoms for the reporting periods compared to a control group.

Conclusions

The mixture obtained by a controlled combination of wild basil tincture and other herb extracts rich in flavonoids, with silver colloidal water, have been shown to improve the healing process in case of SARS-CoV-2 infection.

It was found that the passing of the symptoms typical for the infection is for 3 to 10 days after the start of the treatment course. The highest percentage of patients with passed symptoms was reported from day 4 to day 6 (incl.) after the start of treatment, if the therapy was initiated from day 1 to day 4 of the first symptoms.

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IMPLEMENTATION OF METHODS FOR MONITORING AND CONTROL OF ENEMIES IN AGRICULTURE

Teodora Ilieva
University of agribusiness and rural development, Plovdiv, Bulgaria

Anna Karova
Agricultural University, Plovdiv, Bulgaria

Abstract: One of the most important steps for the implementation of efficient plant protection activities is the accurate determination of the phytosanitary status of the crops and the identification of pests using appropriate methods. A good agricultural plant protection program is the key to making environmentally sound pest management decisions. The need for control and the impact are determined by monitoring pest populations and providing information on their density, population dynamics, and developmental stages. One of the ways is the use of sticky panels for monitoring and traps, which reduce the use of plant protection products and at the same time protect the environment. In this way, modifying agricultural practices and getting closer to nature will help sustainably develop the farm.

Key words: pest monitoring, sticky tapes, sticky boards, traps.

ВНЕДРЯВАНЕ НА МЕТОДИ ЗА МОНИТОРИНГ И КОНТРОЛ НА НЕПРИЯТЕЛИТЕ В ЗЕМЕДЕЛИЕТО

Теодора Илиева
Висше училище по агробизнес и развитие на регионите, Пловдив

Анна Карова
Аграрен Университет, Пловдив

Резюме: Една от най-важните стъпки за провеждането на ефикасни растително-защитни дейности е точното определяне на фитосанитарното състояние на посевите и идентифициране на вредителите с помощта на подходящи методи и средства.

Добрата програма за растителна защита в земеделието е ключът към вземането на екологично обосновани решения за управление на вредителите. Необходимостта от контрол и въздействието се определят чрез наблюдение на популациите от вредители, което предоставя информация за тяхната поява, плътност, популационна динамика и етапи на развитие. Едни от най-широко прилаганите способи включват използване на лепливи плоскости и капани за мониторинг и за директна борба, посредством които се редуцира употребата на продукти за растителна защита и същевременно се опазва околната среда. По този начин модифицирането на селскостопанските практики и приближаването към природата спомага за устойчивото развитите на стопанството.

Ключови думи: мониторинг, лепливи ленти, лепливи плоскости, капани

Въведение

Опазването на здравето на хората и възстановяването и поддържането на екологичното равновесие в агроекосистемите и природата са приоритети в съвременното земеделие, което в значителна степен се повлиява от дозата и честотата на приложение на синтетични пестициди. Остатъчните количества от тях излагат на риск не само хората, но и животните и фуража за тяхното изхранване (Nesser et al., 2016; Jepson et al., 2020). Освен това те могат да доведат до резистентност в популациите на вредителите (Sawadogo et al., 2020) и да повлияят отрицателно върху нецелевите организми като опрашители и естествени неприятели (Losey et al., 2006; Chaplin-Kramen et al.; 2011 Kennedy, 2013). Нарушаването на равновесието в природата и намаляването на естествените врагове води до намножаване на вредителите, въпреки третирането със синтетични пестициди (Janssen and van Rijn, 2021), което е широко докладван проблем, свързан с тяхната употреба (Guedes, 2016). Това налага търсенето на алтернативни методи и средства за решаване на проблемите с вредителите и запазване качеството на продукцията. Ефикасност в това направление може да бъде постигната посредством използването на средства за мониторинг, като различни цветове лепливи плоскости, ленти и видове капани, които оказват и частичен контрол с улавянето на индивидите.

Защо е необходим мониторинг на неприятелите в посевите и насажденията?

Земеделските култури се нападат от голям брой неприятели и причинители на болести, които при липса на подходяща стратегия за контрол, могат да доведат до значително намаляване на качеството и количеството на добивите, както и на цялостната устойчивост на агроекосистемите. Все още растителнозащитните стратегии разчитат до голяма степен на химичния контрол, но съвременните агроекологични подходи изискват активиране на биологичните процеси за доставка на екосистемни услуги и намаляване на употребата на пестициди. Така в съвременните системи на земеделие като биологично производство, биодинамично земеделие, агролесовъдни системи, интегрирано производство, стратегиите за управление на вредителите имат за цел да намалят негативното влияние върху околната среда, като осигурят максимални добиви и намалят разходите (Ehler, 2006).

Земеделието в последните години изпитва все по-силни негативни ефекти от климатичните промени, като мониторингът и контролът на вредителите не правят изключение. Особено силно се повлияват вредните насекоми, тъй като измененията в температурата пряко засягат тяхната биология и екология, включително размножаването, динамиката на популационната плътност, разпространението и взаимодействието им с техните естествени неприятели. Насекомите бързо се адаптират към новите условия и инвазивните видове завладяват нови територии.

В борбата с неприятелите по земеделските култури от съществено значение е времето на третиране на растенията с продукти за растителна защита. Сигурен и надежден метод е използването на прогноза и сигнализация у нас чрез "Бюлетин за поява, развитие, разпространение и сигнализиране на сроковете и начините за борба с вредителите по земеделските култури" за определен период – седмица или месец, издаван от специалистите по растителна защита към областните дирекции по безопасност на храните (ОДБХ). Бюлетините са полезен инструмент за информираност на производителите, но трябва да се отчита фактът, че всяко стопанство се характеризира със специфичен микроклимат, неприятели и степен на нападение. Преките наблюдения за степента на повреда по растенията не могат да дадат точна преценка за популацията и определяне момента на третиране и в стремежа си да опазят продукцията земеделските стопани извършват понякога повече от нужните третирания на растенията с продукти за растителна защита, което от своя страна оскъпява производството. Този проблем може да бъде решен чрез похватите на мониторинга – използване на лепливи плоскости и ленти, както и различни видове капани, чрез които се проследява състоянието на популациите и се определят подходящи средства за защита – интродуциране на биоагенти или употреба на продукти за растителна защита. В допълнение по този начин може да се ограничи и плътността на неприятелите.

Ползите от мониторинг на неприятелите

Оптималното планиране и провеждане на растително-защитни мероприятия е трудна задача и изисква богат опит, комплексен подход и дългосрочна концепция. Болестите и неприятелите причиняват най-сериозните проблеми по културните растения, като намаляват значително получените добиви и пазарната им стойност. Въпреки че прилагането на химични методи е характерно най-вече за интензивното конвенционално производство, а в интегрираните системи и особено в биологичните стопанства приоритет са превантивните мерки, мониторингът е в основата на ефективното и успешно опазване на растителното здраве. Целта на растителната защита при биологичното земеделие е не да унищожи вредителите (плевели, болести и неприятели), а да предотврати щетите от тях и да ги контролира под праговете на икономическа вредност. В биологичното производство вредните и полезните видове се поддържат в динамично равновесие и се възприемат като елементи на биоразнообразието. При преход към биологично производство подходите за растителна защита изискват замяна на синтетичните неразрешени пестициди не с разрешени такива, а с биологични процеси и оптимално използване на екосистемните услуги. Насърчаването на екосистемните услуги може да увеличи възможностите за устойчиво оптимизиране на селскостопанското производство и за производство на здравословни земеделски продукти и храни, които не съдържат остатъчни вещества от пестициди. Извършването на своевременен мониторинг е от съществено значение за успешните растителнозащитни програми. За поддържане на популациите на вредителите под ПИВ е важно те да бъдат установени във възможно най-ранен етап от появата им и преди масовото намножаване. Ефективният мониторинг трябва да отговаря на четири основни критерия - надеждност, представителност, относимост и практичност, описани подробно от Binns et al. (2000). Той включва периодична оценка на неприятелите по селскостопанските култури (поне веднъж седмично, а при висока популационна плътност и по-често), факторите за природно регулиране (полезните видове насекоми), особеностите на културата (фенофази на развитие) и факторите на околната среда (температура, валежи и др.). Всичко това изисква задълбочени познания върху биологията както на вредителите и техните гостоприемници, така и на полезните видове (хищници и паразити), и потенциалните им възможности за регулиране популационната плътност на вредните видове.

Средства за мониторинг

За разработване и внедряване на ефикасна стратегия за растителна защита е важно да се събира информация както за популационната динамика на вредителите, така и за екологичните фактори, които й оказват влияние. Правилният избор на подходящ метод за мониторинг е от решаващо значение за успешните програми за контрол, прецизното определяне на необходимостта и времето за третиране, както и на последващия ефект. Научните изследвания от последните години показват, че настоящите техники за мониторинг трябва да бъдат адапитирани чрез въвеждане на автоматизирани системи и смарт капани, които да бъдат част от устойчивото производство, като подобрят ранното и бързо откриване на вредителите и техния контрол, подпомогнат намаляването на екологичния отпечатък и подобрят мониторинга в условията на климатични промени (Čirjak et al., 2022). Въпреки това все още сред най-широко използваните средства за мониторинг остават лепливите плоскости и ленти, както и феромоновите капани. Целта е да се прогнозира плътност, при която ще бъдат нанесени щети или намаляване на добивите, така че своевременно да се предприемат действия. Чрез тяхното използване плътността се наблюдава индиректно, като се използва уловът като индикатор на плътността по растението. Затова определянето на връзката между улова и броя индивиди върху растението и съответните загуби в добива са решаващи за вземане на правилни решения за контрол.

Цветни лепливи плоскости

Лепливите плоскости и ленти са отличен вариант за мониторинг и директен контрол срещу различни видове неприятели. Те са лесно достъпни за фермерите и не изискват значителни финансови средства или специфично обучение. Произвеждат се от пластмаса с най-високо качество, годна за рециклиране, което гарантира дълъг живот. Използваното лепило е нетоксично, водоустойчиво и не изсъхва, не омеква и не се разтича при топло време. Тези плоскости са подходящи за дългосрочно наблюдение и могат да предоставят количествени данни за видовете насекоми. Навременното поставяне и осигуряване на достатъчен брой от лепливи плоскости на единица площ може да доведе до значително ограничаване на разпространението и плътността на вредителите. Основното им приложение е в условия на оранжерийно отглеждане на култури, но могат да служат за мониторинг и при производство на открито.

Цветните лепливи плоскости са широко използвани в световен мащаб. Разработката им като средство за мониторинг е продиктувана от факта, че много насекоми имат предпочитания към светлина с определена дължина на вълната. Лепливите уловки могат да бъдат в различен цвят в зависимост от видовете неприятели, които са обект на мониторнинг или контрол. **Жълтият цвят** е универсален. Използва се за улавяне на белокрилки, мухи, въшки и др. **Черният цвят** се използва успешно за доматения миниращ молец, **светло синият цвят** привлича трипси, **червеният цвят** – цикади, а **белият цвят** - дървеници.

Сред най-широко използваните са жълтите лепливи плоскости, които са въведени като средство за наблюдение през 1980-тте години, обект са на изследване в продължение на десетилетия и са включени в програми за контрол на различни насекоми като белокрилки, трипси, листоминиращи мухи и други неприятели по редица култури в оранжерии и на открито. В оранжериите служат за определяне на началото на летеж и ранно установяване на вредителите, както и за прогноза на относителната плътност и мониторинг на възрастните, особено *Trialeurodes vaporariorum* (Westwood, 1856) и *Bemisia tabaci* (Gennadius, 1889) (Gillespie & Quiring, 1987).

Според Ekbom и Rumei (1990) жълтите лепливи плоскости са едни от най-ефикасните техники за мониторинг при условие, че е определено оптималното им разположение за конкретния вид и култура. Те намират по-голямо приложение в оранжерии, отколкото на открито. Въпреки че лепливите плоскости се използват основно за мониторинг, те са приложими и като метод за контрол в зависимост от условията на отглеждане (Lu et al, 2012). Редица автори проучват потенциала им за потискане на популациите на вредните видове самостоятелно или в комбинация с други стратегии или капанни култури. Moreau и Isman (2011) сравняват ефикасността на жълти лепливи плоскости и капанни култури (патладжан и тиква) за мониторинг и контрол на *Trialeurodes vaporariorum* (Westwood, 1856) при отглеждане на пипер. Жълтите плоскости са най-ефикасни за улавяне на възрастни белокрилки, както и за намаляване на яйцеснасянето по пипера. По отношение на капанните култури много повече индивиди са установени по патладжана в сравнение с тиквата. Нито една от двете капанни култури обаче не намалява значително популациите на възрастните белокрилки. Комбинацията от жълти лепливи плоскости и паразитоиди е ефективен метод за контрол на *Bemisia tabaci* (Gennadius, 1889) (*Hemiptera: Aleyrodidae*) в оранжерии, но не и на открито. В оранжерийни условия жълтите лепливи плоскости значително намаляват популациите на белокрилката, но на октрито почти не се установява разлика в числеността между полетата с лепливи плоскости и тези без лепливи плоскости. Pinto-Zevallos и Vänninen (2013) определят жълтите лепливи плоскости като ключов компонент на интегрираната растителна защита за някои неприятели в оранжерийното производство. Допълнителни проучвания са необходими обаче за визуални средства, които да подобрят улавянето, както и върху комбинирането на жълти плоскости с други стратегии.

Едновременният мониторинг на вредителите и техните хищници представлява особен интерес при внедряването и използването на биоагенти. Böckmann и Meyhöfer (2017) например проучват възможностите наличните на пазара цветни лепливи плоскости да бъдат използвани като средство за мониторинг на популационната плътност в системата вредител-хищник при оранжерийното производство на домати. Те установяват, че *Macrolophus pigmaeus* (Rambur, 1839) (*Hemiptera: Miridae*) може да бъде наблюдаван еднакво добре със сини и жълти плоскости, като в производствени условия по-голям брой хищни дървеници са уловени върху сините в сравнение с жълтите плоскости. Но поради известното предпочитание на *Trialeurodes vaporariorum* (Westwood, 1856) жълтите могат да бъдат използвани за комбиниран мониторинг, като броят уловени индивиди кореспондира с популационната плътност в културата. Основни фактори, които оказват влияние върху ефикасността на лепливите плоскости за мониторинг и масово улавяне, са броят, времето и мястото на разполагане в различните фенофази от развитието на растението-гостоприемник.

За да се проследи в най- ранна фаза от развитието на растенията появата и числеността на вредителите, плоскостите се поставят непосредствено след засаждането на културата, първоначално около входовете и прозорците на оранжериите, на разстояние

20-30 см от растежния връх на растенията. За мониторинг обикновено са достатъчни 10-15 броя/дка, като трябва да бъдат разпределени по ъглите и в центъра на оранжерията/полето. Навременото обследване на плоскостите дава ясна представа за плътността, фазата на развитие и вида неприятели в конкретното съоръжение или поле. Плоскостите са разграфени на по-малки фигури за по-лесно обследване и броене на неприятелите попаднали върху тях. Налице са редица подходи и технологични иновации, които подобряват практичността чрез намаляване на усилията и времето, необходими за отчитане на насекомите, методи за улесняване идентификацията на видовете в смесени популации на уловката. Алтернатива на лепливите плоскости ла лепливите ленти, които се опъват на два или три реда по конструкцията на оранжерията в крайщата ѝ и по редовете.

Използването им за наблюдение на вредителите в оранжериите е стандартен начин да се помогне за намаляване на общите разходи за управление на вредителите, когато са съчетани с инспекции на растенията. Някои оранжерийни неприятели обаче не се улавят на лепливите плоскости и ленти, а крилатите форми обикновено не се появяват, докато нивата на популациите не са високи. Поради това тези средства трябва да се използват в комбинация с визуални растителни инспекции, за да се потвърди наличието на икономически вредни популации вредители.

Феромонови капани

Феромоновите капани са друго широко използвано средство за мониторинг на насекомите, но са най- ефикасни при ниска популационна плътност. Основно тяхно предимство е, че не застрашават полезните видове и могат да доведат до дълготрайно намаляване на популациите на вредителите, което не може да се постигне с употребата на химични пестидици (Witzgall et al, 2010). Освен това изискват по-малко работна ръка, което намалява и разходите (Mullen and Dowdy, 2001). Употребата им е в три основни направления: мониторинг на неприятелите (ефективно средство за ранно откриване на насекомите), контрол чрез масово улавяне (с използване на голям брой капани за намаляване на популациите на вредителите) и контрол чрез нарушаване на размножаването с използване на синтетични феромони, чрез които възрастните се дезориентират, не могат да се открият и да копулират (Campion, 1983).

Броят на уловените насекоми е в зависимост от три основни фактора – дизайн на капана, разположение и плътност (Subchev et al, 1994, Jacquelyn et al., 2008). Ahmad and Kanarudin (2011) считат, че такъв фактор може да бъде и размерът на лепнещата повърхност. Разработването на ефикасен и практичен дизайн на капаните е от решаващо значение за осигуряване на по-голям дял на феромоните като част от растително-защитните стратегии. (Cross et al, 2006).

Дизайнът на капаните и дозата на феромоните са тясно свързани. Когато те се определят, необходимо е да се прецени къде ще се разположат капаните. Редица изследвания показват, че височината на капана не оказва влияние върху броя уловени пеперуди (Boo and Jung, 1998). Позиционирането на капана обаче трябва да осигурява представителен брой уловени възрастни, да има икономична поддръжка и лесен достъп. Цветът на капаните също може да бъде фактор за тяхната ефикасност.

Освен по отношение на мониторинга много проучвания в световен мащаб са посветени и на възможностите за контрол на вредителите чрез масов улов с феромонови капани (Smit et al., 2001; Alpizar et al., 2002; Norman and Othman, 2006; Norman et al., 2010). Witzgall et al (2010) заключават, че масовият улов е икономически по- изгоден в сравнение с нарушаването на копулацията поради по- малките количества феромони. Масовият улов намалява популациите на възрастните и води до намаляване на числеността на следващите поколения, напълно е съвместим с биологичния контрол и с минимален ефект върху околната среда и човешкото здраве. Ahmed and Kanarudin (2011) предлагат разработване на такива методи за контрол на няколко вредни вида едновременно, за да се намали необходимостта фермерите да използват продукти за растителна защита за други насекоми.

Капаните **Delta trap** са сред най-широко използваните (Cardé and Elkinton, 1984). Те са с лепнеща вътрешна част и триъгълна форма, устойчива на вятър и дъжд. Прилагат се за борба и мониторинг на пеперуди и молци в оранжерии и открити площи. Действието на капана е съвместно с феромонов диспенсер, който се поставя в центъра на капана. Мъжките индивиди се привличат от феромона и попадат в капана, където залепват и не могат да излетят. При много висока популационна плътност обаче лепнещите капани могат да станат неефективни поради залепването на твърде много насекоми върху повърхностите (Ahmad and Kanarudin, 2011). Като алтернатива могат да се използват водни капани.

Други широко използвани капани са **Funnel Trap** - капан за мониторинг и борба на неприятели от род *Lepidoptera*. Тези капани са от две части: прозрачна пвц секция и капак, в центъра на който е монтирана кошничка за поставяне на феромон. Капанът се използва в комбинация с феромонов диспенсър. Насекомите привлечени от феромона летят около капана, докато не попаднат вътре в него, след което не могат да излязат. В пвц килията може да се постави течност, в която попадналите насекоми да се удавят.

Заключение

Мониторингът на появата, разпространението и популационната динамика на вредителите са от изключителна важност за разработването, прилагането и ефективността на съвременните растително-защитни стратегии. Установяването на периодите на поява и мигриране на вредните видове позволява на фермерите да вземат подходящи и навременни решения за опазване на растителното здраве. Цветните лепливите плоскости и ленти, и феромоновите капани са широко разпространен лесен и удобен начин за мониторинг, приложим без ограничения и в биологичното производство. Освен за целите на мониторинга те могат да се използват успешно и за директна борба и ограничаване на плътността на неприятелите без използването на химични средства.

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