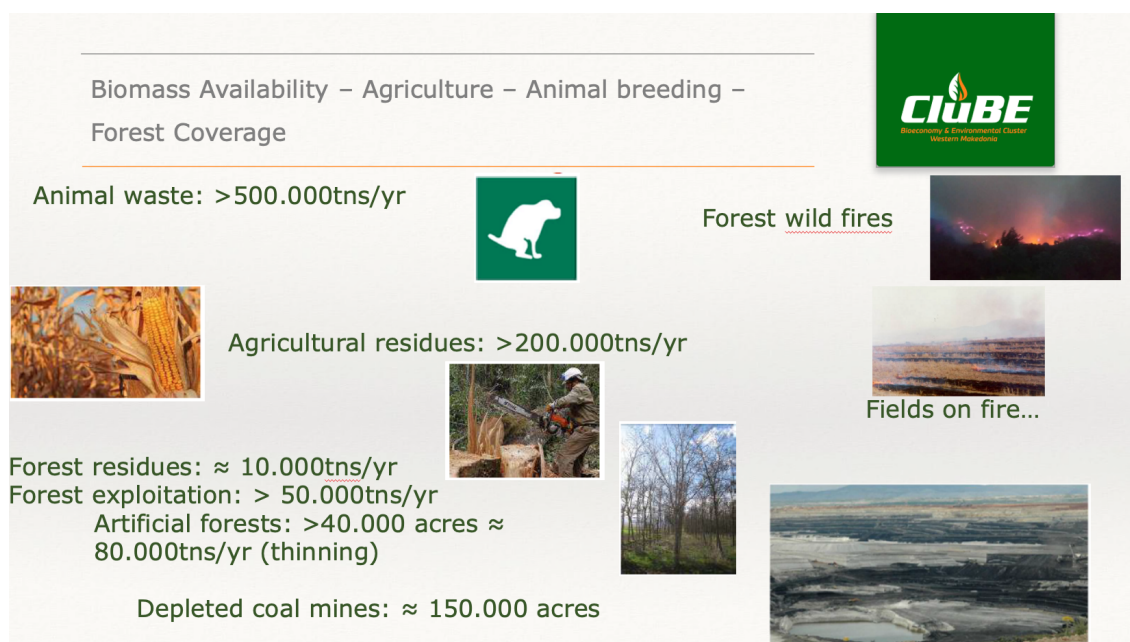




**Figure 26.** Energy sector in Western Macedonia, CLuBE, Greece

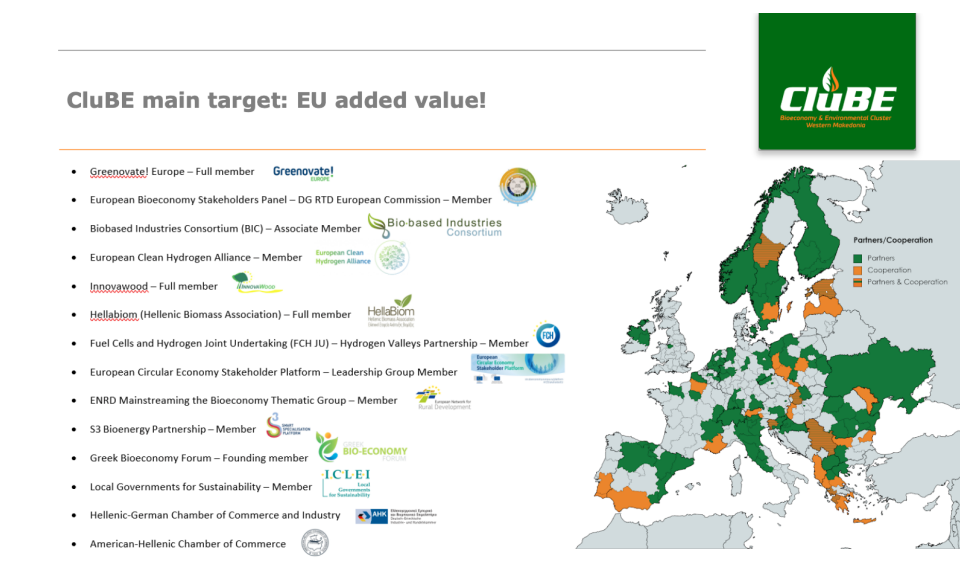


**Figure 27.** Agriculture, Animal breeding, Forestry potentials in Western Macedonia, CLuBE, Greece

To portray the managerial aspect of how and why a cluster such as CLuBE is effective and sustained through the years, we are using their member portfolio - which is a rich ecosystem with more than 40 Quintuple Helix members from public sector, R&D, SME, Environmental and Social enterprises (Fig 28); and their partnership and project outreach (Fig 29).



**Figure 28.** Cluster membership structure, CLuBE, Greece



**Figure 29.** Cluster project and partnership network, CLuBE, Greece

## 09. Local Context of North Macedonia

### PESTEL Analysis - North Macedonia

Our PESTEL analysis performed for the Republic of North Macedonia on environmental principles, sustainability and circular economy, sheds multiple aspects that need to be tackled both on level of regulations, enforcement, engineering and education.



#### Political environment

The Republic of North Macedonia has been in an unstable political situation for the past few years. This situation has a great influence on the focus of the Government. In other words, political parties are increasingly competing and focusing on winning power, rather than solving the problems of the citizens or of the environment. But, with the organization of protest marches by various civil associations, they began to raise awareness about the pollution in the environment and the excessive concentration of waste. The government, together with the Ministry of the Environment, have set goals for the fight

against climate change at the global level as an integral part of all sector policies, preventive action (before damage occurs, i.e. pollution), the polluter pays (the costs of environmental protection must be borne by the responsibility of the legal or natural person who endangers the environment), fight against environmental damage at the very source of pollution (where it is simpler and more economical to remove the consequences of pollution) and integration of environmental protection into other policies (agriculture, transport, energy, industrial policy, etc.). To achieve these goals, various laws are passed and various activities are carried out. One of the primary objectives of the Government is to regulate waste management. Part of the Government's objectives, incorporated in the Plan for waste management for Republic of North Macedonia (2021-2031) are:

“Our goal is that by the end of 2025, at least 60% of the weight of packaging waste generated on the territory of the Republic of North Macedonia will be processed by processing operations or used to obtain energy, and by the end of 2025, at least 55%, and a maximum of 80% of the weight of packaging waste generated and collected in the territory of the Republic of North Macedonia to be recycled.

- In 2020, we will introduce the National Waste Prevention Plan as a national goal and policy for waste generation, reduction, reuse and recycling (2020-2026). We will continuously carry out activities to set up systems in accordance with the new 6 laws on special waste streams, in order to improve the primary selection of special waste streams (waste plastic and paper, waste household equipment, waste tires and oils, used vehicles and textile waste). We will work on an integrated regional infrastructure for the collection and treatment of waste, with an emphasis on separate collection, at the point of generation of waste, of materials that can be recycled, as well as on the treatment of biodegradable waste. The total reduction for the period 2020-2026 of biodegradable waste disposed of in landfills will be 25%.

- We are introducing enhanced control of import and export of waste, collection, storage and treatment of all types of waste, as well as extraordinary control of all issued permits for waste management. We will invite non-governmental organizations to join us for transparency and increased trust among citizens.



- We will implement strengthened inspection control of the legal entities that hold permits for the collection, transport and treatment of waste (especially medical and other types of hazardous waste), as well as of its creators.”<sup>28</sup>

### **Economic environment**

The global spread of the Covid-19 virus infection pandemic and the introduction of measures to prevent it caused major negative effects on global economic activity. According to this, the economic situation of the country is also affected by the pandemic. Consequences of the recession in our country, as presented in the Annual Reports of the Central Bank for 2020<sup>29</sup> and 2021<sup>30</sup> are:

- Weak growth of the economy in the first quarter of 2020, and signals from high-frequency data on economic activity are in line with expectations for a decline in activity in the second quarter;
- Improvement of the economy starting from the second quartile of 2021 and moderate improvement throughout the year, with GDP growth of 4% for 2021. However the net-exports have been slower, compared to the imports, especially due to the energy crisis.
- Stable and low inflation, but slightly higher than the expected rate;
- Growth of foreign exchange reserves above expectations; maintaining the adequacy indicators of the foreign exchange reserves in the safe zone;
- The solid growth of the deposit base and the credit activity of the banks continued, supported by the measures of the state and the National Bank;
- The National Bank in the second quarter of 2020 reduced the main interest rate to the level of 1.5% and halved the supply of treasury bills, for a total of 15 billion denars, in order to provide support to the Macedonian economy by maintaining credit flows and the credit cycle ;
- And there are more pronounced risks, especially from the external environment;

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<https://www.moepp.gov.mk/wp-content/uploads/2021/10/План-за-Управување-со-отпад-на-PCM-2021-до-2031-година.pdf>

<sup>29</sup> [https://www.nbrm.mk/content/Годишен\\_извештај\\_за\\_2020\\_НБ.pdf](https://www.nbrm.mk/content/Годишен_извештај_за_2020_НБ.pdf)

<sup>30</sup> [https://www.nbrm.mk/content/Годишен\\_извештај\\_2021\\_НБ.pdf](https://www.nbrm.mk/content/Годишен_извештај_2021_НБ.pdf)

- The National Bank will continue to monitor these developments and take additional measures if necessary.

### **Socio-cultural environment**

The socio-cultural environment consists of the population together with its characteristics, i.e. the attitude of people towards themselves, towards others, towards institutions as well as towards the environment. In order to keep our environment clean and healthy, people's habits have the greatest influence. Many expressions show that awareness of the excessive amount of waste in our country is at a very low level. A large proportion of the waste generated by households throws it into landfills. That's why these landfills are everywhere. According to the environmentalist Antonio Jovanovski, this behavior of people contributes to the lack of awareness of the damage caused by waste and the education system in the country. The traditional view of education that it is necessary to "produce" personnel needed in the labor market is not at all efficient for the environment. Because the focus is on the need for all kinds of personnel, not the sustainability of the environment. He also points out that humanity generally does not care how much and how it uses resources, so in the coming years we will face a lack of a large number of resources.

But, with the passage of time, more and more awareness is raised about the waste problem and civil associations are starting to be formed. For example, the ecological society Planetum, which aims to manage waste, develop alternative forms of tourism and urban development. In order to achieve these goals, it undertakes a large number of activities such as research, education of the population and undertakes a large number of initiatives. The most up-to-date initiative is the "Stop illegal landfills" initiative, for which money is instantly collected and will be allocated to cleaning illegal landfills.

The Eco-awareness association also contributes to the sustainability of the environment, which aims to contribute to sustainable transport, renewable energy sources and energy efficiency, sustainable waste management, protection from chemicals and heavy metals, protection from genetically modified organisms, etc.

The fact that the awareness of the population regarding a healthy environment is starting to be raised more and more is evidenced by the numerous protests of citizens. They are asking the Government and the Ministry of the Environment to pass more laws to protect the environment as well as appropriate sanctions in case someone breaks the laws.

## **Technology environment**

The collection of municipal waste is mainly carried out by public enterprises. According the National strategy for waste management, only a small proportion of waste collectors are private enterprises, usually those working with waste in rural areas. About 70% of the total population uses waste collection services, but only 10% of that in rural areas<sup>31</sup>. The collection, sorting and transport of waste is insufficient in several areas to achieve compliance with existing regulations. Much of the waste is leaking, and the waste collection vehicles are very old, with little capacity and often broken down. Mixed industrial and municipal waste, including hazardous waste fractions, is collected from service users. Daily activities are usually characterized by low productivity practices and inadequate utilization of fixed resources which does not encourage the provision of a service that will be efficient compared to costs. On the territory of Macedonia, there are 43 active municipal non-standard landfills (Đubrishta) without any permit. The "Drisla" landfill, which serves the Skopje region, is the only landfill in the Republic of Macedonia that is relatively well managed. At municipal landfills (or landfills) in rural areas, waste is simply disposed of by utilities at no operating cost, with the exception of some overhead costs (guard pay, if any) and the occasional cost of water consumption to extinguish spontaneous fires. None of the 54 municipal landfills meets the requirements for sanitary operation and environmental protection. Most of the municipal solid waste and other collected waste is deposited without any pre-treatment in the communal non-standard landfills/landfills. Most packaging waste is disposed of in landfills as part of municipal solid waste and similar commercial/industrial solid waste. Landfills operate without the technology normally applied to landfills and without any environmental impact

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<sup>31</sup> <http://www.ezo.mk/zakoni/003.pdf>

monitoring activities. There is no comprehensive record of the delivered waste, and no visual inspection of the characteristics of the waste to be deposited is carried out. Municipal waste that is not collected by the official collection companies is disposed of in inappropriate places - landfills. Construction waste and rubble are also, for the most part, disposed of in inappropriate places - garbage dumps; there is no capacity for separation and landfill for disposal of this type of waste. It is estimated that the number of landfills, especially in rural municipalities, is around 1,000.

In terms of application of innovations and implementation of new technologies, Pacomak<sup>32</sup> is a leader in society. Pacomak is a non-profit company, founded on 3.12.2010, whose activity is management of packaging waste. According to the new Law on the management of packaging and packaging waste, since January 10, 2011, Pacomak is the first company in Macedonia that has a permit for the selection and processing of packaging waste. With the help of the Innovation Fund, Pacomak is the first Macedonian company to introduce the secular trend in recycling - returnable vending machines for plastic bottles and cans

The enormous volume of waste that is created by the increased consumption in modern society, the selective disposal of waste, its collection and recycling is an extremely important process for maintaining a clean and unpolluted environment. But, for many, this process is stressful and takes too much energy, so Pacomak will try to motivate the citizens of Macedonia to join in a simple way through the introduction of reversible vending machines, the so-called called SmartBin, which will work in conjunction with ecoMac - an incentive system that rewards people who selectively dispose of waste through prizes, discounts or other benefits. We have never had such a project on the territory of Macedonia and it represents a real innovation in the field of municipal waste collection and recycling.

## **Legal environment**

In the Republic of North Macedonia there are several laws that cover and solve certain problems and issues related to waste. Part of those laws under the

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<sup>32</sup> <https://www.pakomak.com.mk/PakomakSite/mk-zanas.html>

jurisdiction of the Ministry of Environment and Spatial Planning<sup>33</sup>. Laws governing waste:

#### *Environmental Protection Act*

The objectives of this law are: 1) preservation, protection, restoration and improvement of the quality of the environment; 2) protection of human life and health; 3) protection of biological diversity; 4) rational and sustainable use of natural resources and 5) implementation and promotion of measures to solve regional and global environmental problems.

#### *Packaging and Packaging Waste Management Act*

In accordance with the principle of sustainable development, the objectives of this law are: - to prevent the creation of packaging waste, - to reduce the amount of packaging waste, - to reduce and limit the use of harmful metals and materials in packaging and to reduce the toxicity of packaging waste, - to prevent or reduce the negative impact on the environment of packaging waste and to ensure a high degree of environmental protection, - to achieve a high level of packaging reuse, - to achieve a high level of recycling and other types of processing of packaging waste and to reduce the final disposal of packaging waste, - to provide conditions for the establishment of systems for return, selection, collection, reuse, processing and recycling of packaging waste, - to provide conditions for the establishment and development of a market for the processing and recycling of packaging waste and - to ensure equal protection cooperation between domestic and foreign legal and natural persons and to avoid and remove trade barriers that can disrupt the market.

#### *Introduction of new regulation for plastic bags*

According to the latest amendments to the laws on packaging and packaging waste management in Macedonia from December 1, 2021. the use of plastic bags is prohibited. Biodegradable bags will have to be sold on the market for 15 denars each, which will have to be produced according to prescribed standards for biodegradability. And this time, doubts remain about the thorough implementation of the law. With this law from December 1, traders will have to keep records on a neighborhood basis for the number of bags sold, which they must deliver to an expert body of the Ministry of the Environment. The

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<sup>33</sup> <http://www.igu.gov.mk/?q=node/29>

total amount obtained from the compensation from the sold bags, the merchants must transfer to a special account opened for that purpose of the environmental authority. It is assumed that the price of 15 denars will demotivate consumers to unnecessarily buy disposable bags, reorienting themselves towards using reusable alternatives. Markets will be required to provide paper bags or other alternatives. In addition to this, the amendments also stipulate a ban on the use of single-use plastic packaging in catering establishments on the territory of protected areas in the country. Environmentalists ask why this ban is limited only to the territory of the protected areas, and not to the entire territory of the country.

### **Environmental analysis**

The numerous identified environmental problems in the Republic of North Macedonia can be grouped according to the medium and area in the environment where they appear:

- Problems with waste management (municipal, industrial hazardous and non-hazardous waste and other types of waste), due to the absence of an integrated waste management system (organized collection, transport, treatment and final disposal), which would consist of an appropriate network of processing facilities for the use of materials/energy and landfills built in accordance with modern standards;
- Air pollution with different intensity in different parts of the country;
- Soil contamination, resulting in inadequate quality of agricultural products caused by such contamination. A special problem related to the state of all environmental media is the insufficiently developed monitoring of the environment with an emphasis on the absence of historical data. Such data on the state of the individual environmental media are a basic prerequisite to determine the new desired status of the media, as well as to plan correct and reliable actions for mitigating or eliminating the environmental problem. In the past and today, improper waste management leads to the degradation of ecosystems and the loss of valuable natural resources. Certain environmental impacts even lead to potential and documented risks to human health. Improper waste management has serious impacts, especially



on soil and water, i.e. surface and underground waters. Groundwater is contaminated by landfill runoff, which is generally highly contaminated with toxic organic and inorganic compounds, in some cases with pesticides and heavy metals. The impact on the quality of surface waters (rivers and lakes) is evident from the higher concentrations of biodegradable organic substances, ammonia and nitrates and toxic metals. Improper disposal of waste, general disposal of hazardous and non-hazardous waste and wild landfills pose a risk and cause soil and water pollution; in some cases, impacts on the health of the population living near such areas have been identified. Industrial contaminated sites represent a special source of water, soil and air contamination. They mostly belong to mining and thermal processes (thermo-energy and metallurgical capacities) and contribute to higher concentrations of toxic metals and suspended particles; abandoned landfill areas containing flotation slag and dry-weather fly ash represent an unconventional source of dust particles. The impacts on the natural environment and agricultural crops are evident. Improper management of medical waste and potentially infectious animal by-products represents a serious risk to the health of the population, as well as an economic risk to the food industry. Uncontrolled burning of waste in open areas of landfills and plastic films in fields and the use of waste oils and other combustible fractions of waste result in the synthesis of highly toxic and bioaccumulative organic compounds. Such uncontrolled air emissions result in ambient air pollution, long-term pollution of agricultural soils and plant tissue and pose a serious risk to human health.

We are referencing in this category the notions from the Report for strategic evaluation of the environment for strategy for development of energy sector in Republic of North Macedonia up to 2040<sup>34</sup>. An additional problem is the traditional burning of communal waste, waste from plant tissues, as well as plastic from plantation or silage production in open space; such a way of burning waste can cause the synthesis of highly toxic and bio-accumulative organic compounds, and uncontrolled emissions in the air cause pollution of the ambient air and long-term pollution of agricultural soils and plants. The

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<sup>34</sup>[https://www.economy.gov.mk/Upload/Documents/SEA\\_FINAL\\_MK\\_Dek\\_2019.pdf](https://www.economy.gov.mk/Upload/Documents/SEA_FINAL_MK_Dek_2019.pdf)

existing waste disposal practice does not comply with technical standards and/or environmental protection standards.

The annual reports on the quality of the environment from the state monitoring network for years have recorded an alarmingly impaired quality of the ambient air in larger settlements, especially in terms of solid particles up to 10 micrometers in size (PM10 and PM2.5). First of all, the large urban areas of Skopje, Bitola, Tetovo should be highlighted, where the situation is much worse in the winter period and with significantly more exceedances than allowed during the year. According to the inventory of suspended particles (PM2.5, PM10, TSP) for 2018, the most significant share in the emissions of these particles is the heating of homes and administrative facilities, using biomass as fuel. The share of emissions from the category of households and administrative buildings, (especially from burning wood) in 2017. in total emissions of total solid particles (TSP) is 33%, in emissions of solid particles up to 10 micrometers in size (PM10) accounted for 37% and 62% in emissions of solid particles up to 2.5 micrometers in size (PM2.5). It was determined that other key sectors in the emissions of suspended particles are 2-Industry (32% TSP, 13% PM10, 5% PM2.5) and I.A.1- Electricity and heat production (25% TSP, 26 % PM10, 18% PM2.5). The greater share of 2-Industry in TSP emissions in relation to smaller particles results from high dust emissions (TSP) from the Road Asphalt category which falls under the Industry sector<sup>35</sup>.

### **MultiCreation project: Sustainable Non-garbage**

A MultiCreation project for Sustainable Non-garbage (the conceptual antonym of continuous waste)<sup>36</sup> has been taking place in the Pelagonija region (Bitola, Prilep) across a broad ecosystem of stakeholders: Faculty of Economics Prilep (Prof. dr. Renata Petrevska Nechkoska), Technical Faculty Bitola (Prof. dr. Daniela Koltova Nechoska), Primary school in Bitola, Voluntary initiative #MetiSiSoKlasneto and business actors Oriflame and Wellness.

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<sup>35</sup>

<https://www.pravdiko.mk/wp-content/uploads/2013/11/Zakon-za-kvalitetot-na-ambientniot-vozduh-31-07-2012.pdf>

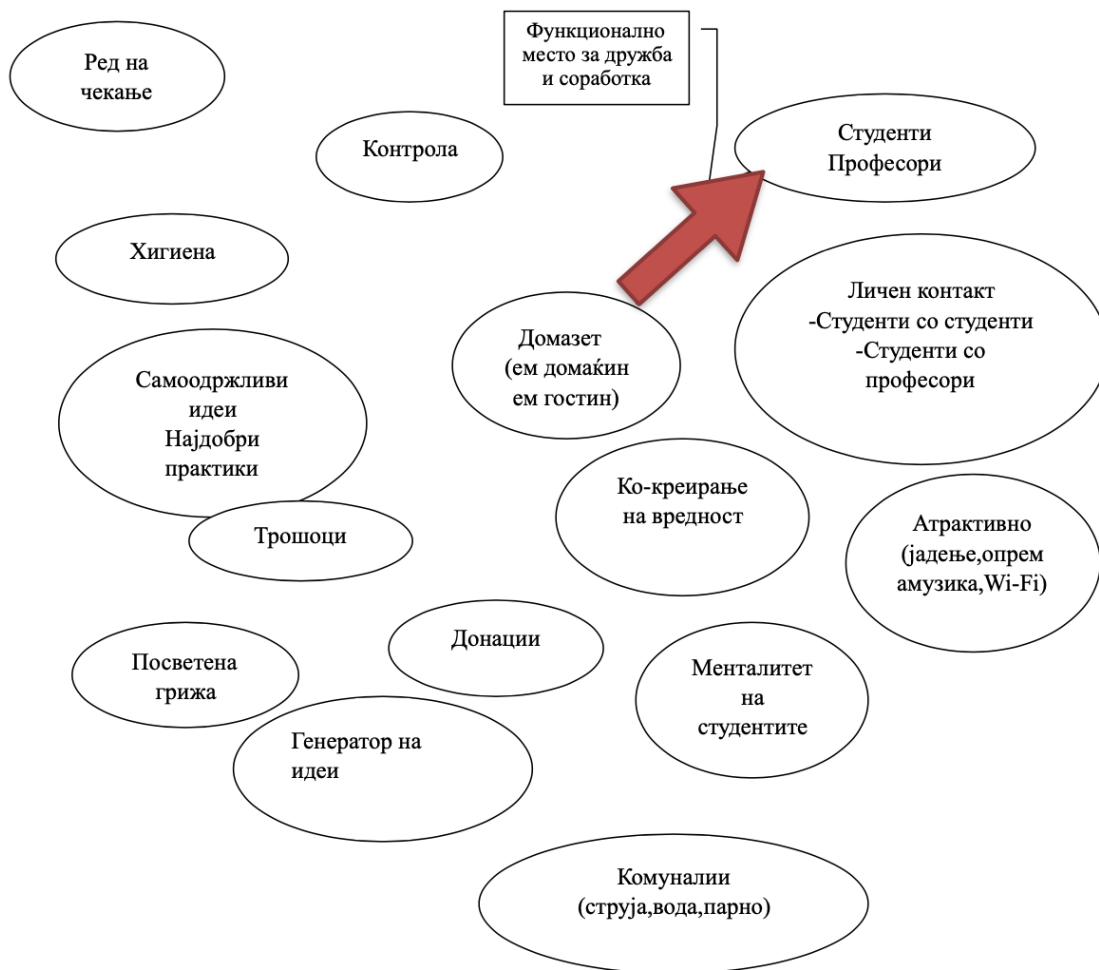
<sup>36</sup> <http://tactical-management-in-complexity.com/course/view.php?id=28>

The project focused on educational research activities for involved students from academic institutions, secondary and primary schools, as well as specific tangible solutions for (i) organizing self-sustaining student space within the faculty, where the students will circulate books, test entrepreneurial ideas, collaborate, meet with professors, employers, guests, present ideas, showcase own art or models - to be equipped by reusing existing wasted furniture with creative twist; (ii) mapping the household garbage trajectory in part of the city of Bitola and offering traffic-like solution and (iii) conceptualizing an app and solution for car-sharing and transportation of passengers who travel between Bitola and Prilep on daily basis, for different reasons (businesses, faculties, personal) on regular basis or occasionally.

The Denica managerial method was used to make the Role and Accountability System diagram so that whoever was onboarded, could immediately understand what the student space is about and how to fit in (Fig 30). The main roles are between Student (who is at the same time host/guest) and everyone else in the student space, with a primary purpose Having a functional space for friendships and cooperations, which is self-sustained (by all means).

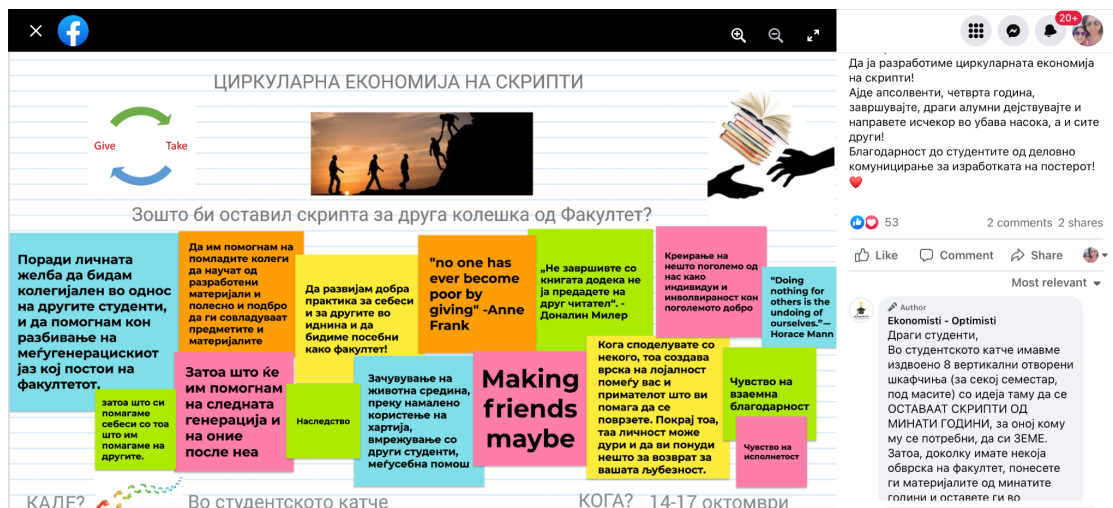
## 5. Систем со улоги и одговорности за нашиот проект

(Информациски сензори, информациски емитери и ризици)



**Figure 30.** Role and Accountability System diagram for the student space, MultiCreation project

The first challenge got kicked off with circulating books and scripts among the students, with special shelves where they have been disposed to be taken from another. The students created a promotional post and re-shared it on social media, so it became a yearly habit, which saves substantial amount of the student budget, and has other benefits too (Fig 31)



**Figure 31.** Circular Economy of student scripts and books, MultiCreation project<sup>37</sup>

The process of refurbishment and reuse of existing leftover materials and furniture across the faculty building has been creative, and since the initial principle was to achieve it all with ZERO money, all was in direction of no expenditures and the CE principles.



**Figure 32.** Enterier items made from household materials

Students also made fun videos for their main necessities (such as second hand printer-copier, water heater, ...) to attract companies to donate them, and shared on social media<sup>38</sup>.

<sup>37</sup>

<https://www.facebook.com/EkonomistiOptimisti/photos/pb.100057406391342.-2207520000./381724706568064/?type=3>

<sup>38</sup> <https://www.facebook.com/watch/EkonomistiOptimisti/1154236008472980/>