Soil is a sink of enlarging group of contaminants such as nanoparticles (ENPs), antibiotics (ABXs) and related with them antibiotic resistance genes (ARGs) as a result of human activities. Once released to soil, these emerging contaminants (ECs) may interact among themselves in different ways (Fig. 1), which may affect their spread in the environment. For instance, the presence of heavy metals in soil facilitates the abundance of ARGs *via* increased selective pressure. To date, few studies on the co-occurrence of ARGs and ENPs containing metals (MENPs) have shown distinct effect in comparison to corresponding metal ions. However, this phenomenon remains under-explored. Moreover, MENPs entering to soil undergo different transformations. Consequently, these transformations may affect the properties of MENPs (such as dissolution rate, surface chemistry) and become game-changers: they may be driving or restraining force of dissemination of ECs in the environment. Therefore, the examination of the role of MENPs transformation in ECs transmission from soil to human diet will be the main goal of this proposal.

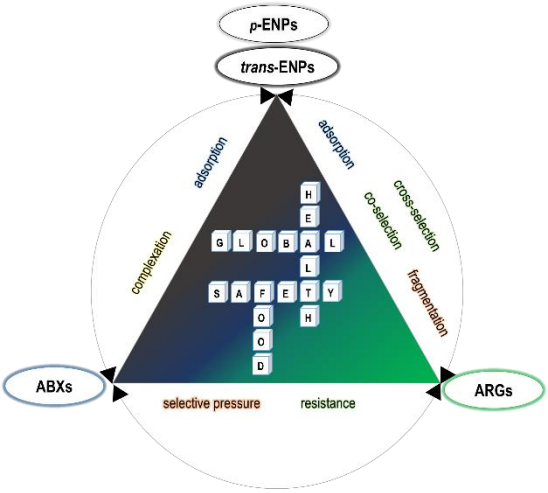

Fig. 1. The potential interactions between ECs.

In the frame of project, we will conduct chemical and biological transformations of MENPs (ZnO, CuO) mirroring the processes which they may be a subject in the soil environment. The chemical transformations will lead to the change of chemical form (sulphides, phosphates) of MENPs, while biological modifications will consist in the biomolecules (polysaccharide, protein) coating on MENPs for the formation of bio-corona. Physico-chemically characterized transformed (*trans*-MENPs) will be used in the analysis of interactions between *trans*-MENPs with ABXs and ARGs. The distinct properties of *trans*-MENPs than pristine one, will influence on their sorption capacity, the binding strength and rate of ECs. The relevance of these interactions for transmission of ECs may be dual: due to greater surface area, MENPs may adsorb more ECs than their bulk counterparts, resulting in a decrease of ECs mobility. However, on the other hand, the persistence of ECs will be extended too. Furthermore, owing to "nano-size", MENPs may enter into e.g. plants and act as "Trojan horse" carrying the adsorbed ECs. It needs to be kept in mind that different properties of *trans*-MENPs may also affect the absorption and distribution MENPs-ECs complex. Thus, the next part of proposal will be to assess the risk of ABX transfer into plant (lettuce) and the impact of MENPs on the abundance of ARGs in plant leaves-associated microbiome. The presence of ARGs on edible plant parts (e.g. lettuce leaves) is especially hazardous for human health due to a risk of development of antibiotic resistance by pathogens. Therefore, traceability of transmission routes of ECs is of pivotal importance in the context of direct protection of soil quality as well as indirect protection of public health.