Team Research Plan

What steps has your team taken to understand the framework of the circular economy? (250 words maximum length)	We worked together as a team to clearly understand the circular economy. We took three steps. The first one is conducting research on the internet to help us understand the principles of the circular economy. We watched different videos on youtube, and we read articles that gave us ideas about what a circular economy is and why we need a circular economy in this developing world. Second, we asked different questions to our professors who are more knowledgeable than us in this field to help us understand the circular economy and its impacts on the social economy and environment. Not only that we also shared the knowledge we had with each other so that we could all be on the same page. Through those activities, our team understood the framework of the circular economy as a way we can use to eliminate waste by improving or changing how goods and services are designed, manufactured, and used. It is, in this case, we thought of what we can do as future leaders to reduce the effects of chemical inputs on our continent by producing organic pesticides and fertilizer for the safety and food security of our communities.
What is the wicked problem your team is interested in addressing? (250 words maximum length)	Our team is aimed at solving the problem of harmful chemical pesticides and fertilizers. In Rwanda, both chemical pesticides and fertilizers are used. These chemical inputs contaminate the plants and last in the soil for so long. Local farmers are using them and the big challenge is that most of those farmers are not educated and they can hardly understand the impact of these pesticides on our environment as well as their lives. These farmers cover around 72 percent of the total population according to the National Institute of Statistics of Rwanda (NISR). As a result of this problem On July 2, 2021, the farmers that rear fish in Lake Muhazi faced the disaster, which resulted in the deaths of more than a hundred and ten tons of fish. This is a result of the excessive use of pesticides in the farms that are near Lake Muhazi(Kamugire, 2021). We want to solve this challenge by introducing an organic pesticide fertilizer called Eza pesticide fertilizer which will act as pesticide and fertilizer at the same time. EZA pesticide fertilizer will reduce the use of chemical pesticides and fertilizers since it has a combination of different organic matter, main essential nutrients needed for plant growth, and pest control agents. Introduction and use of this pesticide fertilizer will also minimize the exposure of farmers to harmful chemical pesticides and fertilizers during farm activities and will boost their production with the provision of our product at a reasonable price. https://www.ktpress.rw/2021/07/what-is-behind-dying-fish-in-lake-muhazi/

Description Area	What context is critical to help others understand the wicked problem your team is interested in addressing? Provide 3 web links that provide this context.
Link 1	https://rema.gov.rw/fileadmin/templates/Documents/rema_doc/publications/Fertilizer-Report.pdf
Link 2	https://sidaenvironmenthelpdesk.se/digitalAssets/1748/1748556_environment-and-climat
Link 3	e-change-analysis-rwanda-2019-06-05.pdf
What human, technological, and ecological factors impact the wicked problem your team is interested in addressing? (250 words maximum length)	Rwanda's agriculture sector is developing by using modern practices such as the use of agro-chemical inputs. Many farmers are encouraged to use these inputs to boost their production. On the other hand, these have been threats to the environment, animal, and human health. Leaching of nutrient residues such as ammonia, nitrate, phosphate, and pesticide lead to land and water pollution (REMA, 2019). Most farmers are not skilled in the proper use of agrochemical inputs during their farming activities for the sake of being environmentally friendly. That leads to high risks during production and consumption. The residues of these chemicals are carried away by water runoff to pollute water and other soil surfaces. This is the main cause of excess nutrients in water bodies(eutrophication), death of terrestrial and aquatic organisms as well as contributing to greenhouse gases. Eventually, this causes biodiversity loss which reduces the ability of ecosystem natural processes and leads to climate change as the biggest impact (REMA, et al., 2016). The use of technology in agriculture has helped in the proper use of inputs through Precision agriculture. This helps in the efficient use of pesticides and fertilizers and reduces the overapplication by applying needed amounts in different sites. We want to contribute to this technology and help to minimize the agrochemicals application effects by providing organic pesticide fertilizer.

How could addressing this wicked problem support the development of a circular economy? (250 words maximum length)	In our project implementation, we plan to use waste and idle resources available in our community. We will use waste resources from enterprises, livestock wastes from farms, and invasive species plants to develop our product. Benefiting from these unused resources will allow us to make a profit as a business and provide an affordable product to our community. First, we will be using leftovers of chili pepper oil production from agro-processing industries. In addition, we will use cow urine and chicken dung that local people consider as wastes. They contain the highest amount of nitrogen, phosphorus, and potassium. We took this initiative to collect and use them while making EZA pesticide fertilizer which will reduce the wastes from our environment. Moreover, we will use eucalyptus globulus, which most of the time is not efficiently used. They only use their stems and we want to give value to their leaves as raw material for our product. We also want to exploit lantana camara and tagetes minuta which are widely spread invasive plant species and are considered wild weeds. They both have an essential oil component which is a powerful pesticide and insecticide ingredient. Most Rwandans use firewood to cook and they throw away ashes after cooking. We want to use it since it is rich in potassium and phosphorus nutrients and it is available in abundance.
How could addressing this wicked problem support the United Nations' Sustainable Development Goals? Choose 1-3 specific goals to focus on. (250 words maximum length)	Introducing Eza pesticide fertilizer will help the United Nations sustainable development goals such as zero hunger, no poverty, climate actions, and also good health and well-being. Chemical pesticides are leading to critical and long-term health impacts. About 385 million cases of non-fatal unintentional pesticide poisonings have been estimated to occur every year, with approximately 11,000 deaths(UN environment program, 2020). Introducing Eza pesticide fertilizer which consists of organic matter which is not toxic to human health will contribute to the reduction of the number of health issues such as cancers, immunological, and reproductive effects resulting from the use of chemical pesticides and fertilizers. EZA pesticide fertilizer will serve to reduce hunger which mostly leads to malnutrition in Africa and across the globe. The components of our pesticide fertilizer act as pesticides and kill different pests including armyworms, thrips, and locusts which affect the crop yield. On the other hand, our pesticide fertilizer contains essential nutrients such as Phosphorus, Potassium, and Nitrogen which are highly needed for the growth of crops and nutritional content in foods. Thus, this will boost agricultural production and enhance food security EZA organic pesticide fertilizer will help to minimize the negative effects of chemical fertilizers and pesticides on the environment, soil nature, and climate change. Not only that but also our product will be affordable, and farmers will no longer spend a lot of money buying pesticides and fertilizers separately. This will contribute to the reduction of loss and hence reduction of poverty.

How do you plan to involve mentors and/or subject matter experts in your design process as you develop your solution? (250 words maximum length)	We will work with two professors from Rwanda Institute for Conservation Agriculture (RICA) as our mentors. Dr.Tibebu Belete Chane, a Ph.D. holder in Plant Protection, and Dr. Nshogoza Gilbert, a Ph.D. holder in Biochemistry and Molecular Biology. They will assist us and provide us with the laboratory room to conduct the experiment in testing the raw materials in our EZA pesticide fertilizer production process. We will also work with Nicholas Ssekiziyivu, an entrepreneur, and educator at AKILAH Institute Davis College. He holds a Masters's degree in Business Administration and is very passionate about youth empowerment. We will also consult Rwanda Agriculture and Animal Resources Development Board (REMA) as part of our subject matter experts to assess the pesticide components. The REMA has a plant health clinic that does crop protection against pests, fungus, and other diseases, and they will provide us with more guidance in our project. Furthermore, working with REMA in our project will help us to produce the standardized quality of pesticide-fertilizer and to get a license. Moreover, we are searching for more information about pesticides and fertilizers through google scholars and interviewing different professors and researchers in various universities such as the University of Rwanda College of Agriculture, Animal Science and Veterinary Medicine (UR-CAVM), Rwanda Institute for Conservation Agriculture (RICA). https://rab.gov.rw/index.php?id=80 https://cavm.ur.ac.rw/
What are your next steps? (250 words maximum length)	Our next steps are to do more studies and to consult the mentors and experts to learn more about the different components of our new product. We continue to do more analysis about the resources and raw materials we will use for our pesticide production and collect the sample products for the project prototype. We will also have a regular two hours zoom meeting every Saturday evening to work on the project and share ideas about the project progress as a team. We are going to gather the information from the different farmers in the Eastern province, Bugesera District to know how ready they are to use the EZA pesticide fertilizer. We are also going to do research about where we can get most of the plant ingredients that we will need to use in the process of producing our product because most of them are found in unused bush areas. We will also conduct the households and farms to make agreements with them so that they will give us the waste material we need to use. Moreover, we are going to research technologies to use in the production of pesticide fertilizer that supports the circular economy and high-quality maintenance such as in processing, storage, packaging, and distribution.