Global Issues Champion Booklet

Competition: 2022 International Conference
Topic: Antibiotic Resistance
Division: Middle
Affiliate: Singapore
Students: Caroline, Sijia, Siqi, and Xin
Award: Middle Division First Place

Step 1. Identify Challenges

Read the Future Scene carefully and generate ideas for challenges, concerns, and possible related problems. Choose the 16 most important challenges and write them in the space provided.

1.	Since the worldwide cherry shortage resulted in the closure of many farms, this may be a problem as the food supply may be negatively affected. It may be possible that due to the farms producing other food supplies and not just cherries, the supply of these foods may be reduced. Hence, this may lead to people, who rely on farms as their main source of food, being unable to fulfill their basic need of food
2.	Since there has been the presence of biological quarantine in Tasmania in order to contain the spread of antibiotic resistance, this may be a problem as this may result in the tourism industry being affected. This may be especially detrimental to the economy of countries who mainly rely on tourism as an economic source. For example, Maldives, in which one third of its GDP comes from tourism. Hence, this may result in Tasmania's economy declining, as a result of lack of revenue from tourism
3.	Given that the beautiful blossom-covered trees are now reduced to dry, brittle sticks, this may be a problem as the beauty of Tasmania may be heavily compromised. This is because as disease takes over the trees, they may become unsightly. Hence, the aesthetics of the area may be negatively affected
4.	Since the cherries from farms as well as in the water have been shown to have large amounts of antibiotic resistant strains, this may affect the health of humans who consume these food products. Research has shown that in 2022, over 400000 US residents died each year due to food borne antibiotic resistant infections, with 1 in 5 infections being food related. Hence, this shows that the humans who consume food contaminated with antibiotic resistant strains may suffer health conditions due to antibiotic resistance and their physical health may be negatively impacted.
5.	Since all hopes have been placed on Matilda and other cherry farmers in Tasmania to rebuild the cherry industry, and Matilda expressed it was difficult living with so much uncertainty of the cherries, it is possible that farmers' psychological health be

	negatively impacted. Research has shown that high levels of stress leads to health conditions such as depression and anxiety. Hence, the constant stress that cherry farmers are placed under to prevent and identify infections in cherry trees may possibly lead to their psychological health deteriorating
6.	Since antibiotic-resistant bacteria can remain in water and soil for many years, this may result in the natural environment suffering from pollution. As of 2022, research showed that over a quarter of the world's rivers suffered from potentially toxic levels of antibiotic-resistant bacteria. Hence, this shows that antibiotic-resistant bacteria may exacerbate the issue of water pollution, making it potentially unsafe for aqualife, and negatively affecting the natural environment.
7.	Given that entire orchards could be burnt down one week before harvest, it is possible that the effort to cut down infected trees could negatively impact the environment. Research has shown that trees are essential in holding the soil together and retaining water during the raining seasons. When an entire orchard of trees are removed, this could potentially expose the soil to the elements and the water retention of the soil could decrease, this could make the land more prone to landslides and floods.
8.	Since the identification of infections and bacteria in the cherry trees are solely dependent on the Beebots, this may be a problem as upon the malfunction of nanobots, uninfected cherry trees may be cut down. This is because the nanobots may wrongly identify infections in the cherry trees and farmers may not second-check their identifications. Hence, farmers may cut down the 'infected' trees, possibly reducing the number of cherry trees even further
9.	Since Tasmania is the only location in the world where cherry trees are not infected, it may be possible for antibiotic resistant bacteria pseudomonas avium to spread to Tasmania through travel, despite the strict bio-quarantine put in place. Antibiotic-resistant bacteria may arrive on the shores of Tasmania through freight ships which come in to transport the cherries, the workers from outside Tasmania or through loopholes in the bio-quarantine system. This may expose the cherry trees to antibiotic resistant bacteria as long as travel and interaction with the outside world is present.
10.	Given that though there are many education programmes put in place against misinformation but Matilda still found it hard to know what to believe, this may be a problem as large groups of people may be misinformed. This is because as the issue of antibiotic resistance manifests, there may be incidences of fear mongering, and this may possibly result in a breakdown of communication between the authorities and the farmers, as the farmers may not believe the government's instructions due to the widespread fake news. Hence, there may be a negative impact on the communications due to misinformation

11.	Since there is great uncertainty with producing enough cherries to meet the demand due to the spread of antibiotic resistant disease amongst cherry trees, it may be possible that the cherry businesses may lose profits as they may not be able to sell sufficient cherries. According to WSU insider, it has been shown that bacterial pathogens such as fire blight and X-disease phytoplasma have been killing off crops, costing farmers hundreds of millions of dollars. Hence, this may lead to cherry businesses suffering as they lose business. They may even go bankrupt and go under.
12.	Given that Matilda has access to sophisticated technology like nanobots and bark-embedded sensors to check on her trees, this may mean other farmers who cannot afford such sophisticated technology may be put at a disadvantage. This may lead to already wealthy farmers being the ones that can sustain their business, potentially allowing them to dominate the market, while smaller businesses may face bankruptcy. This may exacerbate the wealth gap, potentially posing a social problem.
13.	Since the IIRA mandates that farmers have to report the first signs of antibiotic resistance in the cherry trees, but many farmers did not and instead opted to quietly remove the tree that was infected, this may be a problem as farmers may be dissatisfied with the mandates of the IIRA. Farmers may be unhappy with how the regulations of the IIRA affected their businesses. Hence, this may lead to protests against the IIRA to demand for better treatment of farmers, and this may lead to social unrests.
14.	Since there have been legal disputes between farmers and insurance companies due to orchards being ruined, it may be possible that there may be more legal cases. This may result in more lawsuits in a court of law. This may be a problem as this may result in the legal system being overwhelmed
15.	Since it has been shown that many farmers have tried miracle cures on their trees, this may be an issue as should the miracle cures have any negative side effects on the trees, this may result in negative impacts on the agriculture. For example, putting syrup on the trees may lead to the trees having an increase in parasitic activity. Hence, these cures with no scientific backing may lead to negative impact on the environment.
16.	Given that Matilda uses a swarm of bee-like nanobots that fly continuously between trees, this may result in disturbance to the natural environment. This is because their behaviour may be unnatural, which may cause animals in that area to see it as threatening, which may lead to stress amongst them. Studies have shown that bears show signs of distress like increased heart rates when drones are nearby. Native wildlife in Tasmania may also be affected by the presence of these nanobots. Hence, this may cause a disturbance to the environment.

Step 2. Select an Underlying Problem

Using the challenges listed in Step 1, identify a problem of major importance to the Future Scene situation. Write your Underlying Problem making sure your question clearly explains the action that will be taken and the desired results/goal of that action.

Given that there is great uncertainty with producing enough cherries to meet the demand due to the spread of antibiotic resistant disease amongst cherry trees, how might we improve the development of effective botanical treatments targeting antibiotic resistance so that the negative impact of antibiotic resistance on cherry businesses can be mitigated in Tasmania in the year 2047 and beyond?

Step 3. Produce Solution Ideas

Generate solution ideas to the Underlying Problem in Step 2. Choose the 16 most effective solutions and write the elaborated ideas in the space provided.

1.	We, the Technological Institute of Tasmania, will develop the DocVision Machine, which will virtually imitate how bacterial mechanisms and treatments work and respond to each other. DocVision speeds up the proving of treatments and comes up with suggestions in case treatments do not work. With DocVision, researchers do not have to worry about waiting for results nor acquiring experimental ingredients as everything will be done virtually, hence increasing the speed of developing effective botanical treatments. We hope to implement this solution by the year 2047, in Tasmania
2.	We, the Australian Government, will host the Cherry Problem Solving Competition where competitors from every country will compete to find botanical treatments for the cherry farmers in Tasmania. The competitors judged to have the best solutions will be awarded with a 1 million cash prize for research and a long-term collaboration with Tasmanian cherry farms, and the solutions will be used by scientists and farmers to solve the antibiotic resistance issue in Tasmania. We plan to implement this solution in the year 2045 in Tasmania.
3.	We, the Developers of ShrubCubator, will develop ShrubCubator, a novel technology which allows researchers to analyse the genome of parent cherry trees and model the genomes and phenotypes of future generations of cherry tree plants with high accuracy. Additionally, ShrubCubator would be able to incubate micro-versions of young plants and facilitate the breeding of antibacterial cherry trees across several generations. Since research has shown that the process of breeding antibacterial plants is often lengthy and can take up to decades, this solution will facilitate the development of cherry trees with immune strands by facilitating the process tremendously so that researchers can analyse the genome and breed the plants with higher efficiency. This solution will be implemented by the year 2047 in Tasmania

4.	We, the Institute of Technology, will work together with 'miracle cure' companies, and identify if they have any scientific backing to the cures. In 2022, it has been shown that food substances have antimicrobial properties. Hence, the miracle cures may not be entirely unfounded. Hence, we will place their inventions under scrutiny in our research laboratories, and through the usage of our Antibiotic Resistant Identifier, we will find out whether any of these miracle cures can have positive impacts on botanical treatments. Should they have any positive impacts, we will combine these cures with scientific backing, allowing the treatment to have both traditional and science backing. We will implement this solution in Tasmania in the year 2046
5.	We, the developers of Beebots, will innovate a new function, Beebop reverse-pathogen, compatible with the Beebot identification function. Upon Beebots identifying antibiotic resistant bacteria, they will dispatch their small Beebop reverse-pathogens into the area of infections. Beebops then senses and analyses reverse-mechanisms that the resistant bacteria uses to overcome treatment, and attack their biofilms accordingly. The Beebops are similar to a blank bacterial canvas that fights bacteria according to their evolutions instead of aiming at a certain type of bacteria, and this prevents bacteria from developing resistance towards Beebop treatment, hence increasing the effectiveness of treatments against bacterial infections. We hope to implement this solution by the year 2047, in Tasmania
6.	We, the Tasmanian Government, will retrieve $3 billion from our economic reserves to aid in funding of the development of effective botanical treatments. We will use this financial resource to support small companies that may be hindered by the issue of financial constraints, thus preventing them from venturing into development of effective botanical treatments. Hence, we will provide the financial support to companies nationwide, so that we can find effective treatments as soon as possible. We intend to roll out this financial aid scheme by 2043 in Tasmania.
7.	We, the World Health Organisation will facilitate a research pact, in which countries who are interested can join in to fund more research and testing. Research shows that funding is a huge issue in developing new drugs to antibiotic resistant strands of bacteria, in which research has shown that for a new drug to enter the market it requires 1.5 billion dollars. Hence, countries who join this pact will get a certain supply of healthy and immune cherry trees when they are developed. We believe that this will be able to facilitate research and new treatments. We will implement this solution in Tasmania in the year 2046.
8.	We, the Australian Physicist Association, will work with the Australian Musical Association, to incorporate a sound wave scientifically proven to calm plants down into an album of Music For Cherry. Currently, social experiments have proved music to be able to facilitate plant growth. Hence, farmers can play the Music For Cherry album to

	the plants throughout the day and increase plants' immunity and growth, allowing plants to fight bacteria better on their own. We aim to implement this solution in Tasmania, by the year 2046
9.	We, the Agricultural Authority of Australia will work with the World Health Organisation to create a International Bacteria Research Team (IBRT) to support research into finding a solution for pseudomonas avium infection. IBRT wil consist of agricultural experts from all over the world. Since research has shown that the thermafrost and underground contains many ancient bacterial sample, ancient bacterial samples will be analysed with the pseudomonas avium to find clues to how pseudomonas avium evolved and develop a new drug from the nacient bacterial strains. This will facilitate research and testing to develop a solution. This will be implemented in Tasmania in 2047.
10.	We, the AntiBYEotics Association, will create a machine that puts crops in a food-friendly electrolyte. This tricks bacteria into moving into the electrolyte, leaving the agriculture free of infections. The bacteria is shocked at high voltage, while the crop shocked at low voltage. This eliminates antibiotic-resistant bacteria,. We believe that this will allow crops to be protected from antibiotic resistant disease. We aim to implement this solution in Tasmania, by the year 2046
11.	We the Association of Genetics, will produce genetically modified amoeba named MunchBa. These genetically modified amoeba which can be added to water (which is used to water the plants) , will be genetically coded to identify the bacteria causing the problems and ingest all of the bacteria. This clears the plants of all the bacteria, and it will be removed from the plant through transpiration and dissolves in the environment. We will implement this solution in Tasmania in the year 2046.
12.	We, the Ministry of Media in Tasmania, will implement a system to guard against fake news. On all media platforms, including social media, any information regarding new botanical treatments will be screened using an algorithm. This algorithm using deep learning such that it can recognise what news is true and what is false. It will place a logo next to information that it deems to be true, while a warning will appear when the user scrolls to information it deems to be false. This provides a real-time indication of whether the news is true or not. This increases the chance that farmers will correctly use the new botanical treatments that are rolled out, thus increasing the chance that the botanical treatments will be effective. We will do this in Tasmania by 2043.
13.	We, the Ministry of Health Tasmania, will put all the data collected from the beebops into a multigovernmental database. This database will allow the data to be shared among different research agencies. This data will be used for research to come up with new botanical treatments. This database will be encrypted with three strong firewalls. Hence, we believe that this solution will be able to facilitate the development of botanical treatments. We aim to implement this solution in Tasmania, by the year 2046

14.	We, the Australian Scientific Organisation, will innovate Desteria, a new bacterial strand that imitates resistant bacteria and obstructs communications between bacteria. Desteria destroys quorum sensing, which are inhibitors that regulate the ability of bacteria to carry out colony-wide functions like virulence. Research showed that quorum sensing is vital for bacteria to attack as a whole. Hence, Desteria prevents the resistant bacteria in the cherry trees from infecting the trees and the bacteria will be destroyed by the trees' own immune system. We plan to implement this solution by the year 2047 in Tasmania
15.	We, the Institute of Plant research will develop a SapTest machine. Farmers could use SapTest to prick the plant, the DNA of the plant sap will then be analysed. SapTest will perform a scan for the antibiotic-resistant bacteria present in the plant and if any infection is found, perform a gene-editing process to remove the infected genes from cells in the plant. The edited cells will propagate and take over infected cells, thereby removing the infection from the plant. This solution will be implemented in Tasmania in 2047
16.	We, the team at Solutions of the Future, will ensure that the new treatments rolled out will be appropriately used by the farmers. We will do so through conducting mass workshops on educating them on how to use the various new solutions, incorporating virtual reality into these workshops. We will have a booth where farmers can step inside and try out using these new treatments. Through this hands-on experience, they will be more familiar with how to use the new solutions, thus ensuring that these treatments will be effective in practice. We aim to do so by 2045 in Tasmania.

Step 4. Select Criteria

Generate criteria to determine which solution idea does the best job of solving the Underlying Problem and/or addressing the Future Scene situation. Select the 5 most important criteria for measuring solution ideas and write them in the spaces provided.

1.	Since reducing the damage on cherry trees caused by antibiotic resistance requires a long term solution, which solution is the most sustainable so that there is less risk to the cherry trees in the long run in Tasmania in the year 2047 and beyond?
2.	Since many farmers do not trust the new solutions due to misinformation, which solution will garner the most trust from the farmers so that it can be widely implemented to the farmers in Tasmania in the year 2047 and beyond?
3.	Since antibiotic resistant disease results in the cherry trees dying, which solution has the least risk of malfunctioning so that the cherry trees are not put at risk in Tasmania in the year 2047 and beyond?
4.	Since the problem of antibiotic resistance in cherry trees is becoming widespread at fast rates, which solution is the most time effective so that the negative impacts caused by antibiotic resistance can be mitigated as soon as possible in Tasmania in the year 2047 and beyond?
5.	Since antibiotic resistance in cherry trees have not had much research and treatments, which solution will improve the development of effective botanical treatments targeting antibiotic resistance the most, so that the negative impact of antibiotic resistance on cherry businesses can be mitigated in Tasmania in the year 2047 and beyond?

Step 5. Apply Criteria

From the solution ideas written in Step 3, select the 8 ideas with the most potential to solve the Underlying Problem and list them on the grid. Use each criterion to rank the solutions on a scale from 1 (poorest) to 8 (best).

Solution Number	Solution Ideas	Criteria					Total
		1	2	3	4	5	
# 1	DocVision	4	1	7	2	3	17
# 2	cash prize for botanical treatments	3	2	6	3	5	19
# 3	ShrubCubator	2	8	5	1	4	20
# 4	miracle cure scrutiny	7	3	1	4	1	16
# 5	Beebop reverse pathogen	8	7	8	6	7	36
# 6	funding new research	1	6	2	5	2	16
# 7	research pact	5	5	4	7	8	29
# 8	Music For Cherry	6	4	3	8	6	27

STEP 6. Develop an Action Plan

Action Plan based on Solution # 5

Development of Action Plan

Develop your top-scoring solution idea into an Action Plan. Thoroughly explain how the Underlying Problem is solved, how the plan will be implemented, and how the Future Scene will be affected.

INTRODUCTION

Realising that there is a great uncertainty with producing enough cherries in Tasmania to meet the demand due to the spread of antibiotic resistant disease amongst cherry trees, We, the developers of Beebots will work with the Agricultural Authority of Australia to improve on the development of effective botanical treatments. To combat antibiotic resistance bacteria in the cherry trees, we have come up with a novel solution - Fastbot, a smaller nanobot which is compatible with Beebot nanobots and acts as a new function to facilitate the identification and treatment of infected cherry trees.
Additionally Fastbot also facilitates more research into antibiotic-resistant bacteria strains affecting cherry trees to help researchers come up with more varieties of solutions to combat the infections.

It is known to everyone that our Beebots surveils cherry farms and scans for bacterial infections in the cherry trees. However, many farmers face the same problem of not knowing how to cure their trees' bacterial infections and are in constant stress about the issue. Fret not, for our new addition to our Beebots: the Fastbot, solves this problem!

FEATURE 1: FAST CURE

Firstly, the Fastbot is a quick cure to bacterial infections in cherry trees. Upon Beebots identifying antibiotic resistant bacteria, they will dispatch their small Fastbot reverse-pathogens into the area of infections. Bacteria uses their reverse-mechanisms to combat antibiotics and develop resistance to them, and Fastbot eliminates this problem by sensing and analysing bacteria's reverse-mechanisms. The Fastbot quickly generates a DNA code to morph itself into a reverse-pathogen accordingly to the resistant bacteria, and attack their bacteria's biofilms accordingly.

To put it in simple terms, Fastbots are similar to a blank pathogen canvas that fights bacteria accordingly to their evolutions instead of aiming at a certain type of bacteria, and this prevents bacteria from developing resistance towards FastBots treatment, hence increasing the effectiveness of treatments against bacterial infections.

FEATURE 2: RESEARCH DATABASE

In addition to effectively removing the plant if the antibiotic-resistant bacteria, Fastbot also analyses and collects information on resistant bacteria's reverse-mechanisms, and send all the information into an encrypted external database managed as a online free database for all researchers in the agricultural sector. The database will be moderated by the Agricultural Authority of Australia and only data from FastBot would be uploaded anonymously. As of current times, such technology exists such as WHO's Global Antimicrobial Surveillence System, that allows researchers all over the world to contribute to the system. Researchers across the world would be allowed to access the data but would not be able to edit. This research database can provide greater insight into how the antibiotic-resistant bacteria affect cherry trees, this could facilitate collaborative research into developing new solutions and improve the the development of botanical treatment of infected cherry tree plants.

WHY IT WORKS (RECAP + LINK TO KVP AND PURPOSE OF UP)

FastBot well addresses our goal of improving the development of effective botanical treatments targeting antibiotic resistance as it in itself, is an effective botanical treatment. What sets FastBot apart from antibiotics or even new classes of drugs is that it is forever one step ahead of the bacteria. Instead of only working on a type of bacteria, it adapts. Once a blank canvas, it will morph into the treatment needed upon analysing what kind of bacteria it needs to fight. Hence, this solution is sustainable. With its algorithm supported by deep learning, FastBot does not need to be renewed every few months when a new strain of resistant bacteria emerges. It learns and adapts accordingly, which is what makes it highly likely to succeed killing resistant bacteria.
Effectively, FastBot is unaffected by bacterial adaptations, thus directly addressing the issue of antibiotic resistance. In turn, the negative impact of antibiotic resistance on cherry businesses can be mitigated. When we address the issue of antibiotic resistance and effective botanical treatments are developed, farmers will then have a solution to their problem. Disease will no longer rampage their crops and their businesses will recover.

In addition, our FastBots are also biodegradable. They will biodegrade should they malfunction. This will ensure that the FastBots are not counterproductive and will not cause problems to the natural environment.

Given its small nature, FastBots can be deployed all around Tasmania, promoting the popular usage of FastBots. This increases the usage of the fastbots by farmers throughout the country.

LIMITATIONS + HOW WE OVERCOME

However, despite the many benefits, our product may have a few limitations. Fristly, it may be possible that farmers may not trust the product. However, we will take important steps to address this issue. We will collaborate with the Hologram Assocaition of Tasmania and create a hologram named AskFast, that will be able to answer any questions that the farmers have. They will answer the farmers queries and assuage their worries quickly. We trust that this hologram will be able to garner trust from the farmers. In addition, we will create a virtual reality programme. This will allow farmers and the public to tour the cherry farms from the point of view of the FastBot, allowing them to understand the function of the FastBot. This will solve the issue of distrust from the farmers by increasing transparency in the technology.

Secondly, it may be possible that there may be concerns about security issues due to the compilation of research information in the database. However, we will take steps to address this issue. The database will be encrypted with 3 strong firewalls. The database will also be multi governmental to ensure that the information will not be misused or wrongly used by the government. Hence, we believe that this will increase security and ensure that the farmers' worries can be solved.

Lastly, it may be necessary to ensure that the FastBots do not malfunction and in turn, cause harm to the natural environment. Before placing the FastBots on the market, we will put the FastBots through a 1 week intense training programme, in which they will be under constant surveillance, with regular checkpoints. This will allow all FastBots to have functioning parts, which will not have any issues when they are dispatched. To ensure that they are working as they should be after they have been sold, there will also be reports about their functions sent to the database, as aforementioned.

FUNDING

We will receive a subsidy from the Tasmanian Ministry of Health. The rest will come from crowdfunding. Furthermore, our FastBots are actually very sustainable as they are made from a new material that our laboratories discovered, Fastium. It is cheaply sourced and biodegradable. Hence, it can be seen that they are sustainable and can be used in the long run.

CONCLUSION

Hence, we believe that FastBot will be the solution that paves the future in botanical treatments targeting antibiotic resistance in Tasmania in the year 2047 and beyond.