

GENE DRIVE SIMULATION INSTRUCTOR GUIDE

TOTAL TIME: 120 MINUTES | STUDENT NUMBER: 9-30 STUDENTS

LEARNING GOALS

The simulation is designed to highlight the inescapability of ethical considerations when developing and deploying technologies. Conscientious scientists must be equipped to engage in ethical reasoning. Each scenario emphasizes the complexity of making ethical decisions. There may be no obvious “right” answer and reasonable people may disagree with one another, however this need not mean that there are no right answers to ethical questions. Working through the simulation and debrief, students will learn that ethics is about justifiability to others using principled reason and begin to appreciate that productive ethical analysis and discussion is a skill, just like technical skills learned in the lab, that can be developed with practice and honed over time.

LEARNING OBJECTIVES

- By the end of this simulation, students should be able to:
 - begin to recognize what is needed to come to safe, effective, and just decisions;
 - by evaluating empirical (e.g., economic, environmental, geopolitical), social (eg., historical structures, and religious and cultural identities) and moral (e.g., rights, responsibilities, and distribution of benefits and burdens) considerations;
 - by considering the quality of available data and inputs and the degree of uncertainty when making a (policy) decision to reduce blind spots;
 - by establishing that a decision is moral by being able to justify your position to every potential audience and all stakeholders (and consider non-human stakeholders and global assets when doing so).
 - recognize the complexity of ethical decision-making and the grounds for reasonable disagreement.
 - self-reflect on their own values and biases.
 - recognize a plurality of moral stances and understand the challenges of communicating across value differences within their own groups.
 - articulate a conception of what a productive ethical discussion looks like.

PREPARATION

CLASS TIME BREAKDOWN (APPROXIMATE)

- Intro and Set Up: 10 minutes
- Running the Simulation (scenarios 1-3): 70 minutes*
- Simulation Debrief: 40 minutes*
- Total: 120 minutes*

MATERIALS

- Enough copies of the Code of Conduct Handout for each student or a PDF ready to share on screen
- Enough copies of each of the three Scenario Handouts for each student
- Two six-sided dice
- Gene Drive Simulation Slide Deck

STUDENTS PREWORK

Assign the following two readings to be completed ahead of class:

- Kahn, Jennifer, "[Gene editing can now change an entire species forever](#)," TED (February 2016).
- "[The Gene Drive Dilemma: We Can Alter Entire Species, but Should We?](#)," by Jennifer Kahn The New York Times (January 8, 2020).

GENERAL PROCEDURES

Before starting the simulation, divide participants into groups of 3-5 individuals. During the simulation, each group will be faced with three scenarios that require decisions. Decisions are to be made as a group according to the following procedure: 3 minutes of private reflection plus approximately 15 minutes of group discussion with the goal of arriving at a consensus that does justice to the complexity of the situation. Once each group has made its decision, the facilitator will call on the groups to report their decision and to roll two six-sided dice to resolve the outcome of the decisions. The facilitator then combines the group's choice with their dice roll to determine each groups' consequence of their decisions (see annotated scenarios and outcomes). The consequences can be shared using the gene drive simulation slide deck. Throughout this process, each participant should use the scenario handouts to keep a careful record of the reasons the group considered in their discussion, the votes taken, the decision the group arrived at, the results of the dice roll, and the consequences of the decision.

After the simulation is over, the facilitator will bring all the groups together for a common debrief. This is the most important element of the activity, pedagogically speaking, so it should not be given short shrift. In the debrief, the facilitator asks a series of questions that work through the decision making process groups just underwent. The goal is to use metacognitive reflection on the decision making process to inductively achieve the learning goals.

SUGGESTED LESSON PLAN

DAY ONE

(5 MIN) SETTLE IN AND INTRODUCE THE CODE OF CONDUCT

- Give rationale for why an agreed upon code of conduct is important: The simulation will cover challenging subject matter and likely raise disagreements. Disagreements are important, but we want to ensure we navigate them in a respectful and fruitful way as a class.
- Ask for questions and if any student would like to add anything to the code of conduct.

(5 MIN) GIVE INSTRUCTIONS FOR THE SIMULATION

- Assign groups of 3-5 students. Students will stay in the same groups for the entire simulation. Make note of who is in each group.
- Share Gene Drive Simulation Instruction (Slides 2-4)
 - To begin, explain that each group should imagine themselves as members of the executive board of the young tech startup Gene Drive Solutions, Inc. (GDSI). Inform them that they will be faced with three situations that require decisions.
 - Decisions are to be made as a group according to the following procedure:
 - 3 minutes of private reflection.
 - Approx. 15 minutes of group discussion with the goal of arriving at a consensus that does justice to the moral complexity of the cases.
 - If consensus cannot be reached, majority rules. If the group consists of an even number of students then flip a coin.
 - Remember to inform participants that although they are acting in the role of members of an executive board, they should be themselves for the simulation. In other words, don't make or accept arguments that they don't actually believe "because a tech entrepreneur would think that way," etc.
 - Use the handout to keep careful record throughout the simulation

(25 MIN) SCENARIO 1: PICKING A TEST CASE

- Distribute Scenario 1 Handout to each student (remember to hold on to Scenario 2 and 3 handouts so that they cannot read ahead).
- Give groups 18 minutes to make a decision (3 minutes for quiet reflection, 15 minutes for group deliberation).
- Return to class
 - Each group reports their decision and then rolls the dice. Read the resulting consequence out loud to the group from the slide deck. Then move on to the next group.

(20 MIN) SCENARIO 2: DETERMINING LIABILITY FOR UNFORESEEN CONSEQUENCES

- Distribute the Scenario 2 Handout to each student.
- Give groups 15 minutes to work on their PR statement.
- Return to class
 - If time allows: Have each group read their PR statement to the class and have other participants vote on how satisfactory they found the statement. This vote will result in a bonus or penalty applied to their dice roll to determine final outcomes (see annotated simulation outcomes for details)
 - Roll the dice and read their outcomes.

(25 MIN) SCENARIO 3: A REPUGNANT REQUEST: MORALITY AND DECISION-MAKING.*

- Distribute the Scenario 3 Handout to each student.
- Give groups 18 minutes to make a decision and to draft a company values statement that aligns with their decision (3 minutes for quiet reflection, 15 minutes for group deliberation).
- Return to class
 - Each group shares their choice and the company values statement they drafted.
 - Roll the dice and read their outcomes.

* IF DAY 1 GOES OVER TIME AND TIME ALLOWS ON DAY 2, SCENARIO 3 CAN INSTEAD BE RUN ON DAY 2 PRIOR TO THE DEBRIEF.

DAY TWO

SIMULATION DEBRIEF (30-50 MINUTES DEPENDING ON CLASS SIZE)

After the simulation is over, the facilitator will bring all the groups together for a common debrief. This is the most important element of the activity, pedagogically speaking, so it should not be given short shrift. In the debrief, the facilitator asks a series of questions that work through the decision-making process groups just underwent. The goal is to use personal and group reflection to inductively achieve the learning goals.

You may select from the debrief questions below based on the arc of the conversation, time available, and specific learning goals. Be sure to include questions from each scenario.

DEBRIEF QUESTIONS

- SCENARIO 1
 - Was this a difficult decision for your group? What made it hard?
 - What reason(s) seemed most relevant to the decision you made?
 - How many groups actively discussed the cost of waiting to release the gene drive?
 - Should a private company be able to overrule popular opinion? Did your debate treat B and C as the same, or was one option easier to rule out? Why or why not, given that both populations were opposed to the technology?
 - Does it matter that Equatorial Mbini's people opposed the implementation of gene drives for religious regions?
 - Do you think your group considered all the relevant reasons before making a decision? Why not? What reasons seemed most relevant in the decision reached (i.e. scientific validity, power structures, profit, morality, degree of uncertainty)?
- SCENARIO 2
 - You all drafted statements that were more or less effective at quelling activist anger. How many of you think the position you took in the statement reflects the actual responsibility and obligations of GDSI?
 - When you were crafting the statement as a group, was this primarily an exercise in ethics or public relations?
 - Did the impact of the statement on GDSI's stock price come up? Is that an ethically relevant factor to consider?
 - What are the ethically relevant factors behind this decision? What are some ethically irrelevant factors?

- SCENARIO 3

- How does the choice in Scenario 3 compare to the choice in Scenario 1? Are the same factors relevant and irrelevant?
- In response to Scenario 1, we asked whether a private company should be able to overrule popular opinion. Should a private company be able to turn down a popular request?
- Was it difficult to come up with a company values statement that justified your choices across all three scenarios? [You may want to push students to consider what is ethical action when the moral norms differ across cultures and societies.]
- Generally speaking, did the disagreements within your group tend to involve disputes about what facts matter or how to weigh facts that everyone agrees matter? Give an example from one of your most contested decisions.
- What missing expertise or personal perspective(s) could your group have benefited from?

ANNOTATED SIMULATION

FOR INSTRUCTOR'S EYES ONLY

SCENARIO 1

PICKING A TEST CASE

Gene Drive Solutions, Inc. (GDSI) is a young start-up that specializes in using gene drives to eliminate invasive species in localized areas without threatening the species' broader population. GDSI recently developed an "infertility gene" for a species of rat. The technology works by pushing inheritance rates for infertility in female rats to over 90 percent. Every female rat born with the infertility gene cannot reproduce, and every male rat born with the gene is a carrier for spreading the trait to the next generation. Over a few generations' time, an affected population can be driven to extinction. This specific gene drive has been extensively tested in laboratory settings, and **the development team is confident ($p < 0.05$) it is ready for real world application.**

Students may express reservations about the technology because it is "risky." The technology might not behave as expected. Call this "malfunction risk." According to the terms of the scenario, the best scientific evidence available suggests that there is a 95% chance the technology will work in the wild as it did in the lab. So the malfunction risk is 5%. Is this an acceptable level of confidence? If not, what level would be acceptable? A second sense of risk is that the gene drive might work exactly as advertised, but the social and/or ecological consequences might be unexpected. Call this the risk of "side effects." Side effects are an important consideration for participants to consider, but it is important to distinguish between this risk and the first type of risk. Sometimes people conflate the two and end up exaggerating the malfunction risks. Note that the simulation's results mechanics roughly approximate this level of risk of malfunction—only a roll of 11 or 12 means there was a malfunction (5% chance).

Does New Wyland's prior investments make it more or less appropriate to test the technology on their islands? Has New Wyland established legitimate expectations that the island will be the test site? Or, has New Wyland already borne part of the burden of developing the technology, such that it would be unfair to expect them to bear more of the burden (in the form of risk)?

Throughout the development process, it was assumed the first use would take place in New Wyland. **GDSI's largest investors are an environmentalist foundation based in New Wyland and the government of New Wyland**, and the country is a natural choice for many reasons:

- It is a remote island chain, which makes it easier to prevent the gene drive from spreading beyond the targeted population.
- The rats are not native to the islands, having arrived on European ships in the late 1700s.
- The rats are a threat to several endangered species only found on the islands.
- The islands already spend a substantial amount of money on less effective forms of pest control to keep the rat population from exploding.

NEW WYLAND

Population	4.8 million
Per Capita GDP	\$42,200
Anticipated Benefits	<ul style="list-style-type: none">• Increased income from tourism, decreased pest control expenses, etc. (est. \$800 per capita)• Prevent the extinction of several bird species only found on the island
Public Support	2018 poll: 68 percent in favor, 32 percent opposed. 2020 poll: 66 percent in favor, 34 percent opposed. 2022 poll: 42 percent in favor, 58 percent opposed.

New Wylanders are relatively well off already (\$42,000 per capita). Is a ~2% increase in GDP (\$800 per capita) a significant enough benefit? How important is it to have these economic estimates?

Just as the technology is ready to be deployed, however, New Wyland's participation has been cast into doubt. Despite having expressed support for the last several years, the most recent public opinion polls reveal that a majority of New Wylanders express opposition to releasing modified rats in the country at this time. Reports from focus groups reveal that the negative public response is driven by risk aversion, which has become salient now that the technology is ready for use, not an objection to the goal of eliminating the rats. New Wylanders would be happy to see the rats gone, they just don't want to be the gene drive technology's guinea pig. If the gene drive were proven safe elsewhere first, they would be glad to use it. In response to the shift in public opinion, the New Wyland Parliament seems likely to reverse its support for the plan—and its investment in GDSI. If the company cannot demonstrate its technology's large-scale efficacy soon, its stock price will suffer.

The polling reveals that clear majorities supported using gene drives over several years. Should the present polling receive greater weight? Why or why not, especially since none of this is actual voting?

Fortunately for GDSI, a search for other possible test sites revealed another promising candidate: Equatorial Mbini.

EQUATORIAL MBINI

Population	2.0 million
Per Capita GDP	\$2,700
Anticipated Benefits	<ul style="list-style-type: none">• Increased income from agriculture, productivity, etc. (est. \$1,200 per capita)• Reduced malnourishment and the spread of disease (est. 11,000 lives saved per year)
Public Support	2018 - 2020: No data available. 2022 poll: 32 percent in favor, 68 percent opposed.

Equatorial Mbinians are relatively quite poor. An extra \$1,200 per capita benefit of rat eradication is a 44% increase to their per capita GDP.

Successful use of the gene drive in Equatorial Mbini would save 11,000 human lives a year, while use in New Wylanders would save several bird species. Are these respective benefits commensurable?

Since half of those opposed could be convinced to support the plan if it were tested in New Wylander first (34% of the population), one could argue that gene drive release has a majority support (66% of the population) on condition of it being found safe elsewhere first. Is such an argument reasonable?

Equatorial Mbinini is a Central African country comprising a mainland region in addition to offshore inhabited islands (the capital of the country is located on the largest of the islands). The islands of this nation suffer from an invasive rat problem as well. The rats, which were brought over on Dutch slavers' ships in the late seventeenth century, cause tremendous damage to the country's farmers and pose a public health hazard. Despite the benefits promised by rodent elimination, the Mbininians are even less inclined to allow GDSI to release modified rats in their country than are the Wylanders. **Mbinian opposition is evenly split between two groups.** One group, like the Wylanders, opposes GDSI's plan due to the risks involved. **The perception of the plan's riskiness is exacerbated by Mbinian's historical distrust of Western science and business interests.** However, if a Western country (like New Wyland) were to test the technology first, they could be persuaded to embrace it. The other source of opposition is the country's significant religious fundamentalist population.

Should this reason for mistrust be taken into consideration when evaluating risk? If so, how?

The fundamentalists argue that GDSI is interfering with God's plan by deciding which species deserve to live and die. These people would not be persuaded to accept GDSI's services even if it was proven safe elsewhere first.

Is this a valid type of consideration in democratic politics? Equatorial Mbinini is not a democracy, but this may be relevant insofar as participants think public opinion on an issue matters.

Although a clear majority of the population is opposed to using the gene drive, **the Mbinian dictator, His Excellency, President for Life, Generalissimo Johnson, is a vocal advocate for using a gene drive to solve the country's rat problem.** He has repeatedly made the case to the public that GDSI's technology could jump-start the country's economy and save tens of thousands of lives. In fact, he's even framing it as an ethical imperative for GDSI to work with Mbinini as a form of reparations for historical injustices perpetrated by the West. Less publicly, however, the generalissimo has demanded that the company pay him a small "friendship fee" of two million U.S. dollars to gain access to his country as a test case. The bribe would be a drop in the bucket for GDSI, as long as it can secure a contract with New Wyland by proving its technology's safety. What is more, the economic benefits of rat elimination to the Mbinian people could be life changing.

WHAT ACTION SHOULD GDSI TAKE?

- A Delay deployment of the technology by two years to collect further safety data in more lab based trials, then try again to convince New Wyland to be the test case.

Many participants will think this is the "safe" choice. An important intended takeaway of the simulation is that this choice has costs (the lack of the likely benefits described above) that must be justified to those who could have been helped but were not out of an "abundance of caution." And there's no guarantee that New Wyland will agree to be the test case in 2 years.

- B Bribe the generalissimo, using Equatorial Mbini as the test case. Hopefully it will lead New Wyland to change its mind and become a second adopter.

On the one hand, this involves making a bribe and overriding public opinion. At the same time, it could offer the people of Equatorial Mbini tremendous benefits...if it works.

- C Have GDSI lobbyists pressure Parliament to ignore public opinion and move quickly to test the technology in New Wyland anyway. Ignore the generalissimo's offer.

Like option B, this option involves ignoring public opinion. Is it any better or worse to ignore public opinion in New Wylander vs. Equatorial Mbini, a democracy vs a dictatorship? Also, it should be noted that this option does secure the consent of the people's legitimate representatives. Is lobbying problematic, especially when the end pursued could benefit the people (and the birds) of New Wylander?

- D Bribe the generalissimo and aggressively lobby Parliament to ignore public opinion, using both nations as simultaneous test cases.

To many this will look like a bizarre inclusion, the worst of both worlds. This option is included to draw attention to the fact that choosing New Wylander or Equatorial Mbini as the initial test case inevitably means leaving the other without the expected benefits of the intervention for the year or more it will take to assess the consequences of the gene drive in the real world. Whether or not this is moral or prudent, it does have costs.

OUTCOMES

A Outcomes:

- Result of 2 – 10:
 - Delay for further testing reconfirmed that the gene drive technology appears safe and ready for implementation. In the meantime, New Wyland forewent \$7.7 billion in GDP growth as a result of inaction. Additionally, two of the endangered bird species were driven to extinction by rats that preyed on the eggs of their young. Equatorial Mbini forewent \$4.8 billion in GDP growth as a result of inaction. Additionally, 22,000 people who could have been saved died of malnourishment and diseases carried by the rodents that were not eliminated. GDSI's stock price fell \$10/share because of the delays.
- Result of 11-12:
 - Delay for further testing uncovered a defect, which has been corrected. Had the defect not been corrected, the gene drive could have spread from the targeted rat population to several adjacent native species, leading to the extinction of the native species as well as the targeted rats. The long term impact on the ecosystem had this occurred is unknowable, but economists estimate that the total costs of a faulty release could have run to over \$100 billion. GDSI dodged a bullet!
 - That said, delaying the implementation of the gene drive resulted in two of the endangered bird species being driven to extinction by rats that preyed on the eggs of their young. Additionally, 22,000 people in Equatorial Mbini who could have been saved if the rats had been eliminated died of malnourishment and disease. Additionally, GDSI stock price falls \$15 as the discovered defect has made investors nervous.

B Outcomes:

- Result of 2 – 10:
 - For a mere \$2 million bribe, GDSI secured access to Equatorial Mbini as a test case, and the technology passed its trial with flying colors. Implementation in Equatorial Mbini confirmed the safety of the gene drive technology! As a result, Equatorial Mbini experienced \$4.8 billion in GDP growth and 22,000 Mbinins are still alive who would have died had the rodent problem gone unaddressed. Things are less rosy in New Wyland: New Wyland forewent \$7.7 billion in GDP growth as a result of inaction. Additionally, two of the endangered bird species were driven to extinction by rats that preyed on the eggs of their young. The success of the trial in Equatorial Mbini has made New Wyland anxious to acquire GDSI's services. GDSI stock soars \$100/share!
- Result of 11-12:
 - For a mere \$2 million bribe, GDSI secured access to Equatorial Mbini as a test case. Unfortunately, implementation in Equatorial Mbini revealed an undiscovered defect in the gene drive technology! The gene drive was able to spread from the targeted rat population to several adjacent native species, leading to the extinction of the native species as well as the targeted rats. The long term impact on the ecosystem is unknowable, but economists estimate that the total costs of the faulty release will run to over \$100 billion. GDSI stock falls \$50/share!
 - New Wyland forewent \$7.7 billion in GDP growth as a result of inaction and two of the endangered bird species were driven to extinction by rats that preyed on the eggs of their young. However, given the technology's catastrophic consequences in Equatorial Mbini, New Wylanders are counting themselves lucky.

C Outcomes:

- Result of 2 – 10:
 - Implementation without public support in New Wyland was risky, but the people came around when the release confirmed the safety of the gene drive technology! As a result, New Wyland experienced \$7.7 billion in GDP growth and no endangered bird species were lost.
 - Equatorial Mbini, which did not receive the technology, forewent \$4.8 billion in GDP growth and 22,000 people died of preventable malnourishment and disease. In light of the technology's successful implementation in New Wyland, a majority of Mbinians now support using gene drives to eliminate their rodents, too. GDSI stock rises \$80/share!
- Result of 11-12:
 - Implementation without public support in New Wyland was risky, and that risk didn't pan out when implementation revealed an undiscovered defect in the gene drive technology! The gene drive was able to spread from the targeted rat population to several adjacent native species, leading to the extinction of the native species as well as the targeted rats. The long-term impact on the ecosystem is unknowable, but economists estimate that the total costs of the faulty release will run to over \$100 billion. GDSI stock collapses, losing \$80/share!
 - In Equatorial Mbini, 22,000 people died of preventable malnourishment and disease. However, given the technology's catastrophic consequences in New Wyland, Mbinians are counting themselves lucky.

D Outcomes:

- Result of 2 – 10:
 - Implementation without public support in New Wyland was risky, but the public came around when the release confirmed the safety of the gene drive technology! As a result, New Wyland experienced \$7.7 billion in GDP growth and no endangered bird species were lost. GDSI stock soars \$50/share!
 - For a mere \$2 million bribe, GDSI secured access to Equatorial Mbini and the technology passed its trial with flying colors. Implementation in Equatorial Mbini confirmed the safety of the gene drive technology!

As a result, Equatorial Mbini experienced \$4.8 billion in GDP growth and 22,000 Mbinins are still alive who would have died had the rodent problem gone unaddressed. A second successful demonstration of the gene drive technology is drawing further interest around the globe! GDSI stock rises an additional \$30/share!

- Result of 11-12:
 - For a mere \$2 million bribe, GDSI secured access to Equatorial Mbini as a test case. Unfortunately, implementation in Equatorial Mbini revealed an undiscovered defect in the gene drive technology! The gene drive was able to spread from the targeted rat population to several adjacent native species, leading to the extinction of the native species as well as the targeted rats. The long term impact on the ecosystem is unknowable, but economists estimate that the total costs of the faulty release will run to over \$100 billion. GDSI stock falls \$50/share.
 - The premature implementation in New Wyland as well resulted in an additional \$100 billion or more in damages. The fact that Parliament caved to GDSI lobbyist pressure cost the company half a dozen friendly faces in the legislature. GDSI stock tanks an additional \$45/share!

SCENARIO 2

DETERMINING LIABILITY FOR UNFORESEEN CIRCUMSTANCES

Five years have passed since Decision 1 was made. GDSI's gene drive has been deployed, with details of effects determined by choices in Decision 1. (Choose the description below whose letter matches your choice in Scenario 1.)

- A After collecting further safety data in two years of additional lab-based trials, GDSI was able to secure a contract with New Wyland. Two years after that, the company also signed a contract with Equatorial Mbini. (Without the leverage of being the first test case, the Generalissimo was unable to demand a bribe for this "privilege.") The rodent problems in both countries are on their way to being solved.
- B Two years after using Equatorial Mbini as a [proof of concept] / [chance to work the kinks out], GDSI was able to secure a contract with New Wyland. The rodent problems in both countries are on their way to being solved.
- C Two years after using New Wyland as a [proof of concept] / [chance to work the kinks out], GDSI was able to secure a contract with Equatorial Mbini. (Without the leverage of being the first test case, the Generalissimo was unable to demand a bribe for this "privilege.") The rodent problems in both countries are on their way to being solved.
- D After [demonstrating the efficacy of] / [working out the kinks in] the gene drive in New Wyland and Equatorial Zambia, the rodent problems in both countries are on their way to being solved.

This scenario is intended to resemble the Catch-22 facing many aid efforts: sometimes aid is rendered ineffective because of corruption, but even when it is effective, that very effectiveness can bolster the authority of the repressive regime.

GDSI's gene drive technique is beginning to draw interest from clients around the world. As the company's profile rises, however, a protest movement has arisen that poses a growing PR threat. **It seems that the Generalissimo has been able to take credit for the economic and public health benefits of eliminating Equatorial Mbini's rat problem.** He has used this to strengthen his hold on power, which he has used to expand his government's oppression of a minority group. Now some prominent activists argue that **GDSI is morally liable** for this outcome and they want the company to **1) publicly apologize and 2) pay reparations to the victims of the generalissimo's abuses of power.**

What do participants think it means to be “morally liable” for an outcome? Students may be tempted to think of the unintended side effect described here as a clear example of an unforeseeable “accident.” Is this true? Did any of the groups consider something like this as a potential side effect of providing the gene drive service to Equatorial Mbini? Should they have considered it? Is there anything they might have changed about their deliberative process to make it more likely such a possibility was considered?

Some groups may decide to apologize but not to pay reparations. Is this a coherent moral position? If GDSI is an appropriate subject of blame, why wouldn't they also be under an obligation to compensate those they've harmed?

Draft a public response to the activists' charge for immediate dissemination on social media in 280 characters or less.

OUTCOMES

Roll 2d6. At the discretion of the class/instructor, add or subtract 2 points from the result for particularly persuasive/unpersuasive statements from the Board. Otherwise use the unmodified result of the roll of 2d6.

- 2 – 4: The statement has the exact opposite effect it was intended to have. GDSI shares lose 20 percent of their value.
- 5 – 7: The statement rubbed much of the public the wrong way. GDSI share value declines by 10 percent.
- 8 – 11: The statement adequately addressed activists' criticisms. GDSI stock stays stable.
- 12+: The statement was a resounding success. GDSI share price increases 20 percent!

You may consider having the participants of other groups give their reactions to the tweets as a measure of their likely public reception.

SCENARIO 3

A REPUGNANT REQUEST

Shortly after the events of Scenario 2, GDSI is approached by the prime minister of Indigia. Indigia offers to hire the company to help it eliminate the country's population of wild tigers. The tiger population is small in number (they are on the endangered species list), but a spate of tiger attacks on humans over the last decade has turned the public against the great cats. Last year alone, over three hundred tiger attacks occurred, and a majority of the victims were small children. Polling indicates that 71 percent of Indigian citizens support eliminating all wild tigers, and that number has been consistently rising for years. The governing party in Indigia's parliament explicitly campaigned on tiger elimination and credits this position with much of its support in rural districts.

The government already employs hunters to control the tiger population as much as possible,²² but completely eliminating the predators has proven to be harder than anticipated and the attacks on humans have increased yearly as the tigers' traditional hunting territory shrinks and human settlements expand. The government hopes GDSI's technology will boost the thoroughness of the elimination program beyond what hunting is capable of achieving.

Despite being terrifically popular domestically, Indigia's tiger elimination program has been heavily criticized by other countries, especially in the West. Indigia's response to its critics emphasizes three points:

- 1 Indigia is a democracy and its citizens overwhelmingly support this policy.
- 2 Indigian citizens are the ones bearing the cost of tiger attacks, not foreigners. They should have the final say over how to respond.
- 3 The West's desire to protect the tigers is hypocritical given its willingness to support eliminating pests that plague Western countries, like New Wyland's rats.

To what extent are considerations like these morally relevant?

Accepting Indigia's business would pay well, which would boost GDSI's profitability, but the medium to long-term effects on the company's reputation are hard to predict given international feelings about the project.

That said, if GDSI refuses the Indigian government's offer, it is likely the country will turn to an unproven competitor for the same gene drive service.

Further complicating the decision facing GDSI is the fact that gene drives are not an especially efficient way of eliminating the tiger population, at least not

in the short term, because tigers have a much longer reproductive cycle than rats. GDSI is confident its services could eliminate the tigers eventually, but it might take as long as half a century before they are truly eradicated.

Is it more acceptable to offer an intrinsically objectionable service if you think someone else will provide the same service if you don't? What if the substitute is more problematic in some way (in this case, by being riskier because unproven)?

Is it more acceptable to offer an intrinsically objectionable service if you think your service will not be very effective?

WHAT ACTION SHOULD GDSI TAKE?

- E Develop a gene drive to eliminate the local tiger population.
- F Refuse to aid development of a gene drive to eliminate the local tiger population.

In addition to deciding on a course of action for this case, draft a company values statement that expresses GDSI's principles regarding the use of its technology. Think of the values statement as a list of the principles the company will employ when deciding whether to accept or reject a potential client's request. Ideally, an outsider should be able to look at your principles and accurately predict what you'd choose in both Scenario 1 and Scenario 3.

To what extent is being asked to draft a values statement while making their decision impact the decision making process itself?

OUTCOMES

E Outcomes:

- Result of 2 – 6:
 - GDSI releases a gene drive targeting Indigian tigers. Because tigers have a longer reproductive cycle than rats, the effects are not immediate, but over the next few decades the tiger population that escapes hunting should dwindle to nothing.
 - Global reaction to GDSI's actions is uniformly negative. Many people are beginning to question the ethics of using gene drives for animal management entirely. GDSI's stock falls 50 percent.
- Result of 7 – 9:
 - GDSI releases a gene drive targeting Indigian tigers. Because tigers have a longer reproductive cycle than rats, the effects are not immediate, but over the next few decades the tiger population that escapes hunting should dwindle to nothing.
 - GDSI's reputation suffers from its decision to eliminate a popular species like tigers, and animal rights protestors make the company a prime target of their ire. GDSI's stock falls 25 percent.
- Result of 10 – 12:
 - GDSI releases a gene drive targeting Indigian tigers. Because tigers have a longer reproductive cycle than rats, the effects are not immediate, but over the next few decades the tiger population that escapes hunting should dwindle to nothing.
 - Global reaction to GDSI's actions is surprisingly muted. In light of the steady cash flow generated by the contract with Indigia, GDSI's stock rises 10 percent.

F Outcomes:

- Result of 2 – 6:
 - GDSI refuses to supply Indigia with a gene drive targeting their wild tigers. This plays well around the globe. However, GDSI's refusal does not deter Indigia's tiger elimination program. Instead, Indigia offers its business to an upstart GDSI competitor, Death Drive Inc. Unfortunately Death Drive's gene drive technology was less well developed. As a consequence, its gene drive contained a fault that allowed it to cross from the Indigian tiger population to the Caracal cat population as well. Now both Indigian tigers and Caracal cats are expected to go extinct within a few generations. Given the bad name the incident has given to gene drives, GDSI's stock falls 25 percent.
- Result of 7 – 12:
 - GDSI refuses to supply India with a gene drive targeting Indigian tigers. This plays well around the globe. However, GDSI's refusal does not deter Indigia's tiger elimination program. Instead, India offers its business to an upstart GDSI competitor, Death Drive Inc. DDI releases a gene drive targeting Indigia's wild tigers. Because tigers have a longer reproductive cycle than rats, the effects are not immediate, but over the next few decades the tiger population that escapes hunting should dwindle to nothing. Given the rise of a new competitor in the market, GDSI's stock falls 10 percent.