

IBICT: AGRITECH BATTLE

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Bud Georgiana

BATTLE 5: Agritech → role of technology in the most basic needs of humanity. Is this done well?

Proactive/Reactive: prevent bad things from happening or solving problems.

Understand their vision of technology, if their view of technology creates a better world for everybody.

PROACTIVE

Efficient, healthy, better approach. Point of the battle: different than the other ones;

Proactive vs reactive in systems that vary with time; problems arise:

1. proactive: before the problem → prevent
2. problem...
3. reactive: after the problem → cure

eg. teeth: prevent vs go to dentist

Agriculture

Reactive approach in 1939: pesticides in US, easy to produce then found out to be carcinogenic, allergies ... 1972/8 banished from market; farmers wanted something else → no much bothering about environment.

Proactive approach → 90s: reduce the quantity of products being used in problems in agriculture by taking problem in first stages, when it's weak: use less pesticides. Based on probabilistic models: sensors to collect temperature, humidity...probability of disease predicted → regulate quantity of products to use it.

EU also agrees: pesticides go everywhere (water air...) and wants to remove them or at least reduced → proactive approach preferred because it uses less

EXAMPLES

1 - Seed treatment → hydrate the seed with insecticides(fungicide?) in small quantities (like a vaccine). A reactive approach instead gives risk of death of seed and also disease for humans

2 - Fungus: major cases of troubles in Europe: rapid growth, carcinogenic, detected too late to be recovered.

- eg Corn Aflatoxin, also in Italy → loss of all the production

New technology can help: fungi grow in humidity/temperature --> use sensors to manage them.

3 - Biochemical: fight disease with natural predators:

- eg for a rice fungus that destroys 80/90% of culture, research found that bamboo oil used before the fungus appears can avoid this

Questions: Is a proactive approach more harmful for human health? -> less chemical substance on fields, well absorbed by plants

GMO: Proactive, but made to make plants resistance to toxic substance used in reactive approaches.

REACTIVE

Why reactive approach?

- Costs: proactive is very costly
 - disease prevention creates new diseases to prevent (organisms are more resistance eg antibiotics), also monitoring is expensive; average person will use our approach: higher return on investment
 - Ecological approach is stable [--> Question for them: is your reactive system ecological? In which way?]
- Environmental sustainability:
 - proactive only considers small subsets of problems; what if new bacteria for which you are not prepared?
 - In the reactive you are prepared: ESA allows free satellites images
 - Climate change:

Global warming triggering changes in geographical distribution and populations: can a proactive system prevent this? With lots of research and money.

Satellites images can show these dynamics: 30% CO2 from agriculture & pesticides (we only use when needed, they use it always).

Biodiversity: proactive is destroying it, pesticides destroys it.

TECHNOLOGY

Reactive disease management system: detect problem through monitoring → diagnosis → cure to avoid spreading.

DETECTION

Drones, remote sensing RGB images; wireless sensors for constant monitoring of state of plants; open-ended coaxial probes: problem detected in electrical way; nano technologies GPS: collect precise data, localize problem

DIAGNOSIS -> ML, neural network, lab analysis, experts

CURE -> Not only pesticides; Nano silver: stops diseases; magnetic nanoparticles: apply on field to protect ok plants from cure that you are applying to other ones; traditional: eradication, pruning...

SAILLOG examples: identify & treat several hundreds of problems; 30 years ago technology was not so effective, today we can change it.

HEALTH

Use of pesticides and antibiotics: large use is changing environment of the bacteria, they evolve and get immune. Shared immunity → superbugs: resistance to most of usual antibiotics, infect people from food → almost impossible to defeat (700 000 deaths)

[QUESTION Isn't your reactive approach that created the superbugs?]

QUESTIONS

Focus on challenging the conventional wisdom → preconceived ideas, common sense

Argue on impact and mindset, don't play the blame game

Student: Pesticides: 30% of CO2 are produced by agriculture; reactive said that they are only used when needed and that the proactive approach uses them more. Do you have data?

R: In Trentino: "protocollo di intesa Trentino" puts threshold on treatment, you are bounded. In the other case you treat all the seeds.

Student (rephrased): Why you think that nowadays you are able to react in a more rapid way to a problem?

R: The problem is there, you can detect it early with technology such as wireless sensor networks. Reacting to a change to take the right action

- Proactive: prevention
- Reactive: curing
- Reacting to a change → reacting; (proactive thinks it's part of proactive, because it's done before damage happens)

P: Proactive does not use more pesticides, that's why EU is adopting it. In some cases without proactively acting you will lose production. Also WASA, a university in US is doing research on proactive/reactive usage of pesticides: 10% less pesticides.

Lorenzo: Stick to impacts, not on semantics or data.

Student (rephrased): Evolution and resistance? Smaller amounts in proactive, but these are creating resistance?

Lorenzo: How do you make sure that in your approach you will not repeat the errors of the past? For P: How do you think that your proactive approach will break the induction fallacy related to creating resistance. For R: How can you convince us that in case of disasters the reaction will be quick?

P: We are using more natural methods: remove, limiting problems with glyphosat (reactive), we use other things (cover crop?) that fertilize and prevent erosion: protection for seeds, the good plants go through, while the other ones are suffocated. Other approaches involve natural predators of disease (frogs for insects). So proactive measures are not only chemicals, but thanks to ecological knowledge we have more ecological views to address problems

R: How do we avoid previous mistakes? We had no tech for seeing diseases early, now with a reactive approach we see problem earlier with technology. Technology reduces detection time, less collateral damage and has less impact on the environment.

Student: How do you make sure that proactive measures are the ones needed? What if your proactive measure (e.g. the predators you introduce) is useless?

P: Normally we use satellite image and we know based on data, e.g. aflatoxin... You see some data from which you can see it. When you introduce a predator in your culture you are sure they have enough food; if the insects don't come, the predators will starve.

There is also a testing in the lab.

Student: Every region has different products. In this globalized world you have to find a trade off between generalized proactive measures, that work in more places, because you invest time and resources and you risk that the measures work only on a limited scale. How do you address this?

P: Every country develops own methods, depending on history: prevent diseases based on study of place.

Student: But if the country doesn't have much money to do this research?

P: We have laboratories and every disease is recorded and studied.

Lorenzo: One phenomenon rising is the black swans: unexpected events because we specialise on preventing specific diseases. How can you apply proactive techniques for things that you don't foresee?

P: There are similarities and also differences between ecosystems. Capability to respond to unexpected diseases is rapid if environment is correctly "set up", it must have some characteristics.

R: Epidemics of Xilella: we are failing to prevent and also to react because we are putting effort in preventing... we don't invest in curing, eradication. Puglia olive trees not resistant to Xilella -> failure of prevention in Italy, Xilella comes from North Africa, where olive trees are resistant.

P: After this event, there is no solution for Xilella, because we need more money to study it. Also now after 5 years we are still studying it. Putting more money in a reactive approach would not have solved the problem.

R: But with our technology we could eradicate efficiently the trees.

P: You would have a crisis on the olive oil if you just eradicate all the trees.

R: No, we would invest money to see problem and remove only trees actually infected

Lorenzo: Think of prevention - cure in everything (e.g. cloud infrastructure)

P: In this Xilella problem, nothing worked. Just eradicate trees → more money used to study xilella. But if we obtain a solution, will we use this as a reactive or proactive approach?

R: This is related with the way in which Xilella evolves. If you use it reactively it won't evolve.

Student: Which approach made superbugs?

R: Proactive, because antibacterials are in the environment and bacteria evolve. Also the problem appeared only after the proactive approach was introduced.

P: Antibiotics treatment in human, resistant bacteria is transmitted inside the population.

Student: But in humans the resistance is developed after you take antibiotics.

Lorenzo: Antibiotic resistance comes from proactive use. For example, antibiotics are used in many cases independently from the cause. Here in Italy there is attention about it, but in US it is used more. In any case there are some pathogens in you body and they will get resistant.

SCALABILITY

P: In the reactive approach, how to you scale the technology you are using? E.g. Coaxial open-ended.... -> set up and retrieval from field.

R: Coaxial crops use antennas, wireless; small farmers using app, very low cost; bigger can use cloud with wireless sensor network... scalability is not a problem

Lorenzo: How technologies fit into the vision? Nailing down big trends of ICT (sensors, gps, computer vision...). Can you think of one technology very early in development that may be fitting into your vision? 10/15 years

R: Nano sensors, quantum radars → super radar in development, they send quantum over air

P: Intelligent machines e.g. John Deeres machines have sensors for measuring production → Specific hyper-localised model of disease.

BIODIVERSITY

How is a proactive system dealing with biodiversity? Because they are killing everything even before they are a problem.

Lorenzo(to P): Industrial level architecture, when fertilizer was invented: hybrids as a proactive measure (increase resistance, yield). Problem: selected diversity, seed banks, no more the same initial diversity: is it enough to bootstrap the species again? Monopoly of companies producing seeds being cultivated. How do you break the circle?

It's true that there is this small no. of companies that make seeds; not true everywhere (Australia)

Low scale production, which should be scaled up

to R . When we abandoned micro-scale agriculture, we had good reasons: sustain growth of population. Now you say that we are mature enough to go back to that system. Give me one good reason why, not only technology.

Farmers are more informed, e.g. also in Trentino -> farmers are able to find a reactive answer to the problems

And because the market is shifting its attention -> people are willing to pay more if product is preserving environment and favouring biodiversity

COSTS

Student(to R): What if it the cure takes too long, and my production goes lost?

You can't change the whole system alone. If the other ones adopt a proactive approach, you cannot be the only one using reactive measures: shift of all the system. Minimize losses

Lorenzo: Different mindsets: proactive -> you can control things ...

RECAP

The two approaches reflect a different mindset (e.g. proactive based on the thought that you can control things).

R: When you fail with proactive: damage is unsustainable; time are mature to shift to reactive approach.

P: Do you want to be a person who solved problems only when they appeared or to be a person who things about problems and plan their life before.

Reactive won!