The DiverBeans story
Developing organic crop diversification measures to optimise bean production in North Macedonia

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Act 1

Location: Somewhere at ETH Zürich campus, July 2019

Common beans are widely grown and consumed in North Macedonia. However, their total production has reduced by over 30% in the last decade. Why? How do we sustainably improve bean production?

Let us not assume the challenges. Instead, we will use the transdisciplinary approach and involve the stakeholders to find out. Scientists and practitioners may have different perceptions of the problems and of the desired solutions.
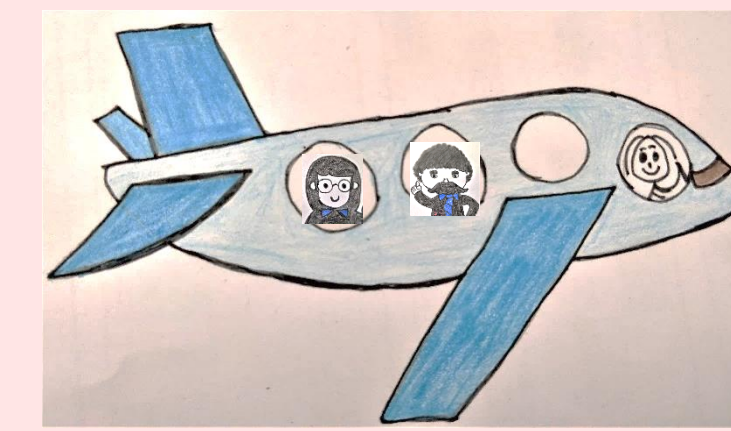
What is transdisciplinarity?

Broadly, transdisciplinaryity is a process that tries to link scientific knowledge to knowledge outside academia by means of a joint dialogue. It aims to find solutions that are accepted by stakeholders and thus, have a higher implementation potential.

Ok, let us go to Macedonia to find out!
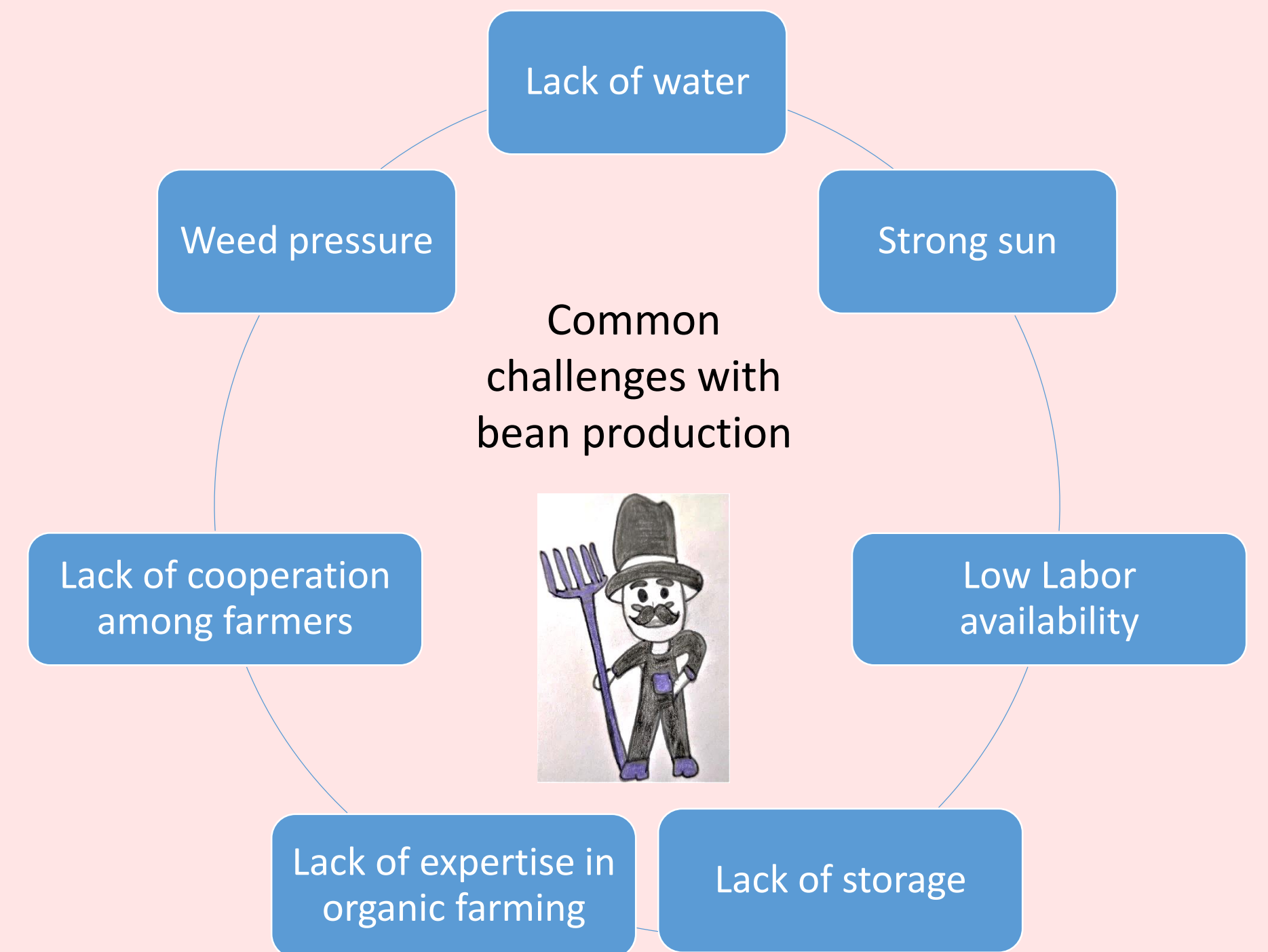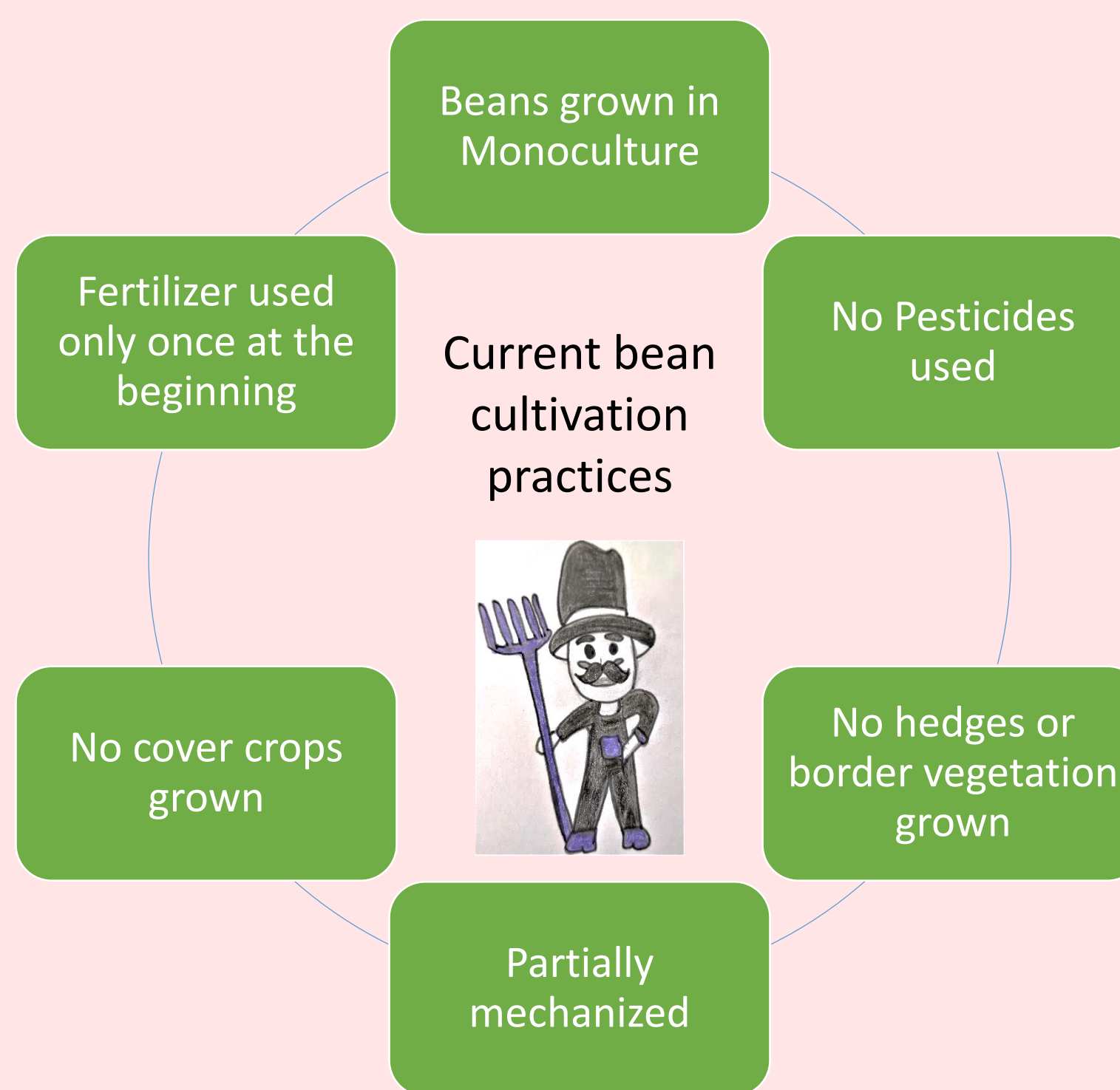
The Actors

Bee and Tetra, The Academics

Jolly, The Farmer

Act 2

Location: Eko-Ilinden farm, North Macedonia, September 2019

We conducted a two day workshop with the stakeholders in Macedonia. It included discussions and a group drawing exercise. The aim was to collaboratively determine challenges with bean production and develop potential solutions

Current bean cultivation practices
- Beans grown in Monoculture
- No Pesticides used
- No hedges or border vegetation grown
- Partially mechanized
- No cover crops grown
- Fertilizer used only once at the beginning

Common challenges with bean production
- Lack of water
- Strong sun
- Low Labor availability
- Lack of storage
- Lack of expertise in organic farming
- Lack of cooperation among farmers
- Weed pressure

Act 3

Location: Thinking hard at the Greenhouse, ETH Eschikon, September 2019

Designing a cropping system, including greater diversity of crops and bean varieties could combat the effect of drought, strong sun and weeds
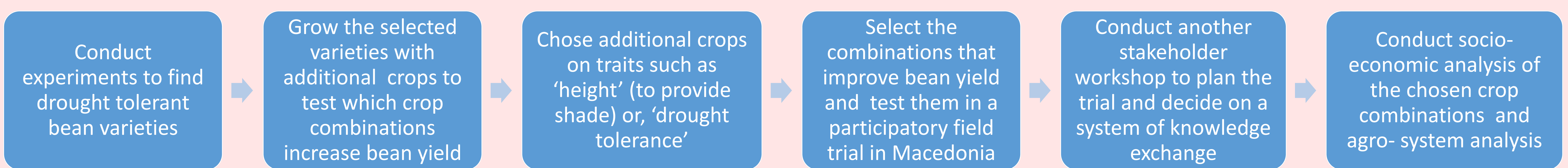
Excellent! As the first step, let's test the effect of diversity and crop identity on bean yield and profitability……

…..Although what about the societal challenges such as lack of cooperation or expertise? We need to understand the system to ensure adaptability of our trial.

hmmm, so we need a deeper understanding of the agricultural system and farmer behavior to estimate the long-term implications of our project

Yes, The transdisciplinary way!
We could follow the steps below:

- Conduct experiments to find drought tolerant bean varieties
- Grow the selected varieties with additional crops to test which crop combinations increase bean yield
- Chose additional crops on traits such as 'height' (to provide shade) or, 'drought tolerance'
- Select the combinations that improve bean yield and test them in a participatory field trial in Macedonia
- Conduct another stakeholder workshop to plan the trial and decide on a system of knowledge exchange
- Conduct socio-economic analysis of the chosen crop combinations and agro- system analysis

Act 4

Location: WFSC Symposium, ETH Zürich, October 2019

Agriculture is responsibe for 80% of deforestation worldwide[a]. Diverse cropping system may assist SDG goals by….

An example of what our field trial will look like: Image by Prof. Christian Schöb

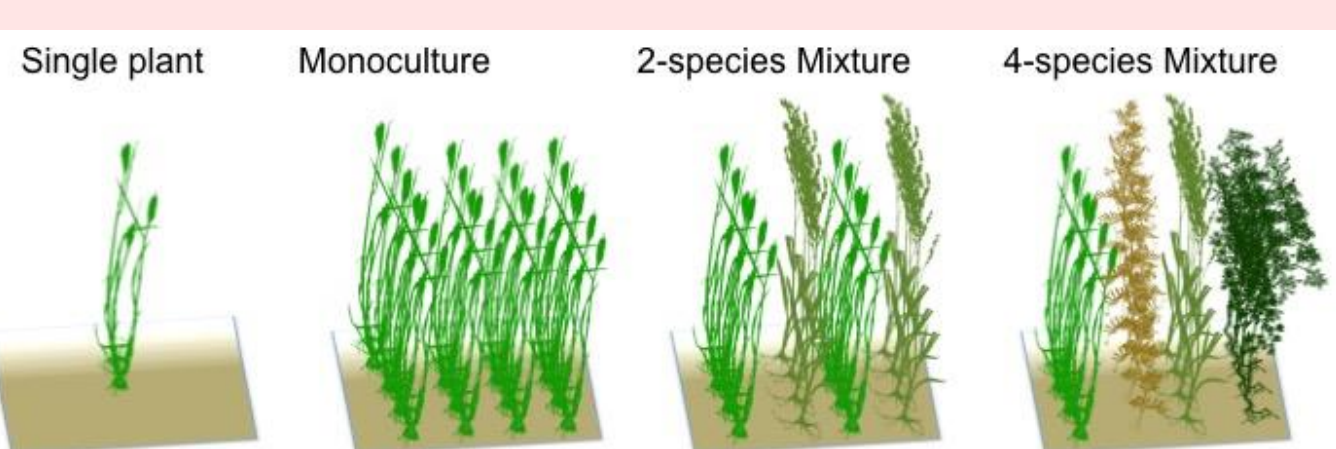Single plant | Monoculture | 2-species Mixture | 4-species Mixture

….Improving economic and food security:
- provide farmers with additional source of income in case of failure of one crop
- increase per unit area productivity of land in comparison to monocultures[b]
- diverse systems have been shown to increase farmers gross income by 33%[b]
- crop diversity has been shown to be positively associated with dietry diversity for small-scale farmer households[c]

….Promoting biodiversity and sustainable agriculture:
- inclusion of legumes such as beans enhances soil fertility; thereby reducing the need for chemical fertilizers
- promote diversity of natural predators, and pollinators and, reduce agricultural pests abundance[d,e]; thereby reducing the reliance on pesticides

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