



## SESSION 4

What do engineers need to consider when designing new farm machinery?



Look at this large farm machinery in action.

Thinking about sustainable farming make a list of the **advantages** and **disadvantages** of using larger farm machinery.



<https://www.youtube.com/watch?v=cKOfOg4ptGI>

Video credit: Norbert Schindhelm

# Did you get any of these **advantages** or **disadvantages**?

Easy to grow and harvest larger amounts of crops which increases income for farmers.

Working on a big scale produces larger amounts of food for growing populations.

Food grown on a large scale will lower the cost of produce for the customers.

Less fuel required (bigger kit operates more efficiently and covers the field in less time).

More efficient and less labour needed

Soil compaction.

Massive cost of machinery to farmers.

Use of fuels adding to greenhouse gases.

Employing less people affects jobs in agriculture.

Creating larger fields would lead to the destruction of hedgerows (ecosystems).



# Engineers have adapted the tractor

Look at these examples of agricultural engineers adapting the tractor to solve different problems.

Modern farmers have a huge range of equipment options for the various activities they do throughout the year.

The ultimate farming machine is undoubtedly the tractor, which comes in a range of sizes to suit any farming operation.

There are several different tractor types that have been adapted for different purposes.



Compact battery-powered tractors



Track tractors



Orchard tractors



Remote-controlled tractors

# Can you spot any problems with large farm machines and UK roadways?

Tractors can have attachments added to:

- Plough
- Till
- Fertilise
- Sow
- Irrigate
- Harvest



# Moveable Machines Challenge



## Moveable Machines Challenge

### What's the farmer's problem?

"I want to use really large attachments on my tractor to make ploughing, sowing, weeding, fertilising and harvesting more efficient. My problem is that the country lanes around the farm are so narrow that I need a solution that allows me to use the large attachments and still move safely around the lanes".

### The engineering design task

Can you adapt the mechanism in a pair of scissors to create an attachment for a tractor that can change shape and size?

There are many advantages to using large pieces of farm machinery including growing and harvesting larger amounts of crops, reducing costs, being more efficient and less labour being needed. As bigger machines cover the field in less time, less fuel is needed which is better for the environment.

### Top tips to get started:

Think about the component parts of a lever mechanism. Use a pair of scissors to see how the simple lever and pivot work.



- Where do you apply the force? Is it a push or a pull force?
- How does this force change the shape and size of the scissors?
- How do the scissors move when the force is applied?

In solving this problem, you will be working like an engineer by designing your possible solutions to the problem. Decide how best to communicate your design idea with others so that you can explain your thinking, explore and develop your ideas - will you use words, drawings and/or 3D models?

### Available resources:

Scissors, Paper, pens, pencils, rulers, protractors, set square, cardboard, split pin metal fasteners, drawing pins, lolly sticks, sticky tape, string, plasticine, art straws

### What is the design brief?

Use drawings and/or 3D models to design a prototype system to allow the farmer to attach large pieces of equipment that can fold away into smaller or narrower spaces.

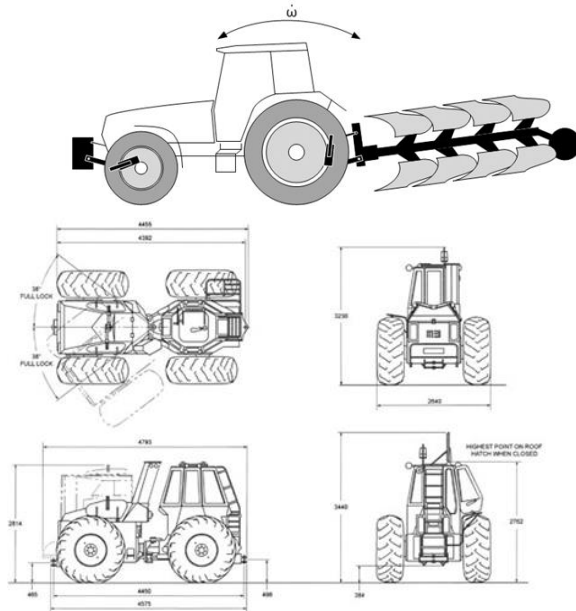
Your design will need to meet the following criteria:

- Uses simple levers and pivots.
- The mechanism needs to change size from large to small and then back again.
- On your design, show where and how a force would be applied to change the shape of your mechanism.
- Your mechanism needs to be operated by one person.

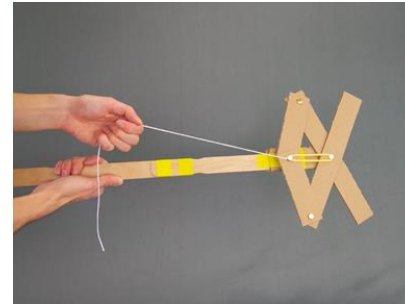
Adapt the mechanism in a pair of scissors to design an attachment to add to a tractor that would enable it to change shape and size to fit on country lanes and under small narrow bridges.

# Visualise your design ideas

Using drawings and diagrams



Using 3D models



# Share your design ideas

You have 3 minutes to present your adaptation idea to the group using your visualisations to share your thinking with the audience.

Be ready to answer questions about your idea.

## Success Criteria

## Score /5

Your mechanism simple levers and pivots.

Your mechanism can be reduced in size then returned to its original size.

You have correctly identified where the force should be applied to operate.

Can be operated by one person.







In this challenge we have worked like agricultural engineers by **imagining, planning** and **creating** a prototype attachment for a tractor that can easily change size.





Look how these amazing agricultural machines have been adapted to make different types of farm more efficient and sustainable: <https://www.youtube.com/watch?v=97JZMrnRnYM>

# SUSTAINABLE FARMS

