Evaluation -

Before manufacturing the prototype, the mechanical advantage was calculated to ensure it met the specification requirements. Using relative data for a handle of 200 mm, the mechanical advantage was calculated to show the efficiency of the lifting activity:

Mechanical advantage= (load x pitch/ typical efficiency)/ (2n x handle length)/ applied force = 441 / ((147x 1.5)/1.16) / (2n x 200) = 15.1

A virtual model was used to ensure that the parts fitted together correctly and to simulate the loading, to give confidence that the structure would be sufficient to resist the stresses caused by the maximum loading.

The evaluation of the physical prototype was carried out by comparison with the specification.

Functional testing was used to assess several criteria, as this gives the best indication of how well it will work when it is used in context. This involved setting up the lifting device in the scenario described in the brief, with a picking shelf and a packing table at the correct height and moving a box of the maximum possible size and weight. The lifting platform was manually aligned and moved from the picking shelf onto the platform and from the platform onto the packing table, achieving accurate alignment in both the pick-up and drop-off positions. This required minimal effort to raise and lower the platform (due to the mechanical advantage) and push the box on and off the surface (due to the lubricity of the nylon sheet).

The functional testing was supplemented by objective tests including:

- measuring the main dimensions of the platform with a meter rule to ensure it could accommodate the maximum stated dimensions
- checking the weight of the mechanism was under 15 kg using scales, so that it could be lifted by a worker acting alone
- carrying out a silk test to ensure that there were no sharp edges
- using the materials certificates to calculate the proportion of material that could be recycled.

Additionally, the drawings were inspected visually to verify that all the components would be manufactured from standard forms and sizes of material, to minimise costs.

Overall, the testing showed that all of the requirements of the design specification were achieved.

While the prototype worked well and met the requirements of the specification, it can be further improved to satisfy the brief even better:

- Include a heavy linen cover for the front of the scissor lift mechanism. This acts as a guard to stop other things getting caught when the lift is raised and lowered (which would otherwise be a risk during use).
- Put a nylon 'lip' around the edge of the lifting platform, so boxes cannot be accidentally pushed off the platform, reducing the risk of damaging the boxes or injuring workers.
- Add wheels to the base so that it is even easier for the user to move it.

Implementation -

For a third party to implement the prototype they will need the following information and documentation:

- The initial design criteria from the brief and final design specification from task 1.
- The bill of material from task 1, so suitable materials can be purchased.
- The engineering drawings for each of the individual components from task 1, to provide dimensional requirements for manufacturing activities.
- The general assembly drawing from task 1, to show the relative locations of the parts during assembly.
- The risk assessments from task 2 and standard operating procedures (SOPs) or a production plan for making and assembling the parts, to facilitate the safe and reproducible manufacture of the mechanism.

A copy of the virtual model may also assist so they can see what the assembled device looks like.

The main health and safety considerations for the manufacturing Include:

- all workers should be trained and competent using the machines
- machine guards should be used where applicable
- personal protective equipment (PPE) such as safety glasses and gloves (for handling the cut parts, except when using the lathe, where gloves would increase the risk of injury)
- overalls should be worn to protect clothing
- loose clothing and hair should be tied back
- the standard operating procedures (SOPs) should be followed during production activities
- all the machines should be well maintained.

Feedback

The candidate has produced a good evaluation and implementation report with some excellent features. They have explained the functional test methods used and provided a brief justification for its use. They have also listed some of the objective tests carried out and their purpose.

They have identified a comprehensive range of improvements each supported by a reason, although these justifications lack detail. These changes are suitable and would be beneficial to the design.

The candidate included a calculation of the mechanical advantage to illustrate the operating efficiency of the device, although this drew on some manufacturers data so may not be accurate for this mechanism. Health and safety considerations were covered for both the design and outlined for the manufacturing implementation.

The candidate has provided a list of documentation relevant to implementation, indicating that they have some knowledge of their relevance and how they would be used by a third party to implement the manufacture.