

1.6 Scope of the project

- To study the traditional mechanical jacquard handloom, its working, its mechanism etc.
- To study the ergonomics involved in the process of weaving cloth using the traditional mechanical jacquard handlooms.
- To devise a mechanism or equipment that would simplify the process of weaving the cloth using the handloom.
- The technology that is intended to be used is pneumatics.
- The attachment of the pneumatic equipment for the lifting of the jacquard eliminates the load on the weaver. These results in
 - Reduction of stress and strain of the weaver.
 - Increasing the productivity.
 - Achieving better quality by uniform shedding.
 - Preventing the health problems faced by the weaver due to continuous working.

1.7 Literature review

Ergonomic approach of assessing the present handloom working status may help in finding some effective solutions. The studies carried out on investigating the ergonomic issues prevalent in carpet industries of Iran, witnessed improvement in quality, productivity and occupational health among the carpet menders. ^(4; 5; 6; 7) In the handloom industry of Western India, study carried out on weavers, on ergonomic issues; suggest difference in prevailing of Musculo Skeletal Disorders (MSD) among males and females. ⁽⁸⁾

Questionnaire design:

In order to gather useful and relevant information it is essential that careful consideration is given to the design of the questionnaire. A well-designed questionnaire requires thought and effort, and needs to be planned and developed in a number of stages: ⁽¹⁴⁾

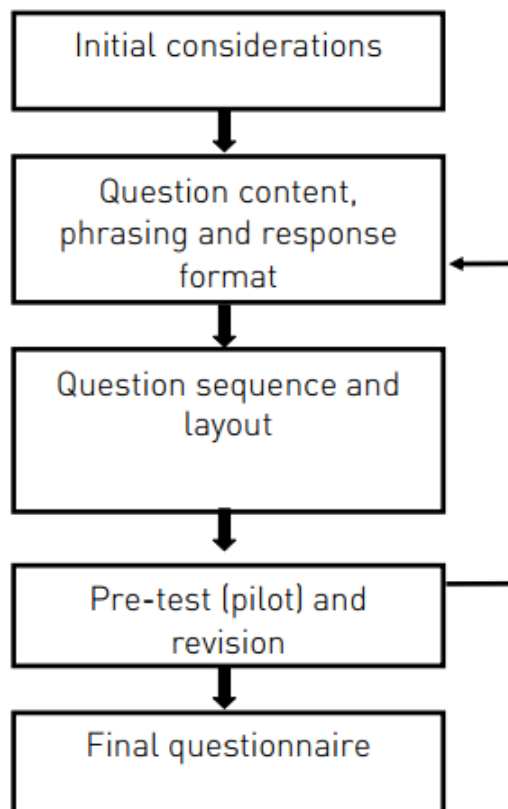


Figure 3-1: Steps in Designing a Questionnaire. ⁽¹⁴⁾

Initial Considerations: Firstly, it is important to be clear about the type and nature of information needed to be collected and exactly who the target population is. It is also important to decide on the most appropriate method for administering the questionnaire. In this case, the target population were the weavers of Phulia who weave Tangail Sarees under the co-operative. As majority of the population were illiterate we used the method of interviewer administered questionnaires. ⁽¹⁴⁾

Interviewer-administered questionnaires offer the following advantages: ⁽¹⁴⁾

- Respondent literacy not necessary;

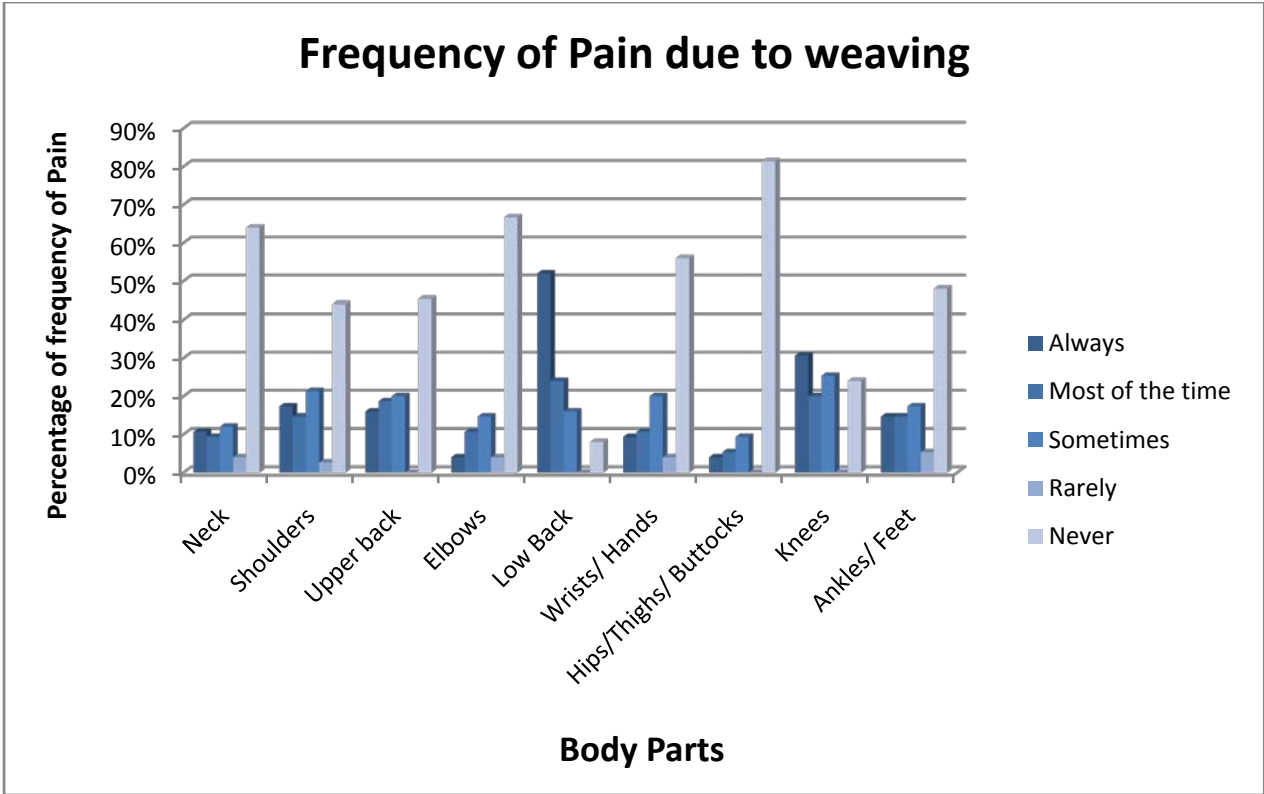


Figure 3-6: Frequency of Pain in different body parts due to weaving.

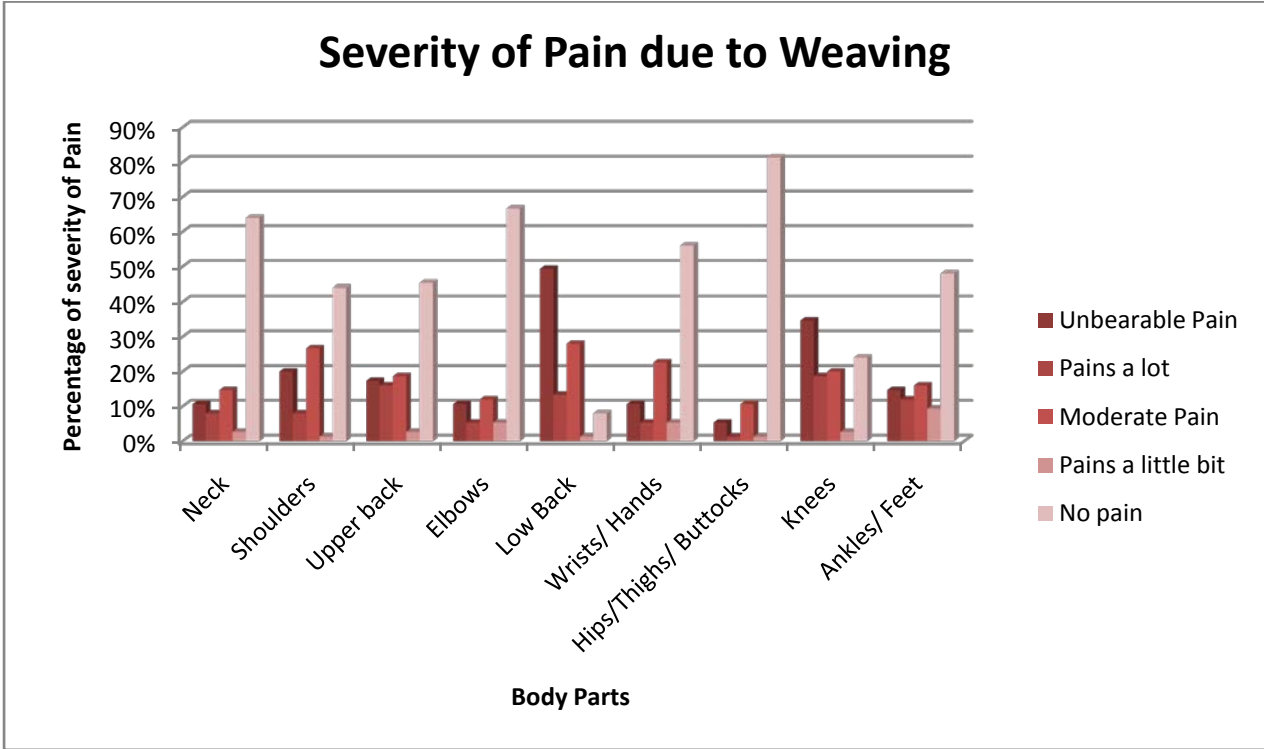


Figure 3-7: Severity of pain in different body parts due to weaving.

6. Punna Sarkar

We took all the 6 weavers to Annuliya Sub-divisional Hospital in Ranaghat Nadia. We had visited this hospital earlier and discussed the matter with the Superintendent Dr. Ranjit Kumar Das. He had given us appointments for the X-rays.



Figure 4-3: The weavers waiting for X-ray to be done at Ranaghat Annuliya Hospital.

Once the X-ray was done the Orthopaedic in charge of the X-rays told us to come after 2 days to collect the reports. However they said, as it is a Government Hospital the X-ray plates would not be allowed to be taken out.

The orthopaedic in charge of the reports of X-ray gave us a detailed report of the weavers who underwent the x-rays.

4.3.1 Results of the X-ray

For most of the patients the doctor gave the following remedies:

- Complete bed rest.
- Avoid heavy lifting
- Avoid forward bending
- Use back support

7.3 Brainstorming on How to fit the prototype in the handloom

Once all the parts involved in the prototype were procured and tested, the next step was to fit these parts in the handloom so that when connected in the proper way the prototype would function as intended; that is, the cylinder pistons would pull the jacquard lever by the means of a rope attached to the cylinder piston, when actuated by the foot operated valve.

Certain considerations had to be taken into account such as:

- Both the cylinders have to be strongly fitted to some support so that when the piston moves forward with the weight of the jacquard, the cylinder should not dislodge from its intended position.
- The cylinders or any other parts cannot be fitted to the handloom as that might hamper the loom in future; this was intimated by the Co-operative Society.
- The foot valves required to be strongly fitted with a base. However, the foot valves neither can be fitted directly to the floor as that would mean drilling holes into the floor, which the Co-operative Society would not allow.
- The handloom that was allocated to us was in the farthest corner of the shed and there was no electrical connection nearby.
- After conducting the Quick Assessment Checklist of the weavers weaving Tangail Sarees, it was found that they did not experience any form of vibration during the process of weaving Sarees in the handloom. Therefore the prototype must be fitted in such a way that it should not touch the handloom and cause any form of vibration which would disturb and harm the weavers.



Figure 7-14: The carpenter is fixing the pulleys.

7.4.4 Fitting the cylinders

Once the pulleys were fixed, the next step was to fix the cylinders in their place. The cylinders were to be fixed horizontally on the two opposite beams of the frame. It was decided that the cylinders would be fixed to their place using iron clamps, so that when the piston is in action, the cylinder should not dislodge from its place.



Figure 7-15: The carpenter is drilling holes into the "L" shaped clamp.

extend port of the cylinder and one quick exhaust valve for the retract stroke of the cylinder. The quick exhaust valves were directly fitted to the ports of the cylinder.

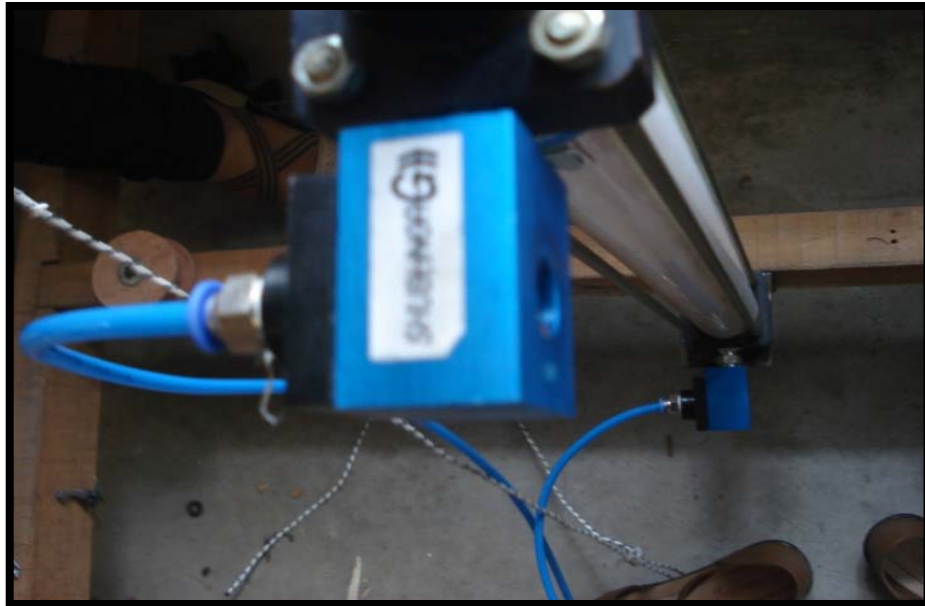


Figure 8-3: The Quick Exhaust Valve fitted to the Cylinder.

8.3 Test Run 3

Once the pulleys were removed, and the cylinders were re-arranged according to the new design, the next step was to Test Run the prototype.

8.3.1 Connections

The air tube from the nozzle of the compressor is connected to the inlet port of the FRL Unit. A T-joint connector is fitted at the outlet of the FRL Unit. From each of the port a small part of air tube is connected to separate ball valves, one for each cylinder. From the each of the ball valves, air tubes are connected to the inlet ports of the foot operated directional control valves.

The Quick exhaust Valves are directly connected to the ports of the cylinders. The air tubes from two of the cylinder ports of the foot valves are connected to the cylinder ports of the Quick Exhaust Valves.

Note that in the current setup, the normal position of the piston of the cylinder will be in the “extending” position, that is, the piston will remain outside the cylinder. When the pedal will be pressed the piston will retract into the cylinder. For this, the connection had to be reversed.

The rope will be connected to one end of the jacquard lever and to the neck of the piston of the cylinder.

8.3.2 Testing

Once the connections are made, the prototype is ready for testing. The switch is put on, and the weaver is ready for weaving. The pressure in the FRL Unit is set at 60 PSI as calculated. Both the ball valves are kept open so that both the jacquards can be tested.

When the weaver shall press the foot pedal, the air from the compressor shall pass into the respective cylinders following the FRL Unit and the foot pedal, thereby pushing the piston in. This piston while moving inside the cylinder or retracting into the cylinder shall pull the rope that is connected to it. The pulling action of the rope will cause the jacquard lever to be pulled resulting in jacquard lifting and shedding motion.



Figure 8-4: The weaver running the Test Run 3.

8.3.3 Results

After the Second Installation and Test Run 3, all the problems that were encountered during Installation 1 were finally overcome.

- The speed of the piston increased.
- The movement of the piston was free flowing
- The Jacquard functioned as it should.

The results for Question 3 are as follows:

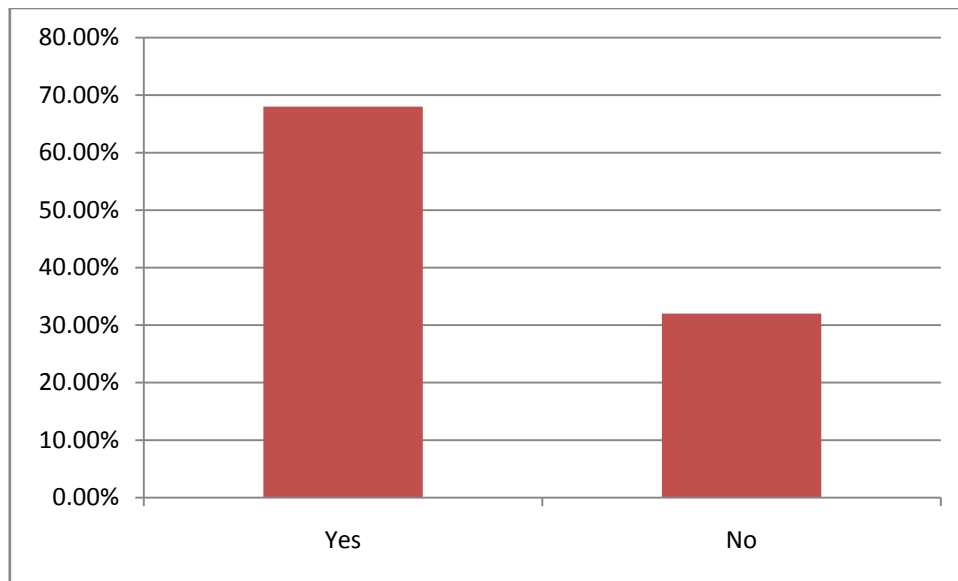


Figure 9-4: Results for Question 3.

From these results it can be concluded that, though majority of the weaver population is illiterate, but if we explain to them and make them understand that this is for their benefit along with adequate training, the weavers are happy with this ergonomic intervention. As seen in the above results, majority of the weavers have approved of this prototype and are also willing to install it if available at a commercial price.

As MSME DCS has approved this project, this prototype can be available commercially in the future if appreciated.

Power Consumption

Power = 0.5 H.P. = 373 watts

No. of hours of operation = 12 hours per day

Therefore power consumed every day = $373 \times 12 = 4476$ watts

Therefore kWh consumed every day = $4476/1000 = 4.476$ kWh

Therefore kWh consumed per month = $4.476 \times 30 = 134.28$ kWh

Rate of power consumption for domestic purposes is Rs. 5/kWh

Therefore, monthly electricity bill = $134.28 \times 5 = \text{Rs. } 671.4$