Productivity Improvements in Punja Weaving

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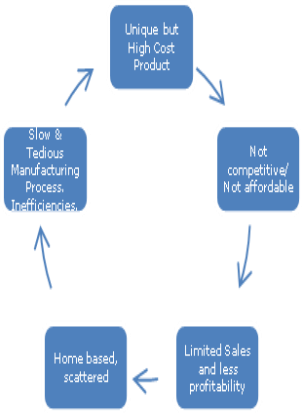
Panja weaving forms part of India's glorious weaving tradition. This craft is mostly used for making durries, (light woven rugs used as a kind of floor covering).

Carpet weaving (clustered around Mirzapur, Bhadoi & other parts of UP) is seen as home based small scale industry & as secondary occupation. The production setup is highly fragmented. Knowledge transfer is limited & very slow, that too within a small group or family or cluster. Production capacities & output has high level of unpredictability making the setup difficult to manage leading to multiple levels of middleman.

There has been almost no or minimal technological advancement in this field. The quality of the product has not really kept pace with time. The scattered production makes it nearly impossible to track or control the entire supply chain leading to wastage of resources & time.

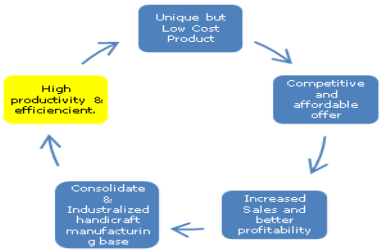


At the same time, Punja carpets are facing the heat of competition from other techniques & also from machine made carpets. Over the years the input costs having been rising. Since weaving cost is a major contributor to the total cost, the focus has been to reduce cost pressure by increasing working hours beyond legal limits and keeping wages below minimum permissible limits. This leads to making the occupation less attractive. On one hand fresh manpower is not entering in the sector because of meager returns & unscientific process of skill development, on the other hand, new entrepreneurs are not entering due to pressure on profits. The industry is in a negative spiral.

On root cause analysis, we discovered that there is one particular issue which is creating most of the problems & that is Low Productivity. We identified that because productivity is low, the output per hour per person is not sufficient to compensate the minimum wages for standard work hours per day and hence there is tremendous pressure on weavers, contractors & businesses, to cut cost and improve profitability. Unfortunately, at the base of pyramid is the weaver who might actually be feeling the pinch most. This pressure on wages is making the sector unattractive & hence new workforce is not entering the main stream weaving activity. The slow process of skill development is further worsening the problem. Our hypothesis as explained below is to break the negative spiral & put the industry on a path of positive development.

Hypothesis

The solution to breaking the negative spiral of the industry is to improve the low level of productivity in a significant manner; provide a scientific method of training to equip the new weaver with right skills and develop consolidated production set up which has scalability.



Analysis of Traditional Weaving Loom to identify opportunities for Improvements.

As in case of any weaving, the fabric is made by interlacement of warps & wefts. The fundamental weaving principals remain same i.e, Primary motions: Shedding, Picking & Beating-up. Warp threads are divided into two layers, thus forming a "shed", through this, weft yarn or pick is inserted & the beating motion by which a "reed" beat up the last inserted weft to fell of the cloth. We tried to understand the difference between a basic loom & "punja" loom & found below points:

- **Shedding**: In existing Punja Loom, the shed formation is principally incorrect. Both layers of warp are not stretched to the same extent because of the way the mechanism is designed, resulting to uneven warp tension on two layers.

- **Pick insertion**: In existing punja loom, the pick is inserted by hand & there is no usage of any device or mechanism to do this activity, unlike Handloom or Power loom, where shuttle or rapier is used to insert pick.

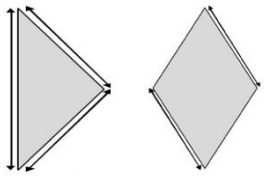


Figure-"A" Figure-"B"

- **Beating Up**: Beating-up motion in punja loom is also principally incorrect. A small hand held device made up of a metal claw or "punja" is used for beating up. The weaver will beat the last inserted pick multiple times because of the small width of the "punja". Unlike other looms where the beating up motion is single stage, here the activity is multi stage & repetitive.

- **Take-up & let-off**: Compared to normal power loom, in which take-up & let-off is a continuous activity, in "punja" loom this is completely missing.

- **Tension adjustments**: Unlike any other form of weaving, warp threads on punja loom are kept at extremely high tension. The high warp tension is required to force weft yarns to take the wavy shape or the "crimp". This is very unique to products made on punja loom.

- **Sitting Position**: Since there is no proper arrangement for Take-up & let-off mechanism, weavers are required to adjust their sitting height in order to weave durry up to a specific level. This means at the start of weaving, a weaver sits close to floor level & sequentially raise a platform to higher level till weaving level

reaches a pre-decided & specific height. This is completely against basic principles of ergonomics.

- **Design Interpretations**: We observed that weavers are required to either cram/memories each motif or complete design. This required sufficient practice and also resulted in defects in design duplication.

Other points contributing to low productivity are that few tasks which can be easily performed by unskilled workforce or by simple machines are often performed by skilled weavers or unskilled weavers by hand.

Proposed Solution: New Punja Loom

Based on understanding of the opportunities for improvement, we decided to conceptualize the solution and concentrated on weaving activity or loom to be precise. We identified the key features of the solution:

- *Shedding Mechanism*: Redesign shedding mechanism in order to minimize fatigue and create a shed, which is principally correct & wider than the existing shed depth to facilitate easy pick insertion.

- *Beating Up*: Install "wide width reed" for beating. The "Beating-up" motion with reed should be easy & light in operation. The ideal solution should have the possibility for attaching an electric motor. Either "beating up" or "pick insertion" should be done with the help of foot pedal.

- *Take up & Let off*: The ideal solution should not require so many changes in loom settings, change in sitting height position, should be easy to perform & can be continuous or semi continuous.

- *Sitting Position*: The sitting posture should be ergonomically designed & should be comfortable. The loom should be designed in such a way that it can be operated by single person also.

- *Tightening Mechanism*: The mechanism should be easy to perform & should not require much of a force or pressure.

- *Design Interpretation*: The new loom should have some transparent rest board with facility to hold the graph paper. The cells in the graph should have same density (as in the product) of warps & wefts. This should help weaver in correctly duplicating the pattern.

- *Thread Counting*: The machine or reed should have some sorts of visual references for thread counting. This visual reference should eliminate or minimize counting process by weaver.

- *Finishing Possibilities*: The ideal loom should present the wrong side of the durry visible on the other side so that some part of finishing activities can be performed on the product, while the product is still on the loom frame.

Once above features are identified, we designed the line diagram of our new loom while keeping basic ergonomics principal in mind & continued to work with the concept, sometimes adding some extra features and at times getting rid with some.

Production Trials

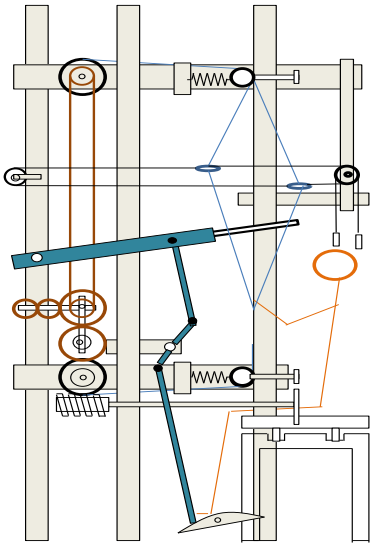
Based on the concept drawing, trial looms were manufactured by Eastern Home Industries, Bhadohi. The production trial was done utilizing existing rug from current production. The outcome of the trial production was successful. The main highlights of the trial were as below:

- The new punja loom was possible to produce rugs of similar qualities as in traditional loom today.

- There was a definite increase in output per weaver per hour, approximately over 25%.
- The loom needs less strength, enables females to operate loom.

- The Loom is adjustable in height , solves problems with working position by providing ergonomical seating to support the long term health of weavers.

- The possibility to utilise sliding chair , which can enable one person to work on a big loom.



Few other benefits to the industry which are also based on outcome of successful pilot production on new loom is:

- The scientific skill development program can be developed around the loom which will speed up the learning activity. Thus making weaving an easy to learn & also attract new weavers.

- It will facilitate creation of large scale industrialized setups with all the amenities of a good factory like annual leaves, standard working hours, fair wages, health & insurance, clean environment etc. just like a big garment factory.

- Bigger capacities will create economies of scale and thus reduce cost. This means more people will be able to afford the unique punja loom product & will result in increased sales & profit for all the stakeholders.

Conclusions & Future Direction

The hypothesis has been proved correct based on the outcome of the trials. The implementation of the new punja loom will definitely break the negative spiral of this industry. The future direction is for mass production of this new punja loom & implementation of the same in large scale integrated production set up's.

Image Courtesy:

1. Dakshenterprises.com

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