The Modification of the Traditional Horizontal Loom from Wooden to Steel Frame for the Production of the Narrow Band Fabric

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Abstract

The aim of this study is to construct a steel frame modified loom from the modified traditional men's horizontal loom already produced in wooden frame to serve as a model for mass production to sustain Nigerian traditional weaving industry and form the basis for experimental research in small scale textile machinery production. Very few people who buy hand-woven products have the background to understand the time and effort traditional weavers put behind the production of their materials. The modified loom already constructed with wood was reproduced with steel metal. The result is a standard four harness loom that can weave visually any hand woven fabric. Weaving yarns of different spinning methods were used for the warps in order to achieve aesthetic and design qualities of the traditional fabrics. The fabrics tested on the metallic frame loom were in the form of joined strips multiplying the works of many traditional weavers on one loom. The metallic frame loom constructed can weave the equivalent of the works of up to 42 traditional weavers at the same time. The modified traditional men's horizontal loom should not only be motorised, but should be computerized and be a foundation for a small scale textile machinery production.

Keywords: Modified, Traditional, Horizontal loom, Vertical Loom, Fabric

INTRODUCTION

Traditional weaving is historically, one of the greatest contributions of Nigeria to the textiles crafts of the world. Unfortunately traditional weaving industry in Nigeria is disappearing without replacement in the area of improving the Nigerian traditional woven fabrics. The traditional loom should be modified and improved in terms of capacity and production output. The art of traditional cloth and cloth making in Nigeria have been separated from its industrial progress. Traditional weaving has less attention being paid when it comes to adaptation to suit Nigerian market needs. Traditional weaving is still revered, preserving the old ways, which is culturally and historically important, but it has little to do with the economic development of the country, which needs improvement. According to Lamb and Holmes (1980) "It is a fact that, on the whole, the ethnographers of the colonial period were not very interested in cloth and cloth making… while post colonial students of Nigeria material culture, have tended to look more at the art of the dyer than the weaver." In many parts of Nigeria traditional weaving is fast disappearing, unable to face the competition of factory made cloth. Lamb and Holmes (1980), stated that, "the main use of this

loom is to produce the cloth for *Turkudi* veils so beloved by the Tuareg, the Teda, various Arab groups in the Sahara and the Moors of Mauritania." They added that, "There appears to be no rural Nigerian demand for *Turkudi*. It has, however, found its way into certain Fulani Court uses and, as such, is marketed in Kano." This is because of the high cost of the traditional *Turkudi* veil.

This research was conducted as a result of calls and recommendations by some researchers who unanimously agreed that research on indigenous small scale handcrafted textiles would enhance and change their status from traditional to modern small scale textiles centres these researchers include; Adetoro (1980), Ada (1985) and Dutsenwai (1985). Some research studies were conducted on the indigenous textiles like the studies of Renne (2002) and Dutsenwai (2009) but none was specifically focused on the traditional horizontal loom, the works of Shea (1979) and Ada (1985) were well noted.

Adetoro (1980) stated that, "development from the grassroots level is more adequate." He said "what is, important is for the present Nigeria textiles producers to translate the mechanism of the traditional looms to contemporary types."

This study therefore is the transformation of the modified traditional men's horizontal loom from wooden to steel frame loom for the perfection of the loom's movements in order to motorize it. The problem of this study therefore is to the construct a modified mechanized loom model that can replicate the works of many traditional weavers in one woven fabric. The steel framed modified loom is a standard four harness loom that can weave visually any hand woven fabric. Weaving yarns of different spinning methods were used for the warps in order to achieve aesthetic and design qualities of the traditional fabrics. The fabrics tested on the metallic frame loom were in the form of joined strips multiplying the works of many traditional weavers on one loom at the same time. The multiplication of traditional weavers work will increase the production capacity thereby increasing the income of the modified loom weaver which could be organized into industrially based small scale textiles centres.

HISTORICAL BACKGROUND

The Men's Traditional Narrow Horizontal Loom

According to Lamb and Holmes (1980), "The Turkudi loom is tiny, at first sight almost a toy. In fact it is just a miniature version of the Hausa loom type with single pole and rope-secured breast beam. Apart from the extreme narrowness of the warp, the most striking feature of this loom is that the weaver sits with his legs over the breast beam. There is no heddle pulley, instead, a rocker or horse *shuwaka* is used, an oscillating bar connecting the pair of heddles." Hausa loom feature is the method of attaching the breast beam by means of a pair of ropes attached to the pegs in the ground located behind the weaver. Hausa loom has short side pedals attached to the shafts. The pedals are attached to the ground by means of cords fixed either to the warp beam supports or to pegs in the ground. They went on to add that, "In the fourteenth century we know the rolls or strips of cotton cloth were being used as currency in Borno, (see Plate 1) and by that time the trade link between the weavers and the dyers of the Kano region and the Tuareg and other nomards of the Sahara had been well established."

According to Lamb and Holmes (ibid) "Hausa looms have the oldest and most characteristic form of apparatus for enabling the two heddles to oscillate as a rocker or horse, rather than a pulley. Many Hausa looms do make use of pulleys, generally of metal with a nut wheel. According to Lamb and Holmes (1980), "the different users of the Chadic loom include the Kanuri, the Kotoko, and Bagirmi group, the Njagi, Margi, Kilba, Fali and Bata many of whom have intermixed with the local Fulbe and Waja groups. The loom is still in use in the northeastern Adamawa State from Yola through Zummo, to Mubi with their counterparts in Cameroun. The general zone of the West African and Chadic looms include: northeastern Nigeria, northern Cameroun and southeast Chad ". See Figure 1.

Plate 1: The narrow strip fabric
Source: Waziri (2012)

Figure 1: Nigerian map showing areas of hand weaving
Source: Lamb and Holmes (1980)

The significance of this study that will help socio-culturally is the training of youth and the revival of the production of the disappearing traditional narrow strip fabric weaving. The technological and industrial significance of this study is that the modified loom could be the basis of establishing an industrial and technological research institute for the development of textile machinery. Many nations do invest in research work and encourage the use of local materials, the result of which became useful at the time of emergency. The production of the modified loom could be of great potentials to develop concepts and insights into the learning phenomenon in the visual arts and enhance industrial production.

MATERIALS AND METHOD

Materials

The wooden frame loom was used as a model for the construction of the steel frame loom. The welders used steel metallic pipes to reproduce the modified loom. Machine spun threads and hand spun yarns were used for warp and weft of the woven samples, warp frame for warping the warp yarns. Hook for Sleying the warp threads, office pins, Viju milk for sizing the warp yarns and spraying gun, office pins for correcting warp yarns.

Method

The modified traditional loom was constructed in wooden frame during an earlier research programme and one of the recommendations was to reproduce the loom in metallic frames for the perfection of the loom's movements. Steel heddles and heddles frames were used with steel reeds for the newly constructed metallic frame looms at Technology Incubation Centre, Kaduna. The steel frame was constructed from the measurements of the earlier wooden frame loom produced in Industrial Development Center (IDC) Zaria. All parts of the modified steel loom were made in terms of the wood frames, metallic parts and strings of the earlier wooden frame loom were used. The lower loom frame was first assembled using bolts and nuts to hold the arms. Then the upper frame was mounted on top of the lower frame. The warp and cloth beams were inserted into their correct positions. A canvas sheet measuring two metres was attached to the beams, with 1¼ metres to the cloth beam and ¾ metre to the warp beam. The canvas cloth was used to maximise warp yarns usage when weaving starts and when weaving comes to an end.

Plate 2: Wood frame loom

Plate 3: Steel loom production

Plate 4: Constructed Steel frame

Plate 5: Finished Steel Frame loom

The reproduction of the steel framed loom was done by measuring the wood frame loom and reconstructing the parts with steel pipes, bolts and nuts to tie the frames and arms of the weaving loom.

The modified traditional loom was constructed in wooden frame, Plate 4, during an research programme and one of the recommendations of the earlier research was to improve the perfection of the loom's movements. The modified steel frame loom, Plate 5, was reproduced in metallic frames, steel heddles and steel heddles frames were used with steel reeds for the newly constructed metallic frame loom at Technology Incubation Centre, Kaduna for the purpose of the perfection of the loom's movements. The steel frame loom was constructed from the parts of the earlier wooden frame loom produced.

The warp yarns were transferred to the warp beam the next step in the weaving preparation was to passing of the warp threads through the eye of the heddles using a hook and according to the order of warping operation. This was done with the help of weaving draft according to the drawing-in draft (D.I.D). The D.I.D shows the order in which each individual warp thread is drawn in to the shafts of the loom. The drawing–in-draft was a straight draft because the weave plan was a plain weave. The warps were sleyed by passing each warp through the dents of the reed which serves as a comb with the help of a hook. When these processes were made, the warps were tied to the cloth beam and then pulled to the required tension. Then the loom was ready for weaving. The weft yarn was then wound on the shuttle stick and then ready for insertion as planned by the weaver. For the first weaving operation, the loom used two pedals and four shafts. With these attachments a four harness counterbalance floor loom was constructed. The weaver used different weaving techniques to achieve the aesthetic and design qualities of the traditional narrow strip fabric.

Plate 6: Prototype weaving

Plate 7: Prototype 001

Plate 8: Prototype 005

The weaving of the first prototypes was done with yarns as the tradition *Turkudi* fabrics and the warp yarns were sized with Viju milk so that they will not cut easily. All the seven prototypes tested on the steel frame loom could not weave up to one metre before the warp yarns start cutting plates 7 and 8 above, even when the selvages and lines of demarcating the strips were the threads

used for sewing caps. At first it will show the woven fabric as the Turkudi veil but as weaving continues the warp yarns will start cutting. This made the weaver to abandon the planned weaving process using yarns as warps. The loom is steel constructed all through and because of the heavy materials evolved the warps as yarns cannot with stand the process of the weaving operation. The weaver has to experiment another weaving preparation method of having warp yarns that could with stand the weaving process until the warp yarns are exhausted.

RESULTS AND DISCUSSION

This fabric looked better than the first one but it was too thick for the fabric the researcher wanted to weave. The warp and weft yarns were both machine spun; the warp yarns were breaking due to the fact that they were not sized and this problem was solved by spraying VIJU milk on the warp yarns. This made the second fabric better looking than the first one.

The result was at first very encouraging at first but later became disappointing. The researcher experimented using both the cotton and the polyester yarns as weft yarn during the weaving operation. The problem of selvage breakage was controlled in this warping preparation as yarns for the selvage were doubled in each dent of the reed threading. The warp yarns were sprayed with Viju milk to size the yarns. This practice of spraying milk to size the warps, also created tension problem during the weaving operation as the extra warps used to demarcate the fabric to appear in strip form was of cotton fibres. The difference in fibre formation of the two yarns when wet, created the difference in elasticity of the two yarns as the polyester yarns stretched more than the cotton yarns. Another problem encountered with the fibres was that despite the spraying to size the yarns, the polyester filaments started to cut and piled on individual yarns forming balls at the back of the loom due to the movement of the heddle shafts and the reed during the weaving operation. Lamb and Holmes (1980) stated that, "the cost of this cloth, even in Nigeria near to its centre of proposed production, is so high. They added that, "In the Sahara the cost of Turkudi is almost incredible, we wanted to acquire a bundle of four only to find that, even after the most prolonged bargaining we could not lower the price below 100,000.00 CFA Francs for a bundle of four: we had to content ourselves with a single specimen." This was what the researcher experienced at Kura market when the researcher wanted to buy a complete turban of four pieces, but could not because of the cost, so only one piece was purchased at six thousand Naira (6,000.00) for a specimen too. Lamb and Holmes (1980) expressed surprise about the distance between the manufacturers of the Turkudi veil (plate 9), and users of the cloth, when they stated that, "the relationship between Kura, one of the homes of *Turkudi*, and the Tuareg is of great interest. What we see today is a relic of the great age of trans-Saharan trade when merchants from the Kano region could well have had branch offices or associates in Saharan towns like Agades."

Tuareg women use it for head coverings, shawls and other garments……for the Tuareg it has acquired something of the property of a national dress; and it is a fascinating instance of the conservatism, as well as complexity of life in Western Sudan that a people who occupy territory stretching far north into Algeria should rely on such remote craftsmen as the weavers of places like Kura for garments of this kind."

For greater efficiency and flexibility in design and execution, weavers today have the option of using computers to guide the floor loom such as the Leclerc weave bird. According to Leclerc loom manufacturers (2014), "In designing the Weavebird, great effort was made to simplify the

mechanism to minimize what can go wrong and to minimize the task involved to get the loom back working if things do not go right. Rather than the complex system of gears, springs, motors and levers found on other earlier Computer-Dobby loom designs, the Weavebird employs a simple closed cable system to raise and lower each harness. With this design, the only real adjustment the weaver may have to make to the loom is to adjust the length and tension of the cables. This is found in a loom that requires very little or no maintenance over the years."

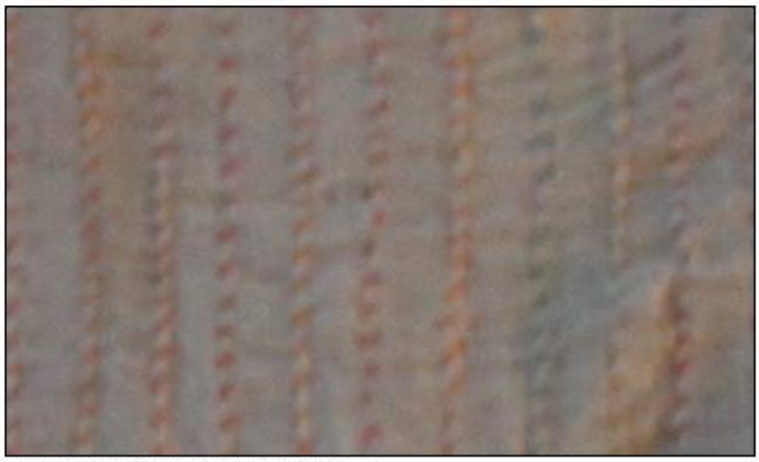

Plate 9: Traditional *Turkudi* cloth

According to, Sankar (2009), "Production and Quality are the two main things that any textile manufacturer has to keep up with. Starting from handlooms to the shuttle-less looms used today, there have been a lot of innovations in the weaving machine. The inherent problem of the shuttle mechanism was discovered and this led to the latest shuttle-less technologies like rapier, projectile, and fluid jet".

With the collaborative effort of mechanical and electrical engineers the researcher hopes to motorized the metallic framed loom by adding gears, shafts and belts to replace human movements in shedding, picking and beating for the primary motions. The secondary motions of let-off and take-off motions will also be in-cooperated. According to Sankar (2012), "Modern industrial looms are improved versions of the 18th and early19th century power looms. They weave much faster and with less wasted energy. Whereas early power looms could insert hundreds of picks per minute, modern looms insert thousands per minute. Power and automatic looms depend on the incorporation of an automatic weft change motion. They no longer use shuttles the weft is propelled by air or water jets."

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2008. The computer aided design (CAD) and the computer aided manufacture (CAM) have taken over the production of the elaborate fabric manufacture.
The modified traditional men's horizontal loom should not only be motorized, but should be computerized and be a foundation for a small scale textile machinery production. Government, the textile manufacturers and the association of textile technologists should come together under one roof and invest in research and development (R&D) for the production of indigenous machines that will form the basis of small scale textile machinery manufacture.

CONCLUSION

The following conclusions are drawn from the work carried out by the researcher: a) If the modified horizontal loom is put under Research and Development study with automation goals, the result could be an automated horizontal narrow strip weaving machine. b) The modification of the traditional men's narrow horizontal loom from traditional to a mechanized loom could be organized into industrially based small scale textiles centres, which will encourage the training of youths and the revival of the traditional textiles manufacture. c) For prestige alone the narrow horizontal strip weaving has survived for a period of over a thousand years of traditional textile manufacture, with the introduction of the fabrics produced by the modified loom there is hope that the fabrics will find acceptance in marketing, usage, and replacement of the already disappearing traditional fabrics.

It is recommended that: a) the mechanized motorized loom production could be organized into industrially based small scale textiles centres which will help to solve the problem of unemployment among the youth through entrepreneurship type of training. b) the traditional men's narrow horizontal loom products should be copied and modified with the modified loom, like the Chinese, in such a way that it will be difficult to differentiate between the two fabrics even at close range, which will serve a useful economic purpose for the nation. c) a Research and Development (R&D) that will bring together textile technologists, textile engineers, textile scientists and textile designers to come together under one institute and have a fully automated and computerized men's horizontal weaving loom.

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