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OCCUPATIONAL VAT DYEING PRACTICES IN THE KANO METROPOLIS OF NIGERIA- Part 2: Operations of the dyers/dyeing enterprises in relation to industrial practices

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ABSTRACT

The incorporation of synthetic blue vat dye and its derivatives in Nigeria since the 1930s reflected significant development within the dyeing industry where the dyers had to acquire new skills and the technical know-how in the use of this new line of ingredient. The aim of this paper is to assess the operations of occupational vat dyeing enterprises in Kano metropolis. The study was conducted among 1387 dyers and further information was obtained through focus group discussion with dyers and cloth vendors, observation and measurement. Data were analysed by descriptive statistics (frequency and average) using statistical package for the social sciences (SPSS) software. Findings revealed that the dyers offer services such as plain and patterned dyeing of fabric and garment, redyeing of faded garment, and dyeing of fashion accessories/household items to customers in the neighbourhood and from other states and other countries as well as cloth vendors by hand dyeing using firewood as fuel, water purchased from vendors, and synthetic vat dye, auxiliary chemicals, and material to be dyed as raw-materials. Most of the dyers work on customer demand and are more engaged weeks before festive periods. The study suggests creating and implementing effective policies that will ban importation of coloured textiles especially from China, subsidize the cost of dyes and chemicals, and tackle insecurity such as Boko-Haram insurgency and banditry which threaten businesses in this part of the country. The dyers should also be encouraged to become formal to be able to seek for infrastructural development from the state government.

Keywords: *vat dyeing, cloth vendors, enterprises, Kano metropolis, cotton fabric*

INTRODUCTION

In the 1st part of this 6-part series, we examined the demographic/socio-economic characteristics of occupational dyers in Kano metropolis as well as composition of the dyeing enterprises. We reported that the dyers studied were predominantly male, educated, and natives where majority have learnt the art of dyeing by apprenticeship and can earn more than the minimum wage for civil servants (>₦30,000 per month) with about two fifth depending solely on the dyeing occupation. We also reported that most of the dyeing enterprises were informal, located in the neighbourhood of residential houses, and work in groups of more than 10 dyers per location. In this 2nd part, we present the results from an investigation of the mode of operation of the dyeing enterprises in relation to industrial practices.

Vat dyes must be reduced to the soluble form with sodium hydroxide (caustic soda) and sodium dithionite (hydros) before they are applied (Baumann and Fletcher, 1966) and the process of dissolving vat colours in alkaline hydrosulphite solution is usually referred to as "vatting" (Wentz *et al*., 1943). Colouration may be carried out at any stage in the manufacture of textile goods where dyeing machines are available for dyeing textiles in the form of loose stock, tow, sliver, yarn, garment (Wardman, 2018; Burkinshaw, 1990; Chakraborty *et al*., 2005) and woven fabric (Wardman, 2018; Holme, 2016; Latham, 1995) either in rope form or open width. Vat dyeing process for cotton knit fabric has also been developed (Wakoh *et al*., 2014; Wakoh *et al*., 2015). Despite their cost, vat dyes are very useful in the dyeing of fabric for awnings, curtains, upholstery, military and naval uniforms. They are also widely used in the colouration of quality shirts, table cloths, towels, sports wears, high quality overalls (Wardman, 2018), handkerchiefs, and embroidery yarns (Gills, 1974).

There are a number of fundamental requirements of dyeing machine construction, for example, they are usually made of stainless steel so that they can withstand the chemical and physical conditions used in the dyeing operation. Different methods of heating and cooling of the dye liquors have been employed, the main requirement being to maintain a uniform temperature throughout the whole of the machine (Wardman, 2018). There is no standard process for vat and sulphur dyeing since the procedure will depend on the available equipment, material, amount of material and the actual dye (s) (Xu *et al*., 2000). For instance, natural indigo vat dye has been applied on cotton fabric and cotton garment using caustic soda and hydros in an open steel bath (Shuvo II, 2018). Additionally, use of soft water is essential in vat dyeing because the dyes are sensitive to some degree to aluminium, calcium, magnesium and other salts which can cause partial precipitation of the reduced form of most vat dyes and may result in inferior fastness to washing, crocking and also increases the dyeing cost (Baumann and Fletcher, 1966).

Until now, little work has been done to examine the activities/operations of occupational vat dyers in Kano metropolis and even in Abeokuta, south-western Nigeria, where several studies have been reported, no detail was given regarding the operations of the dyers especially in the context of science and technology. Kano metropolitan area was selected because the ancient city of Kano attracted historical prominence in the 14th Century with its fine indigo dyed cloth (Ezeanya-Esiobu, 2019) and currently there are many secondary dyeing units in the area that are engaged in dyeing using synthetic vat dyes and chemicals. Large population and availability of markets make the vat dyeing occupation prosperous. The study will contribute in addressing the fundamental question: How do the occupational dyers operate? The study will focus on dyers using synthetic vat dyes and chemicals.

MATERIALS AND METHODS

Study Area

Kano metropolis is among the Nigeria's 4 largest urban areas and it is also the largest in the northern part of the country (Garba, 1997). It is boarded by Madobi and Tofa Local Government Areas to the South West, Gezawa to the East, Dawakin Kudu to the South East, and Minjibir on the North East (Boyi, 2017); has eight (8) local governments namely: Municipal, Fagge, Dala, Gwale, Tarauni, Nassarawa, Ungogo and Kumbotso; lies between Lat. 10o and 12oN and Long. 8o and 9oE; covers an area of 600 km2 with an altitude of 488 m above sea level; and an estimated population of 3, 507, 632 as at 2014 (Weber et al., 2017). Kano city has been a major centre of trade for thousands of years and in the 16th Century was regarded as one of the 3 main cities of Muslim Africa, the others being Fez and Cairo (Home, 1986).

The metropolitan area has many manufacturing industries and vast markets. It has 4 industrial estates including Bompai, Sharada, Challawa and Tokarawa with many companies where Bompai hosts most of the textile industries that are engaged in spinning, weaving and dyeing (Nabegu, 2016). "Kofar Mata", established in 1498, and situated in the ancient city of Kano, is a local industry for traditional indigo dyeing even though most of the dyers are now using synthetic vat dyes and chemicals. There are numerous markets in the area and the business landscape is characterized with the proliferation of super stores, shopping malls and other trading centres along major roads and streets which form another kind of market. "Kantin Kwari", a 2nd generation international cloth market established in 1934 (Ibrahim, 2015), provides a significant demand for the locally dyed materials. For the purpose of this study, the respondents are called "dyers", non-industrial dyeing units are referred to as dyehouses, and traders in 'Kantin-Kwari' cloth market and colour shops are called cloth and colour vendors respectively

Data Collection and Analysis

The study relied on data gathered through a structured questionnaire, focus group discussions, observation and measurements. A structured questionnaire was developed according to standard protocol for questionnaire design and testing (Geer et al., 2006) and questions were developed as a result of insight from Johnson (1999), information from Aspland (1992) and Chakraborty (2010), and practical experience of the corresponding author. The validity of the coverage of questions included in the questionnaire (content validity) was gained through experts in the field, colleagues as well as members of the target population. Reconnaissance visits were made in June, 2020 to locate the dyers, cloth and colour vendors. The developed questionnaire was pretested among the dyers that did not participate in the study and during the reconnaissance visits. Variability in dyers response and the understanding of question content (face validity) was evaluated and this information was used to produce a revised final version of the questionnaire, specifically questions were added where content coverage was lacking and questions

were rephrased where understanding was vague. The questionnaire was prepared in English but was communicated to the dyers in their local dialect (Hausa).

This part of the series covered 11 questions in 1 section which dealt with the enterprise/group's operations (e.g. inputs/raw-materials used by the enterprises, sources of power and water, means of measurement etc.). The research population is the total number of occupational dyers in Kano metropolis where participating dyers were chosen as a purposive sample. A total of 1387 questionnaires were administered in 20 dyeing units (geographical locations of the dyehouses are shown in part 1 of the series) where willingness to participate in the study was confirmed through completed consent form. Dyers who are at least 18 years of age and had worked for at least 5 years in the dyehouses were eligible to participate in the study. Data was collected from August to December, 2020, with the dyers working, through self-completed questionnaire by the researcher and 2 enumerators over a duration of 25-30 minutes with each dyer being asked the same question in the same order. A monetary incentive of ₦3000 ($7.75) was provided for participation due to initial reluctance to participate because according to the dyers, the Chinese used similar approach to learn their techniques. Before initial data screening all the completed questionnaires were coded and entered in Excel software after which the data were analysed by descriptive statistics (frequency and average) using SPPS version 26.

Other data sources included observations while the dyers are on the job and additional information was obtained from focus group discussions with the researcher, assistant researcher and 7 dyers, 1 from a dyehouse in each of 7 local government areas (Nassarawa was not represented) and with 5 reputable cloth vendors separately in December, 2020 at Senior Secondary School Rumfa College, Kano and Kantin Kwari cloth market respectively. The focus groups were selected by purposive sampling technique. Two key informants were used in the study. Aliyu Umar, a wholesale colour vendor, whose nature of business permits him to know the major dyers in Kano metropolis as well as cloth vendors in the market, and Mallam Haruna Baffa who has valuable information being the Secretary of "Kofar Mata" dyers Association coupled with his exposure having attended numerous exhibitions of Africa by Design namely Ghana (2016 and 2019), Dubai (2017), London (2018), United States (2019) and Abuja (2020).

Focus group discussion with the dyers centred on a short list of 5 open-ended questions namely the type of services and customers, cost of services, type (s) of material (s) they can dye, availability and cost of dye and chemicals, and frequency/peak periods of their operation while discussion with the cloth vendors centred on 5 open ended questions including who dye their materials, how frequently they require the service of the dyers, who are the customers of the dyed cloth, sources and cost of white undyed cloth. Focus group discussions were audiotape-recorded so that reference could be made to the remarks of the participants in order to ascertain common themes. Discussion with the dyers lasted for 2 hours while that with the cloth vendors lasted for 1 hour. Discussions were recorded using paper and pencil. Diameter, temperature and volume were measured using measuring tape, thermometer and measuring cylinder respectively and were presented as averages of measurements in triplicates from various dyehouses. Dollar exchange rate has fluctuated considerably between 2020 till date. (exchange rate of ₦386.96 per US$ as at 30th August, 2020 was used where dollar equivalent is given in the text).

RESULTS AND DISCUSSION

Enterprise's/Group's Operations

Services offered, clients, and cost of services

Table 1 shows that of the 1387 dyers investigated, 100 % of them were involved in plain dyeing of cotton and cotton blend fabric. Other services offered by the dyers include redyeing of faded garment, tie-dye, batik work, and dyeing of household items/fashion accessories. Plain dyeing, which involves dyeing the whole fabric uniformly, is easier and faster compared to tie-dye and batik work since it does not require additional work before the dyeing process.

The dyers revealed that both plain dyeing, tie-dye and batik work are normally carried out on 5 yards (4.57 m) of undyed or light-coloured cotton or cotton blend fabric predominantly imported from China. According to them, such fabrics are cheaper, lighter and easier to manipulate than locally woven cloth used traditionally, and are also more available in larger quantities. Similarly, according to Byfield (1997), importation of fabric was the first innovation that propelled the expansion of 'adire' production in Abeokuta, Nigeria. The dyers refer to cotton blend as "mix" or "Mai-rubber" (in Hausa). Artisans in Ghana also dye cotton/blend fabric using similar dyes and chemicals (Aboagyewa-Nitri and Mintah,

2016). Cotton blend, particularly cotton and polyester, when blended, provide better properties than those obtained by pure cotton or pure polyester fibres (Nazir *et al*., 2014).

Table 1: Services offered by the dyers

Services	Yes N=1387 (%)	No N=1387 (%)
Plain dyeing of cotton fabric	1387 (100)	0 (0)
Plain dyeing of cotton blend fabric	1387 (100)	0 (0)
Redyeing of faded garment	1349 (97.3)	38 (2.7)
Tie-dye	327 (23.6)	1060 (76.4)
Batik work	76 (5.5)	1311 (94.5)
Dyeing of household items/fashion accessories	263 (19 %)	1124 (81 %)

According to the dyers, redyeing of faded garment is popular because used cloth usually fades due to contact with sweat by the arm fit and around the chest and back. According to them, faded jeans and stained garments are oftenely redyed. Due to the fact that most sewing threads are made of polyester which they cannot sufficiently dye, the articles have to be redyed to the same shade otherwise the thread will show. Another approach is to carefully remove the sewing thread with the aid of razor blade, redye the material and sew it back with the matching thread. Embroidery threads are usually cellulosic and therefore do not have this problem only that they appear deeper in colour than other parts of the garment which some customers find desirable. According to the dyers, some customers prefer to sew a white fabric with a thread that has colour of their choice before it is dyed to similar shade. They also revealed that dyeing of garment is cheaper and more uniform but requires higher dyeing temperature compared to fabric dyeing and that the former takes longer time to dry than the latter especially when starched. Similarly, Chakraborty et al (2005) reported that garment dyeing has advantages over fabric dyeing such as reduced fabric waste, no shrinkage, low water and labour costs and production of uniformly dyed garments with no variation in shade at different parts of the garment while the disadvantages include longer drying of goods resulting in waste of time, excessive heating and inaccurate production and cost figures.

It has been observed that tie-dye/batik techniques usually employed by the dyers include knotting, binding,

folding, sewing, application of molten wax to the fabric, tying, pinching, and pleating which are similar to the techniques described by Mayusoh (2015). The dyers that offer tie-dye/batik normally give the material to women at home to make the pattern after which they carry out the dyeing processes themselves. This is in line with the practice of local dyers in Abeokuta (Eicher and Eicher, 2014). Dyers engaged in batik work were few may be because it is not an everyday attire in the community and therefore customers rarely demand for such service.

According to the dyers the finished materials are sewn into 'Caftan', 'Bubu', 'Buba' etc. T-shirts from Europe are also customized with the resist dyeing techniques. Products from finished plain dyed materials, plain dyed material sewn to 'Caftan', tie-dyed fabric sewn to 'Bubu', and a tie-dyed customized T-shirt are shown in Figures 1 to 4 respectively. White or light-coloured household items and fashion accessories such as towels, shoes, bags, table cloth etc. are difficult to maintain especially when limited in number and frequently used hence such items are usually dyed to enhance their aesthetic appeal and prolong their duration of use. Similarly, dyeing of fashion accessories in a small-scale dyeing unit in Ghana has been reported by Selase et al (2019).

Among the clients of the dyers, customers in the neighbourhood give more patronage followed by vendors from the cloth market, customers from other states and then customers from other countries as shown in Figure 5. The dyers disclosed that they offer more services to the neighbourhood due to rampant cases of faded garment, dyeing of household items/fashion accessories, and frequent wedding ceremonies where dyed uniforms ("Anko" in Hausa) are used. Some of the dyers have customers from neighbouring states as well as from Niger, Chad and Cameroun. Cloth vendors revealed that they regularly give out cloth for dyeing which are kept in the shops and that they also have customers coming from other places that could make a large

order of dyed materials where the quantity needed
may not be available.

Figure 1: Plain dyed fabrics in a shop at 'Kantin-Kwari" cloth market

Figure 2: Plain dyed fabric sewn to 'Caftan'

Figure 3: Tie-dyed fabric sewn to 'Bubu'

Figure 4: Tie-dye pattern on T-shirt

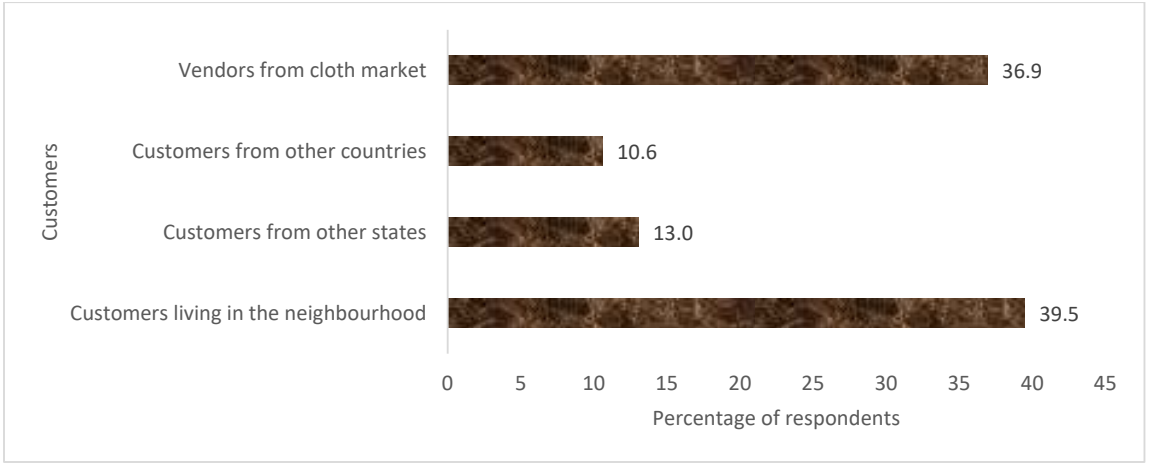

Figure 5: Clients of the services of the dyers

It was learnt from the dyers that they charge an individual a minimum of ₦1,500 ($3.87) for plain dyeing of 5 yards (4.57 m) of material to any colour and ₦1,000 ($2.58) for redyeing of faded garment while they charge cloth vendors ₦35,000 ($90.44) for dyeing 1 'dealer' (200 yards or 182.8 m) which is equivalent to ₦875 ($2.26) per 5 yards (4.57 m). Tie-dye and batik work are more expensive and cost ₦2000 to ₦4000 ($5.16-$10.33) per 5 yards (4.57 m) depending on the complexity of the pattern to be made. Cost of dyeing of household items such as towels and fashion accessories such as shoes, bags, handkerchiefs etc. range from ₦200 to ₦1,000 ($0.51-$2.58) depending on the size of the article.

Tools/equipment, power sources and temperature control

Table 2 shows that all the dyers (100 %) use similar equipment for batch dyeing which include 50-100 L iron drum for heating water, open plastic bowl (average diameter of 9.7±0.38 m, average depth of 4.6±0.11 m, and average capacity of 24.3±0.41 L) which serves as the dyebath, stirrer for mixing the chemicals and rinsing vessel. Similarly, the use of open plastic bowl for dyeing in a small-scale vat dyeing unit has been reported by Frimpong (2009). Dyers in Kano metropolis lack access to expensive industrial machinery as in the case of local artisans studied by Shuvo II (2018) and therefore practise hand-dyeing (Figure 6) which is possible because there is no standard process in vat dyeing and the procedure depends on the available equipment and the dyeing may be batchwise, semi-continuous or continuous (Xu et al., 2000). According to Yusuf et al (2017), vat dyeing takes place in a bucket or vat which is in line with the finding of this study. Baumann and Fletcher (1966) suggested for the use of dyeing machines made of stainless steel in order for the equipment to be able to withstand the chemical and physical conditions used in the dyeing operation. For this reason, use of plastic bowl may not give the best overall result.

Table 2: Tools/equipment used by the dyers

Tools/equipment	Yes N=1387 (%)	No N=1387 (%)
Drum	1387 (100)	0 (0)
Plastic bowl	1387(100)	0 (0)
Rinsing vessel	1387 (100)	0 (0)
Stirrer	1387 (100)	0 (0)

Figure 6: Hand dyeing (Image not necessary)

All the dyers investigated use firewood as fuel which corresponds to 87 % of all the power sources combined as shown in Figure 7. This may be due to the fact that most of the dyers work in the neighbourhood with no electrical installations to use electric heater and which will not allow efficient use of cooking gas due to air. Coal is also another power source used to a limited extent. Basically, the enterprises using electric heater and cooking gas are those that are located in the house of owner/group member and is usually applicable when dyeing small lot/order where just a small quantity of hot water is needed. Similarly, the use of firewood as fuel in local dyeing industry has been reported by Singhi et al (2005).

The equipment and power sources used by the dyers could not provide a precise temperature control. This is in line with a report by Jena et al (2015) that traditional hand dyers use fossil fuel which bring about difficulties in precise temperature control. According to Patra et al (2018), improper temperature control, applicable to non-industrial dyers, results in increased dyeing cost for un-utilized and expensive vat dyes. Precise temperature control is necessary for some vat dyes to get better colour absorption (Chakraborty and Chavan, 2004). We determined that the dyers use hot water having an average temperature of 76±4.24 oC and as dyeing progresses, the temperature drops (to about 46±1.7 oC) since heating is not continuous and the dyebath (plastic bowl) is wide open to the atmosphere facilitating cooling. According to Wardman (2018), it is a requirement to maintain uniform temperature in a dyeing machine. In practical vat dyeing, the temperature at the start of dyeing is determined by the classification of the dye used either IK, IW, IN or IN special (Aspland, 1997). It has been reported that temperature can be gradually raised to about 80 oC and lowered to 40-50 oC towards the end of vat dyeing cycle (Aspland, 1992) which is slightly different from the practice of the occupational dyers. The type of equipment used by the dyers are shown in Figure 8. Majority of the dyers obtain good dispersion of the dye liquor by using hand gloves to stir dye and chemicals while others make use of broom or stick.

Sources of water

Dyeing is characterized by high water consumption (Rosa et al., 2014; Wardman, 2018) and, for example, dyeing of 1 kg of cotton with reactive dye demand an average of 70-150 litres of water (Allegre and Charbit, 2006). Sources of water vary significantly among the dyers as shown in Figure 9 where water purchased from vendors constitutes the majority followed by water from borehole, hand-dug well, and tap. Challawa, Tokarawa, Kano and Watari river systems provide water for human consumption, irrigation and industrial activities in Kano metropolis (Liman, 2015). Water supplied by treatment plants of Challawa, Tamburawa and Watari is far less than the demand of the area (Bello and Abdullahi, 2014) and this can explain why only 5 % of the enterprises use tap water.

High proportion of dyers purchasing water from vendors and making use of borehole may be attributable to the fact that low-income communities in Kano metropolis meet their water demands through dug wells in households, community lined concrete wells, boreholes with hand pumps, public stand posts, privately owned borehole-based systems and hawkers. Water vendors (hawkers), who normally operate hand-dug wells, provide alternative supply (Iliyas, 2000). Cost of water increases significantly over the years where 25 L is sold at about ₦14 ($0.00036) and ₦20 ($0.051) during rainy and dry season respectively as at 2016 (Ahmad, 2016) and as at the time of this study the same quantity of water from borehole cost ₦30 ($0.077) whereas tap water cost ₦50 ($0.129). To avoid purchase of water thereby saving cost, many enterprises use generator to pump water from nearby boreholes. Water from hand-dug well may be hard and the use of soft water is essential in vat dyeing because the dyes are sensitive to some degree to aluminium, calcium, magnesium and other salts which could lead to increased dyeing cost (Baumann and Fletcher, 1966).

Inputs/raw-materials, sources, and cost

As shown in Table 3, all the dyers (100 %) use synthetic vat dye, hydros, and caustic soda to formulate the dyebath and starch as stiffening agent before calendering. Some of them add sodium chloride and/or sodium sulphate to the dyebath. Vat dyes are commonly available in the form of liquids, granules, de-dusted powders and in pre-reduced or solubilized leuco sulphuric ester forms (Xu et al., 2000). Practical dyeing does not begin until the vat pigment is dissolved in caustic soda and hydros solution (Aspland, 1992). Hydros is readily available, inexpensive and capable of reducing a variety of functional groups (Gassman et al., 1981). Caustic soda is a popular solubilizing agent for leuco vat dyeing where it serves to dissolve leuco vat dye to its sodium salt, develop affinity of the dye for the fibre and neutralize acidic

by-products of hydros to maintain pH (Chakraborty, 1992). According to Aspland (1997), sodium chloride and/or sodium sulphate may be added to vat dyebath towards the end of dyeing in order to improve exhaustion. According to the dyers, sodium sulphate is useful when dyeing with black colours as it enhances dye absorption and shine where they refer to it as "flex".

Dyes and chemicals in the colour shops are mostly imported from China. Caustic soda and hydros are respectively sold at ₦400 ($1.03) and ₦800 ($2.06) per kilogram where the former is usually from Tianye chemicals and the latter is mostly produced by Jinhe hydrosulphite factory. Colours that are more commonly available include C. I Vat Blue 4, C. I Vat Red 1 and C. I Vat Violet 1 which are sold at about ₦10,000-₦12,000 ($25.84-$31.01) per kilogram depending on the prevailing market. Other colours such as yellow, green, brown, black, orange, red etc. are also available and are sold within the same price range. India and Germany also supply dyestuff to a limited extent and are more expensive according to the dyers. According to them, dyes and chemicals are readily available but their cost has increased almost 5 times from 2015 to the time that this study was conducted. The dyers use cassava starch to stiffen the dyed material in preparation for calendering and it costs ₦200 ($0.51) per kilogram.

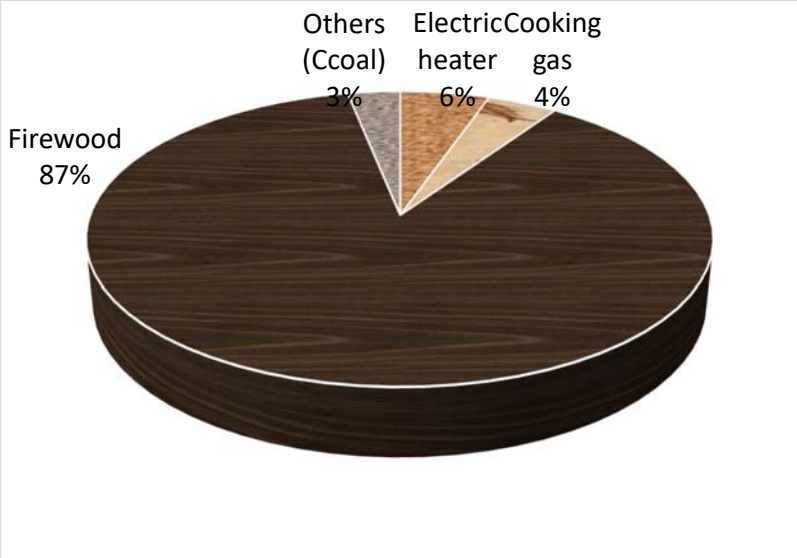

Figure 7: Sources of power used by the dyers

Figure 8: Equipment type

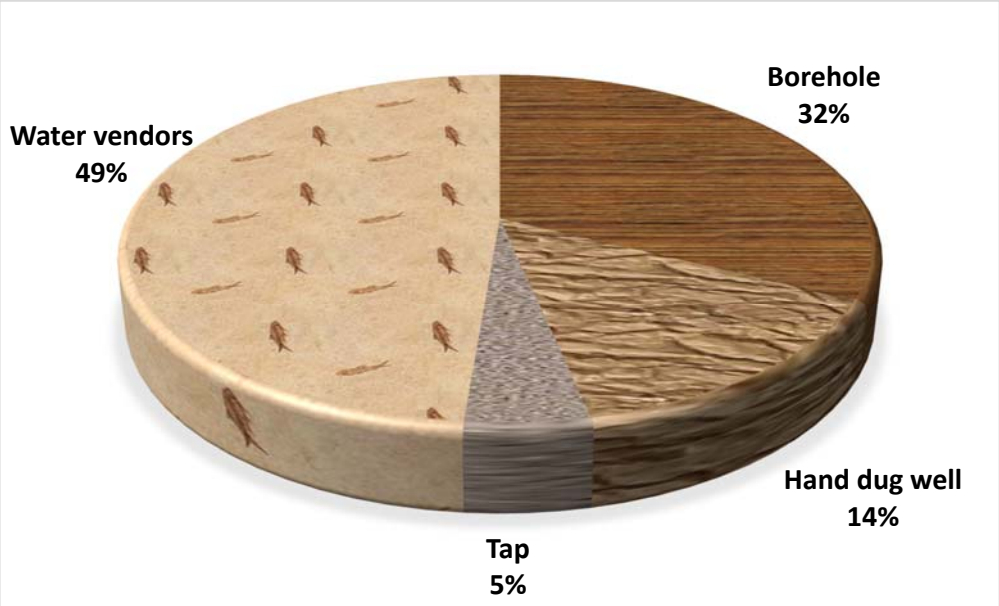

Figure 9: Sources of water used by the enterprises

Table 3: Inputs/raw-materials for the work of the dyers

Inputs/raw-materials	Yes N=1387 (%)	No N=1387 (%)
Dye	1387 (100)	0 (0)
Hydros	1387 (100)	0 (0)
Caustic soda	1387 (100)	0 (0)
Sodium chloride	38 (2.7)	1349 (97.3)
Starch	1387 (100)	0 (0)
Sodium sulphate	24 (1.7)	1363 (98.3)

More than one half of the dyers purchase inputs/raw-materials from retailers while others buy from wholesalers. There are many small colour shops in the proximity of the dyehouses where the dyers purchase chemicals either when dyeing small lots/order or in situations where certain chemical gets exhausted while on the job. Wholesale shops are situated in "Kasuwar Kurmi", "Kofar-Mata", "Hausawa-Sabontiti" and "Rijiyar-Lemo".

Cloth vendors revealed that some of them have visited Ningbo Tong Xi (NBTX), a textile manufacturing company in China, which is the major supplier of white undyed materials to 'Kantin-Kwari' cloth market. According to them, Blue Sky and King Peam, also in China, are among the leading textile suppliers. Some of those suppliers do not own textile industry but place order from other factories in China and then import to the Kano market. Similarly, wholesale textile buyers who have long standing trade relationship with Chinese companies have been invited to visit the industries as a reward for loyalty (Renne, 2015). The vendors also disclosed that a small bale called 'dealer' contains 200 yards (182.88 m) cut into 10 yards (9.144 m) each and usually cost between ₦90,000 ($232.58) to ₦200,000 ($516.84) per dealer depending on the material quality. According to them, there is another type of material called 'Wagambari' that has been accepted for several years especially by the people of Borno State, Nigeria and is usually sold at ₦120,000 ($310.11) to ₦140,000 ($361.79) per dealer. According to the vendors, since 2015, designs of choice of white undyed materials suitable for dyeing became scarce and very expensive when available. Designs appealing to customers are only available in coloured form and entirely imported from China. Both the dyers and cloth vendors revealed that at the peak of the dyeing business in 2015, the Chinese started bringing similar dyed cloth to 'Kantin-Kwari' which are sold at the outskirt of the market. Similarly, Renne (2015) has reported the same situation. Moreover, on the 14th of May, 2015, thousands of the occupational dyers staged a demonstration against the importation of Chinese

textiles and engagement of the expatriates in retail sell of fabrics in Kano market (Muhammad, 2015).

Weekly dyeing rate and peak periods

As shown in Figure 10, majority of the dyers usually work on customer demand and according to them, in situations that the dyers work several times in a week, the marketer among the group has multiple links to the cloth market where the vendors select white undyed fabrics or light coloured materials and give out for dyeing on regular basis to stock their shops with dyed materials. Some dyers own stalls within the market and usually re-stock them with dyed materials after sells.

The peak periods for the occupational vat dyeing business were during Eid Al-Fitr 'Karamar Sallah', Eid Al-Adha 'Babbar Sallah', Mawlud al-Nabi 'Birth of Prophet Muhammad' and Christmas period as shown in Figure 11. During the Muslims festivity periods, people in the northern part of the country wear new clothes for the celebrations which are mostly from dyed materials thereby making the dyers highly engaged. There are also significant number of Christians in Kano metropolis that celebrate Christmas with native clothing and therefore require the services of the dyers.

Means of measurement

The dyers mostly measure dyes/chemicals using uncalibrated stainless-steel spoon. Very few of the dyers use weighing balance (0.3 %) for measurement and this is a disadvantage as, for example, addition of too little hydros results in oxidation which removes the dye from solution, incorrect heavy colour selvedge and poor fastness to washing while too much hydros can lead to destruction of the dye chromophore which leads to loss of colour yield (Teli et al., 2001).

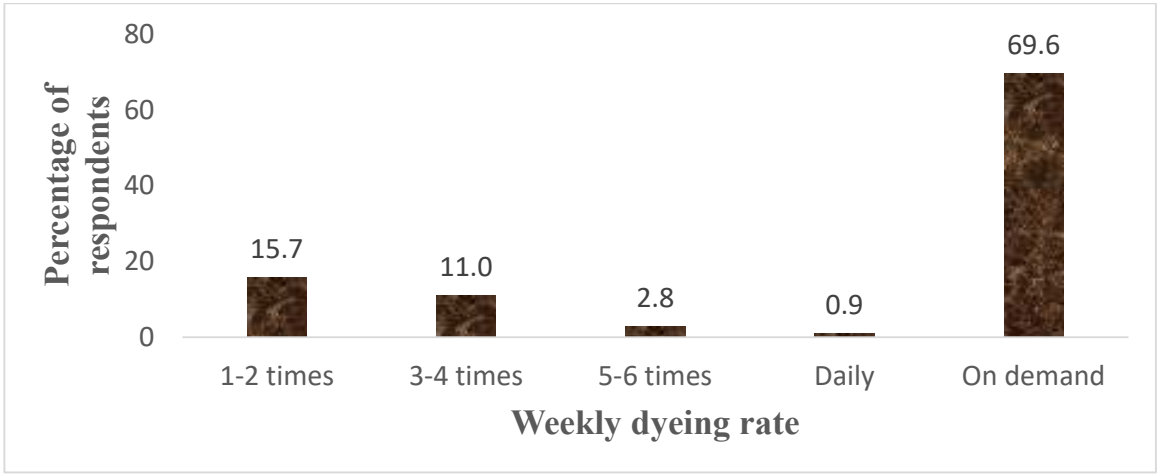

Figure 10: Weekly dyeing rate

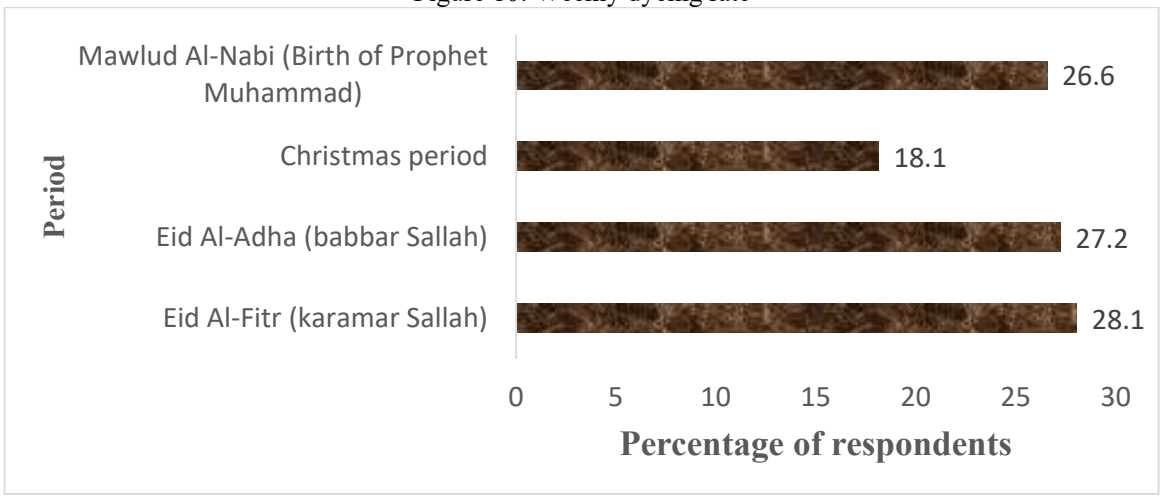

Figure 11: Peak periods of the dyeing activities

CONCLUSION

The dyeing enterprises offer services such as plain and patterned dyeing of fabric and garment, redyeing of faded garment, and dyeing of fashion accessories/household items to customers in the neighbourhood and from other states and other countries as well as cloth vendors using firewood as fuel, water purchased from vendors, synthetic vat dye, auxiliaries, and material to be dyed as raw-materials. Piece dyeing of fabric/garment, redyeing of faded garment and dyeing of fashion accessories/household items are needed on daily basis and it may not be convenient getting such services in a textile industry. The occupational dyers are therefore needed because they are easily accessible and since satisfying the needs of the customer is more important than achieving the highest levels of technical performance in dyed and finished goods. The dyeing occupation stood the test of time and may likely be sustained due to the lucrative nature of the business as well as the availability of dyes/chemicals/materials (from China) and huge patronage because of large population and numerous markets. Two important issues could result in the decline of the dyeing venture. On the one hand, lack of precise temperature control and inaccurate measurement of dyes/chemicals may not allow the production of good quality dyeing with best overall results. On the other hand, the increase in cost of dyes and chemicals, rise in cost and scarcity of white undyed fabric, and importation of coloured textiles could be linked to Chinese competitive advantage, gradually making the dyers jobless. The study suggests the ban of importation of coloured textiles especially from China, subsidizing the cost of dyes and chemicals, and tackling insecurity such as Boko-Haram insurgency and banditry which threaten businesses in this part of the country. The dyers should also be encouraged to become formal to be able to seek for infrastructural development from the state government. Further research should focus on the dyeing processes, challenges and prospects of the vat dyeing occupation, dyeing conditions used and quality of the locally dyed materials, environmental impacts of the dyeing activity as well as knowledge, attitude and safety practices related to the dyers.

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