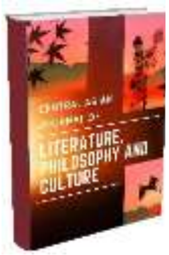

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Innovative Construction Of Wireless Agidigbo Traditional Musical Instrument: Using Experimental Design

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Abstract

In today's technology advancement, every society has their musical instruments which they are known for in spite of marginalization, westernization and industrialization. Traditional musical instruments are not spun out in the technology use. Therefore, the call for technological innovation in Nigeria traditional musical instruments is indispensable. This study constructed a modernized and amplifiable wireless Agidigbo musical instrument by giving an aesthetically upgraded facelift with advancement of technology in the South Western Nigeria. The field experimental research design was adopted to seek pertinent information on tools, materials, machine and process in the fabrication and design of wireless Agidigbo from traditional musical instrument builders in Ibadan, Oyo State and Epe in Lagos State. Major research instruments were interview, apprenticeship and participant observation methods. The study presented real life construction of a wireless Agidigbo with real assistance of an exponent musical instrument builder in Ibadan and data generated were analyzed using the content analysis technique. Finding revealed different types of Agidigbo which range from the smallest (soprano), medium size (alto or tenor) and the large (bass). The Agidigbo had four sides, a pair each of the same length and breadth, which made it a rectangular-like box. Finding also showed that Agidigbo has a soundboard with a perforated sound hole, and a base. The study revealed materials property, material size, thickness of the wall of materials, length of material and resonance cavity as determinant factors in the construction of wireless Agidigbo. Finding also deduced that size, shape, the thickness of the resonator wall and property of the material selected for the construction of Agidigbo influenced its sound production. The study concluded that wireless system was a viable material for constructing musical instrument and sound of Agidigbo can be engineering through the alteration of frequency, Medium Density Fiberboard can be *used for musical instrument manufacturing. The study therefore recommended that conservation materials for Agidigbo musical instruments should be assessed before application to evaluate their impact on sound as they may significantly affect the acoustic properties of musical instruments and thus alter both their tangible and intangible identity.*

***Keywords**: Agidigbo, Technological innovation, Musical Instrument, Wireless System*

Introduction

The study of musical instruments can be approached from many different perspectives and backgrounds. Musicologists and musicians may investigate and classify instruments by their musical functionality and applications. Acousticians will be interested in the sonic properties and the way these musical tools function from a physical point of view, whereas historians and cultural sociologists may research the role of instruments in past and present communities. A somewhat peculiar category of individuals to study musical instruments is formed by instrument-makers, since they are usually more involved in the practical side of things, the actual manufacturing, and less in scholarly activities surrounding instruments. Still, they have a very close relationship to the object, even literally in the sense that they have shaped and held in their hands each of its individual components. In order to comprehend the architecture and manufacturing process of (historical) instruments, Instrument makers are inclined to look beyond outer characteristics and musical application, trying to understand what is beneath that surface of wood, metal or ivory. Like a curious youngster dismantling an obsolete electronic device to discover the interior, makers want to look inside, or even better, through the objects of their interest, and nowadays the technical means to do so are available more than ever before.

It is from this deep incentive to understand the structure and creation process of instruments that Instrument makers can contribute their unique expertise and methodologies to the field of organology. Moreover, in making reconstructions of historical instruments, their practical activities could become the nucleus for a multi-faceted organological study project, where "workbench research" generates questions, answers and understanding, while also allowing for the practical testing of construction hypotheses. The study therefore discussed the pivotal steps in the innovative construction process of wireless Agidigbo traditional musical instruments.

Several innovative musical instruments are being invented, but too little striking music is being made with them (Jordà, 2004). In the present day, roughly any creation or instrument equipped with wireless, sensors, processors and circuits can be transformed into a musical instrument (Delle et al., 2008; Kim et al., 2011). On the other hand, technology intervention does not always translate to improving the design or the users' interaction with that creation. While new musical instruments feature state-of-the-art technology and many new performance possibilities, they also embody un-orthodox user interfaces, novel but sophisticated interaction models, over-engineered or too simple functionality and unfamiliar product semantics/semiotics.

In the contemporary view regarding innovative design of traditional musical instruments, the bulk of the artifacts are either easy-to-use musical instruments with little to no space for mastery, musical fluency or overdesigned instruments equipped with state-of-the-art computing and sound technologies.

One of the factors affecting decisions of musicians for choosing to engage with a musical instrument is the learning curve. In addition; the amount of time it takes a novice to gain enough skill with the instrument and the experience of playing it is rewarding (Vertegaal & Eaglestone, 1996). This research put forward two main rationales behind the aforementioned problems, which are: lack of theoretical knowledge in literature concerning the fabrication of wireless traditional musical instruments and lack of user-centered study to inform the fabrication process of new musical instruments.

Presently, there is a noticeable lack of theory pertaining to new musical instrument construction in the literature. Medeiros et al. (2014) point out that there are some assembly challenges regarding New Interfaces for Musical Expression (NIME) research and practice, which are not well described, analyzed together or explicitly discussed in the literature. The authors further suggest that dimensions such as usability, efficiency or fun are not obvious when applied to new invention of musical instruments.

> In fact, some issues are especially hard, such as how to deal with virtuosity, how to include cultural elements surrounding the artifact, how to consider the musician context in his/her experience in using the artifact, how to catalyse the creation of new artifacts, how to define what is a successful design, how to promote adequately the adhesion of adopters, etc. (Medeiros et al., 2014, p. 644).

The above-mentioned challenges need to be addressed by researchers working on fabrication of wireless or sensor-based traditional musical instruments. O'Modhrain (2011) mention that there is no doubt that the most important stakeholder in the process of designing and construction of digital musical instruments (DMI), electronic musical instruments (EMI) and new interfaces for musical expression (NIME) is the performer. Unless the instrument can successfully translate their musical intent into sound in a reliable way it fundamentally fails as an instrument. Existing musical instruments require the musician to adapt to the instrument rather than stretching the parameters of the instrument to make it adaptable to the needs or preferences of the musician. Mulder (1996) suggest that this case is true for both traditional and new musical instruments due to factors such as inflexibility or standardization. However, Rebelo (2006) suggests that traditionally, a musical instrument is very much treated as a difficulty, an obstacle that needs to be overcome in order for the musician to become 'one' with it. Rebelo (2006) further believes that a desire to alleviate this obstacle is evident in recent research in the field of musical instrument design using new technologies. Today's technological possibilities also elevated expectations in terms of what new musical instruments can deliver to the musicians on multiple aspects of musical performance such as creativity, expressiveness, efficiency and functionality.

The majority of studies on electronic musical instruments are not specifically intended for the musician. Rather, a considerable amount of research has been dedicated to designing and building instruments for non-experts and 'ordinary' users (i.e. people who would not profess to being musicians) (Beyer & Meier, 2011; Luhtala et al., 2012). Throughout the history of music, never before have class of musical instruments been designed for amateur (not musician) users. Since the majority of new electronic musical instruments are neither designed and constructed by professional musical instrument makers, nor intended to satisfy the needs and expectations of musicians, their design specifications (such as affordances, usability, usefulness, expressiveness, etc.) have not emerged from traditionally established criteria. Furthermore, culture is characterized by language, traditional religion, social habits, music, arts and the totality of a people's way of life. Both tradition and culture of Yoruba people are implicated with modernity which are grossly eroded by modernist ideologies, resulting in gradual neglect/ rejection of the trado cultural status quo. The above has made the traditional Agidigbo musical instrument not to be known by most Nigerian youth, and invariably there had not been any noticeable improvement as such in its fabrications, aesthetic and electronics wise, which in essence is the focus of this new study to provide the missing link.

The general objective of this study is to construct a modernized and amplifiable wireless Agidigbo by giving an aesthetically upgraded facelift with advancement of technology all round. The specific objectives of the study are to: explore more durable and aesthetically presentable materials for the fabrication; identify old way of construction and speculate a modern technique for its reconstruction; construct a set of Agidigbo; search for a suitable and workable sensor/pick-up to be used for its amplification and document the stage by stage procedure of the upgrading and fabrication.

LITERATURE REVIEW

Fabrication of Musical Instrument

Over the course of human history, musical instruments have always been employed as an intrinsic part of music-making. From early woodwind instruments made out of bamboo canes to drums with stretched animal leather, the construction of musical instruments was initially based on the available materials and the necessities of the circumstance (Saenz, 2021). However, the craft of constructing these instruments eventually became a highly refined process with masters and students dedicating their lives to creating some of the most beautiful instruments of all time. Since the advent of the second industrial revolution in the late 19th century, large factories with an assembly line system were able to produce better, faster and cheaper goods than the classical craftsman approach which had reigned since the dawn of civilization. Although musical instrument manufacturing is even in this day and age a highly artistry craft with specialized shops and luthiers still being the norm for high-end instruments, industrially manufactured products are the standard for low-end and beginner's instruments (Saenz, 2021). Furthermore, the mass production of factory-made instruments represents an important step towards the popularization and general availability of musical instruments to people from all walks of life.

According to Saenz, (2021) there is fundamental differences between the handmade and factory-made musical instrument. Although the instruments themselves might seem very similar to the untrained eye, to a honed musician, the differences between handmade and factory-made instruments are quite profound. First and foremost, no two handmade instruments are the same, even by following the same blueprint and employing the same tools, the wood employed for the creation of a viola or guitar will change from season to season depending on weather patterns and the maturity of the tree, the metal for brass instruments depends on the refinement and purity of the alloy, even something as superficial as the varnish can change enormously from one instrument to the next one. On the contrary, in industrial processes, for the assembly line to flow smoothly, the materials must be as equal as possible and the procedures systematized to the last detail, meaning that two industrially produced violins made in the same batch will be fundamentally equals with close to zero differences.

Secondly, the human factor which a handmade product has can lead to tweaking and general modifications coming at the request of performing musicians or even the inventive of the luthier (Saenz, 2021). These modifications can be as simple as adjustments to perfect the technical mechanisms or something profound which might affect the very definition of what the instrument at hand is, this sort of human inventiveness is what led to the different stages of technical development of instruments over time, it is curious and kind of expected that essentially every western instrument in use in a modern orchestra achieved its highest degree of technical and mechanical perfection around the late nineteenth century, pretty much at the same time as industrial manufacturing became the norm.

Electronic Musical Instrument

From the beginning of the 20th century, music authorities had started indicating the need for exploring the physical properties of sound in compositional studies. Agidigbo musical instrument has not been considered as an individual traditional musical instrument. An electronic musical instrument or electrophone is a musical instrument that produces sound using electronic circuitry such an instrument sounds by outputting an electrical, electronic or digital audio signal that ultimately is plugged into a power amplifier which drive a loudspeaker creating the sound heard by the, performer and listener. Electronic musical instruments can be viewed as a subset of audio signal processing applications. Simple electronic musical instruments are sometimes called sound effects.

In the 21st century, electronic musical instruments are now widely used in most styles of music. In popular music styles such as electronic dance music, almost all of the instrument sounds used in recordings are electronic instruments (e.g., bass synth, synthesizer, drum machine). Development of new electronic musical instruments, controllers, and synthesizers continues to be a highly active and interdisciplinary field of research. In musicology, electronic musical instrument under the Horbostel – Sachs system musicologist typically only classify music as electron phones if the sound is initially produced by electricity, excluding electronically controlled acoustic instrument such as pipe, organ and amplified instruments such as electric guitar. Sachs divided electrophones into three subcategories:

- 51=electrically actuated acoustic instruments (e.g., pipe organ with electronic tracker action)
- 52=electrically amplified acoustic instruments (e.g., acoustic guitar with pickup)
- 53=instruments which make sound primarily by way of electrically driven oscillators

The last category included instruments such as theremins or synthesizers, which he called radioelectric instruments. Galpin (1937) provided such a group in his own classification system, which is closer to Mahillon than Sachs-Hornbostel, lists electrophones with three second-level divisions for sound generation "by oscillation", "electro-magnetic", and "electro-static", as well as third-level and fourth-level categories based on the control method (Loriod, 1987).

Wireless Musical Instrument Systems

Wireless is a term used to describe telecommunications in which electromagnetic waves (rather than some form of wire) carry the signal over part or the entire communication path. Some monitoring

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devices, such as intrusion alarms, employ acoustic waves at frequencies above the range of human hearing; these are also sometimes classified as wireless. The first wireless networks were develop in the pre-industrial age these systems transmitted information over line of distance (later extend by Telescope) using smoke signals , torch signaling ,flashing mirrors, signal flares or semaphore flags. Guglielmo (1896) invented the wireless telegraph. In 1901, he sent telegraphic, signals across the Atlantic Ocean from Cornwall to St. John's Newfoundland; a distance of about 3200 km. His invention allowed two parties to communicate by sending each other alphanumeric characters encoded in an analog signal. Over the last century, advances in wireless technologies have led to the radio, the television, the mobile telephone, and communications satellites.

A wireless system for musical instruments is the element that replaces the jack cable linking instrument to the very next element in audio signal flow. This could be between violin, guitar or bass and multi-effects unit, or directly between cello and amp. The wireless system receives and transmits the signal coming from the musical instrument without any physical connection (Eberly & Jingjit, 2022). Generally, a wireless system works with two components: a transmitter and a receiver. The transmitter is positioned on the jack of violin and the receiver is connected to the rest of audio signal flow. It works in a simple way by allowing the transmitter to sends the signal it receives to the receiver. The signal then travels to the amp or the PA system. Most wireless devices now come with small transmitters that can plug into violin or guitar. They are no heavier than a jack cable.

Characteristics of Wireless System

Wireless systems have greatly evolved. The earliest wireless systems do not have much in common with the latest ones available on the market. To understand characteristics of wireless system, there is need to understand the differences between a multitude of terms that describe different technologies: Very High Frequency (VHF), Ultra High Frequency (UHF), 2.4Ghz, Wi-Fi, analog, digital, channels, etc. All wireless systems communicate on a frequency band to transmit the signal. In the field of music, UHF band is used or the 2.4Ghz frequency band which is also used for conventional Wi-Fi.

i. Ultra High Frequency (UHF)

The UHF system uses radio frequencies and more precisely the range between 300Mhz and 3000MHz which can support a large number of devices at the same time. Each country has its own band of usable frequencies. It is not the same from one country to another.

ii. Wifi 2.4Ghz

This frequency band is legally accessible everywhere in the world which means it is universal. This can also be an inconvenience, because if there are many devices using this network in the vicinity, interferences can occur. But in reality, this does not happen very often, because manufacturers have developed a system of interchangeable channels. This means that if the channel on which user are transmitting is saturated, user can simply change channels.

iii. Very High Frequency (VHF)

The VHF which stands for "Very High Frequency" relies on radio frequencies. But in the music field, it is not used or not anymore.

iv. Analog vs Digital

This is a raging debate in the music area. Each musician has his own opinion on the subject. Some will tell that analog is better and others prefers digital. Each wireless system has its advantages and disadvantages. UHF wireless systems are analog and wireless systems using Wi-Fi frequencies are digital. A UHF system is analog and will have a lower audio quality than a digital system. In fact, to send the audio signal through the radio frequencies, it has to compress it and then decompress it. This implies small data losses. A digital system does not need compression to transmit the signal. An analog UHF system, on the other hand, has no latency when passing through radio waves. A digital system will always have a small latency. Today, they are minimal, due to the fact that the quality of the products offered on the market has greatly improved.

v. Channels

Wireless systems based on 2.4GHz frequencies use channels. The number of channels is limited, usually between 4 and 6 maximum. Musicologists are advised to select the least used channel in the area to prevent any interference. Some devices are able to automatically choose the best channel. Others can even change the channel in the middle of a live performance if they determine that the current channel is overloaded. There are apps and software that can be installed on phones or computers to identify the least used channels in a particular space. They are primarily used to calibrate home Wi-Fi systems. By using them, it enable user to identify the least used Wi-Fi channel in the neighborhood in order to improve its stability.

Benefit of Wireless System

i. Freedom of movement

The first gain of a wireless system is the freedom of movement. The musician is no longer dependent on the length of his cable and can move from one end of the stage to the other. This way, during a solo, it is easier to position yourself at the front of the stage right next to the singer. The stage presence is thus simplified. Some recent studies have attest to several wireless systems and affirmed that their coverage is more than sufficient for large stages (Eberly &Jingjit, 2022; Estrella 2018). Most wireless systems provide a reach of at least 25 to 30 meters when there are no obstacles to block the transmission. A wall between the transmitter and receiver may likely affect the signal, but walls on stage are pretty rare (Tahiroğlu & Magnusson 2021).

ii. Fewer cables

Using cables can quickly become a hassle. The more people on stage, the more complicated it gets. If musician move around, he or she unwind cable and when he or she goes back to original spot, it will most likely be lying around in the middle of the stage. Therefore, wireless systems are also an advantage for keeping a clean stage. What could be more professional than a stage without dozens of jack and XLR cables lying around! All bands and musicians try to hide them from the audience, but still there is a pile of cables all over the floor. This is the main reason why different Xvive wireless systems are used at events (Livingston, 2000). The stage is cleaner without cables lying on the floor. In addition, all cables deteriorate over time, that is, because as they are wind and unwind constantly. The ground wire inside the jack cable can become weak or even break. In some cases, it is often difficult to realize that a jack cable has been damaged. The reason for this is that, musician at times play non-stop, tend to focus on the playing itself and usually think that the problem originates from something else. A wireless system cuts through all the ground problems. Of course, it can also deteriorate over time. But a device stored in a box is usually better cared for than a jack cable thrown in the bottom of a bag or a case.

iii. Battery life

Generally, wireless systems run on regular batteries or lithium batteries. As with any such system, the battery has a limited lifespan. It is important to always remember to replace the battery or charge wireless system properly to avoid runing out of power on the day of the event or concert. This requires a little bit of planning ahead. According to Jordà (2005) most professional wireless systems use lithium batteries, they last long enough to deliver a full performance. Most wireless devices have at least a 3- to 4-hour battery life. Just like a phone battery, as it gets charged and discharged, it will wear out and its life span will decrease over time (De Souza, 2017).

iv. Latency

Technically, latency is the delay between the moment when the musician plays, and the moment when the sound played is emitted by the speakers or amplifier. There will always be latency in this process whether it is done with a cable or a wireless system. The cable path is more direct, so there is less latency (or none at all). Analog (UHF) wireless systems have very low latency because they use FM radio waves. Digital wireless systems (2.4GHz Wi-Fi) have a slightly higher latency. However, it is advised by DeNora, (1995) that musicians do not expect it to be huge. There are a lot of myths around latency. It is mostly a misunderstanding of the technologies and the mishaps associated with older wireless systems using older technologies. Many people think that wireless systems for musical instruments work like wireless systems for portable speakers for example. Wireless musical instrument systems do not use Bluetooth, a technology with high latency. Today, most wireless systems do not have latency problems. Campbell and Myers (2004) state that, latency is always mentioned therefore it is important to read the specifications of the wireless systems. Any latency below 8ms will not be noticeable. It is so low that user will not even notice it.

v. Signal quality

Many musicians believe that a wireless system decreases the quality of the signal that is sent. This is technically true. But it is mostly minimal and hardly perceptible to humans. To transmit the sound of a musical instrument or the voice in the case of microphones, analog wireless systems (UHF) will compress the signal so that it can be carried through radio waves. Once this signal reaches the receiver, it is decompressed. During this process, there are inevitably losses. They are small, but still present (De Souza, 2017). Digital systems do not involve any compression process. The sound is therefore generally of better quality. Jordà (2005) did tests with musicians where study tried to recognize a sound with a wireless system or a sound through a cable. None of them could tell for sure which sound was wireless or cable.

Wireless systems work with almost any musical instrument, effects pedal or amp. However, it has been reported by a number of musicians that some active musical instruments may not work properly with wireless (Goehr, 2007). A musical instrument is said to be active if it has an integrated battery-powered pre-amp. Any other instrument is said to be passive. If instrument requires a battery to produce sound, there is need to check the compatibility of the instrument with wireless systems on the Internet. It may not be compatible. Electric violins are all passive and therefore all compatible with wireless systems. However, beware of entry-level wireless systems that sometimes handle the intensity of passive pickups poorly. The result is a nasal sound that comes with sudden and blurred interruptions. This is clearly a sign of poor quality, as it is neither compatible with active pickups nor with the majority of passive pickups.

Types of Wireless Communication

Mobile-		Cellular Phones (GSM / cdma2000.1x)
Portable	**-**	IEEE 802.11b (Wi-Fi)
	-	IEEE 802.15.3 (UWB)
Fixed	**-**	IEEE 802.16 (Wireless MAN)

Rules of Improving Wireless Musical Instrument Systems Performance

A few simple rules will improve the reliability of wireless musical instrument system. Avoid putting obstacles in the signal transmission path (between the transmitter and the receiver). Any objects in the way will reduce its reach. If the receiver is positioned on the floor of multi-effects processor or footswitch, it wise not to place objects in front of the receiver. At the soundcheck, test the range capability of the wireless system on stage or in the room if need to move around. There may be a particular area where the transmission is being interfered with. At the soundcheck, if several musicians are playing with wireless devices (instrument, in-ear monitors, microphone), check that all wireless systems are working properly under playing conditions. Check the condition of the wireless system batteries. Replace any battery that might not last long enough.

Theoretical framework

This study is based on Transformative conceptual framework proposed by Adedeji (2006), says that transformative musicology is the musicology that aims at the transformation of our environment and our world at large. It encompasses all musical activities that focus on transformative purposes (Adedeji, 2006). In his application, Adedeji observed that following inadequacy or failure of existing systems, musical studies and activities need to be re-contextualized to meet contemporary challenges and made relevant to contemporary societal needs.

METHODOLOGY

This study employed the field experimental research design. This design is considered for this study because it encompasses a broad array of experimental designs of innovative wireless of Agidigbo, each with varying degrees of generality. Some criteria of generality (e.g. authenticity of treatments, participants, contexts and outcome measures) refer to the contextual similarities between the traditional Agidigbo and the wireless Agidigbo. This study adopted a combination of three data collection methods in order to adequately justify the essence of the study. These includes: interview method, apprenticeship method and participant observation method. This study made use of both primary and secondary source of data. Primary data used in this study include interview, apprenticeship experience and personal observation of the musical craft design. The interview and information were gathered on the field. Secondary data which was already collected and readily available from other sources were obtained through journal, books, articles, and other relevant publications including the internet sources. Since the research is essentially experimental, the study adopted content analysis. This statistical tool was used in this study to determine the presence of certain traditional musical instrument concepts in texts or images obtained through qualitative data. The following as listed are the tools and materials used in the construction process of the Agidigbo. The tools are*:* Hand saw, Hack saw, Steel rule, Long rule, Try square, Flat file, Rasp file, Pencil, Hammer and Knife. While the materials are: Medium Density Fibreboard (MDF), Ply-wood, Nail, Glue, Metal prong or tine, Butterfly nut, Flat watchers, Bolt and nuts, Screws and Sawdust.

Design and Construction of Agidigbo

The design and construction of indigenous drum is usually determined by wood carvers and instrument makers in line with strict compliance to ideologies rooted in traditional myths and taboos. Relating to instrument making generally, Adeyeye (2011) stated that the acoustic foundation on which African instruments are constructed leans heavily on these factors: size of the materials used; property of the material used; thickness of the wall of the material body; cross sectional area of the bore (resonant cavity) and length of the material used. From these basic acoustic factors, it is clear that the case and stripes of metals set up side by side are the main construction properties of the *agidigbo* drum. Modern science describes acoustic as the study of system that produces and propagates what we itemized as sound (Backus 1969). Abegunde and Oyedepo (2012:1) describe acoustics as embracing all aspects of science of sound. The knowledge of acoustics is the backbone for constructing any musical instrument. In consideration of acoustic as it borders on traditional African instruments, African instrument makers make use of available materials or resources and technically manipulate it to achieve the necessary acoustic sound associated with such instruments. Sound is produced as a result of vibration of a source such as the metal stripes, which is transmitted through the air as wave and to the ear drum where vibration is set at the same rate. The basic parameters that are put into consideration in the construction of any musical instrument narrowed down to Yoruba *agidigbo* includes: materials, size of the material, shape of the material, the thickness of the wall of material, length of material, resonance cavity. All these parameters are very important in determining the acoustic of the *agidigbo* drum. It has been noted that the Agidigbo of the Yoruba are made out of hard wood to make a rectangular box as resonator with plywood on top. The choice of hard wood varies from Omo wood, Mahogany wood, Apa wood to mention a few, which peradventure might contribute to its gradual getting into extinction. People in this new generation world

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believes in what they see and is readily available than description of what they do not know or see regularly. Also, it is worthy of note that the study about aesthetic cannot be overemphasized. Beautification of the agidigbo then becomes eminent. This is achieved by the use of the Medium Density fiberboard compare to the initial type used as seen in the Picture below.

Medium Density Fiberboard

Medium Density Fiberboard (MDF) is an engineered material made by breaking down hardwood or softwood residuals into fine particles, combining it with wax and a resin binder and applying high temperature and pressure. It has been discovered that MDF can withstand changes in humidity and heat better than solid wood. Real wood tends to expand and contract when humidity and temperatures rise and fall. As a result, cabinets, doors and panels made from real wood require more maintenance and care

The Step by Step procedure with pictorial view

Cutting of the MDF Board

The *Agidigbo* known to comprise of a rectangular box as discussed earlier kicks off by cutting the MDF sheet to 4ft by 8ft to get the two sides required to make the rectangular shape. To do this, a measuring tape is used to mark the sizes to be cut be cut out.

Preparing the brace for the rectangular box

The Picture shown in plate 4.6 above indicated that a brace or stopper is placed inside to form a perfect required shape. After getting the four sides ready with two opposite side equal to form a rectangle, the next is to join the sides.

Applying the White glue for better bonding

The application of white glue to solidify the instrument through bonding that the glue has created before the application of the nail to further strengthen the bonding and the instrument as a whole

Nailing the 3rd side along with the key informant

The researcher (Right) with the key informant, Mr. AdesanyaAdeyeye (Left). He is the Director of African Institute of Arts Technology, a research institute where many traditional instruments are manufactured. Here, the third side of the rectangular box with the MDF board is been constructed.

Affixing the 4th side with one of other informant

The researcher with one of the informant at the research center, Mr. Gorioye Adeyeye (left), affixing the fourth side of the box along with the Researcher (right).

Completed rectangular box with brace

The rectangular box is made and complete with the brace at two edges to hold it firm to allow the glue added before nailing to hold it tight and firm. Those two pieces of wood are later removed to allow the plywood to take its place.

The sound board: This is done by joining two plywood of different types together. The first plywood which is one eight plywood is glued together with fancy plywood which is also known as cover. This is to reinforce its strength to avoid easy damage. A fireboard should have been used but this will not allow for good sound production. This is similar to the table or sound board of a guitar. It has sound hole which after the throngs are plucked travels down through the hole to produce a resonating sound

¾ plywood for the top of the Agidigbo

The ¾ plywood which is to be used for the base of the instrument and also doubled to make the top cover of the box.

Cutting the required size for the top

The use of the Hack saw in cutting the ¾ plywood into sizes that fits the top through placing of the rectangular box on it and then making with a pencil to show the exact portion to cut.

The two boards to be glued together for stronger top

The plywood to be used for the top of the instrument. You will observe that they are two, which is expected to be glued together to make the top strong enough to stand the test of time and also enhance the nature of acoustic sound expected.

Application of Evostick to the plywood

Marking out of the sound hole

Cutting out of the marked sound hole, then using rasp and flat file to smoothen the surface. You can also see the small holes meant for the bolt to pass through.

Using the Flat file to smoothen the sound hole

The above picture shows the researcher using the electric drilling machine to make the holes on the bridge. The bridge is constructed before fixing the sound board permanently to the box. The bridge holds the keys of the *Agidigbo.* The bridge is made by drilling holes into two blocks of wood of 25cm by 2cm each. This is done in a way that each key falls between two holes on the bridge. The hole which must be straight passes through both bridges. The measurement of the spaces between each hole is also done on the sound board where the bridge sits. The bolt and butterfly nut is then used to join the three together.

Electric drilling Machine at work

Vice holding the bridge and Manual drilling machine

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The metal plates (keys)

The metal plates that make up the keys vary in number depending on the size and part that each is meant to play in the set. Inclusive in these set is even two octave *Agidigbo*.The metal plate are often referred to as *OjaAgba* by the local building materials sellers/traders. This is cut into different sizes using the hack saw and all the edges are dulled using the flat file, hard sandpaper, and smooth sandpaper. This is to avoid the player been injured while playing the instrument.

Top board with bridge and two keys

Electric driller

Ojaagba / metal keys

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Fixing the keys:

This is done by fixing each key between two blocks of wood of the same size which form the bridge. The washer, butterfly nut, and bolt which pass through the holes drilled in both bridges are used to fasten the keys so that they won't move around while playing or performing on it.

Tuning the keys:

The tuning is done by either increasing the length of the keys or reducing it. Pulling the keys forward through the sound hole makes the pitch lower and reducing the length by pushing it back increases the pitch of the key. The longer the length of the key the lower the pitch and the shorter the length of the metal keys the higher the pitch. While tuning the keys, the hammer is used to tap the edges gently either in or out of the bridge.

Keys of Agidigbo

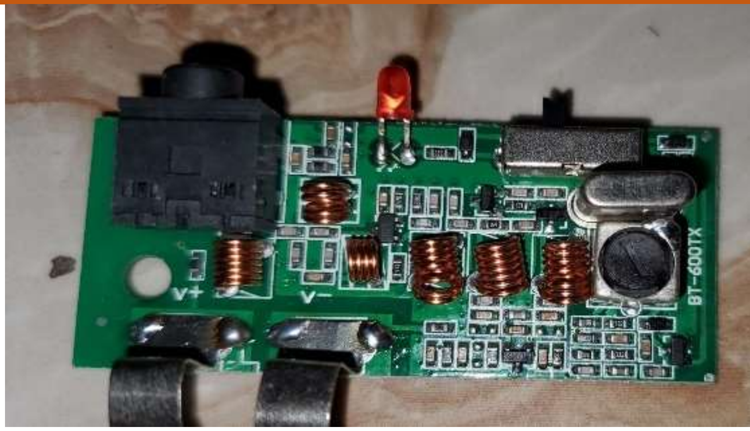

The selected pickup sensor to be affixed into the Agidigbo is of two types as shown below

Round edge pickup sensor


Type A –VHF Round edge Type B – VHF Flat edge

The two types will perform the same assignment in terms of pick up range of 200meters range, it also came with a transmitter and a receiver. The transmitter operates with a 9 volt battery and the receiver with a AA Battery type with 1.5 voltage range.

Wireless Transmitter



SUMMARY AND CONCLUSION

This study paper put forth an inventive design of wireless traditional Agidigbo musical instrument in the South Western Nigeria. This study sought to explore more durable and aesthetically presentable materials for the fabrication; identify old way of construction and speculate a modern technique for its reconstruction; construct a set of wireless Agidigbo; search for a suitable and workable sensor/pick-up to be used for its amplification; and document the stage by stage procedure of the upgrading and fabrication. The field experimental research design was adopted to seek pertinent information on tools, materials, machine and process in the fabrication and design of wireless Agidigbo from traditional musical instrument builders in Ibadan, Oyo State and Epe in Lagos State. The study presented real life construction of an innovative wireless Agidigbo with real assistance of an exponent musical instrument builder in Ibadan and data generated were analyzed using the content analysis technique. Major findings of the study are outlined thus:

This study revealed different types of Agidigbo which range from the smallest (soprano), medium size (alto or tenor) and the large (bass). The Agidigbo had four sides, a pair each of the same length and breadth, which made it a rectangular-like box. Finding also showed that Agidigbo has a soundboard with a perforated sound hole, and a base. The study revealed various determinant factor in the construction of wireless of Agidigbo which range from materials property, material size, thickness of the wall of materials, length of material and resonance cavity. Finding showed that property of the material selected for the construction of *Agidigbo* influenced its sound production. Finding also revealed that size of the material plays a significant role in determining the pitch of musical instrument. In the case of *Agidigbo* drums, it was found that the bigger drum of the *Agidigbo*, the lower the frequency it gives. This was detected in the size of the drums as it was discovered that the bigger the size of material used the lower the pitch produced by such instrument and the smaller the size of material used, the higher the pitch of the instrument. The study further revealed that musical instruments are made in different shapes; therefore, the rectangular box shape of *Agidigbo* has a way of influencing the timbre of the sound produced from the Agidigbo. The study found that shape affected the acoustics of Agidigbo musical instrument in terms of quality of sound. The study concluded that among the thickness of the resonator wall is one other factor that influenced the sound production of *Agidigbo* drum, which is why the researcher keen interest was taken by instrument makers for choice of wood or type of board used to achieve the right wall thickness of the *Agidigbo*.

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