

## Applicability of Radiocarbon Dating in the Valuation of Cultural Properties: A Study of Ikoro in South-East Nigeria

<sup>1</sup>Chikezie Okoronkwo, Abstract

<sup>2</sup>F. I. Emoh &

<sup>3</sup>J. U. Ogbuefi

<sup>1</sup>Department of Estate

Management Federal

Polytechnic Nekede

<sup>2</sup>Department of Estate

Management, Nnamdi

Azikiwe University Awka

<sup>3</sup>Department of Estate

Management, University of

Nigeria Enugu Campus

Radiocarbon dating is a scientific procedure used to date organic matter depending on the radioactive decay of carbon-14 ( $^{14}\text{C}$ ) an unstable isotope of carbon which is continually synthesized in the upper atmosphere by cosmic rays. With a half-life of about 5730 years, the process is used to date objects up to about 60,000 years in the past. The process for the valuation of properties has been evolving over the years. The value of sacred places and objects, historical and cultural sites and properties may not be required to establish a measure of degree of exchange between a hypothetical buyer and a hypothetical seller, which of course is the expression of market value. This is because the value is intrinsic and deeply buried within the psychology of persons who desire and indeed benefit from the existence of the objects and sites as well as those who though may not benefit directly but are associated with the preservation of the sites. It is thought that the application of radiocarbon dating will exhume the appropriate value of cultural properties especially those made in wood. This study explored the applicability of radiocarbon dating in the valuation of cultural properties of Igbo people of South East Nigeria. A pilot study was conducted in which ten (10) cultural objects from different parts of Igbo land were selected as samples (two samples from each of the five states of the region). The objects were made of wood from the "ikoro" family. These were subjected to observations in four phases 1-4. The phases abut and were non-overlapping periods which in other words mean that the samples were considered under distinct periods. The test population (10) is a small fraction of the population of the main study since cultural objects and properties of the Igbo people of South East Nigeria are many and varied. A small scale interview was administered to test run the choice of cultural objects chosen for the study. This was essential to obtain opinion on the cultural objects that are very important for the study in view of the purpose and scope of the investigation. Field survey, controlled experiment and process tracking methods were adopted in this investigation. Communities and local government areas were randomly selected from the South East geopolitical zone of Nigeria. Each of these communities was represented by an elder of the community chosen by consensus among members of the community. In most communities, recourse was to the "Chief priest" who presides over the relics and culture of the community and shrine/deity or "Akajiofor" who nonetheless is usually the oldest male representing the community. The population of the study area was 16,381,729 (NPC, 2006). This population was projected to 21,450,000 (NPC, 2018). Taro Yamane Formula was adopted in determining the sample size of 399.99 approximately 400. Spiegel and Stephen (2006) observed that any sample size of above 30 is a large sample. Indeed our sample size of 400 was large but considered appropriate for the nature of the study. The study employed the use of Chi Square primarily in the analysis. F-test and Regression Analysis were thereafter relied upon in assessing Correlation Coefficient and Coefficient of Determination. The study also tested data with Analysis of Variance (ANOVA). These acted as checks in the analysis of data. These were carried out using the Statistical Package for Social Sciences (SPSS) version 20. The study concluded that radiocarbon dating is applicable in the valuation of properties especially cultural objects as the process exhumes and reflects the importance of age and time in the determination of intrinsic values of a people. The study recommended among others the establishment of Accelerator Mass Spectrometry (AMS) laboratory in Nigeria to reduce the cost and burden of testing and analyzing samples overseas as well as critically examining the curriculum of Estate Management in our tertiary institutions to provide for the teaching and learning of the valuation of cultural properties.

### Keywords:

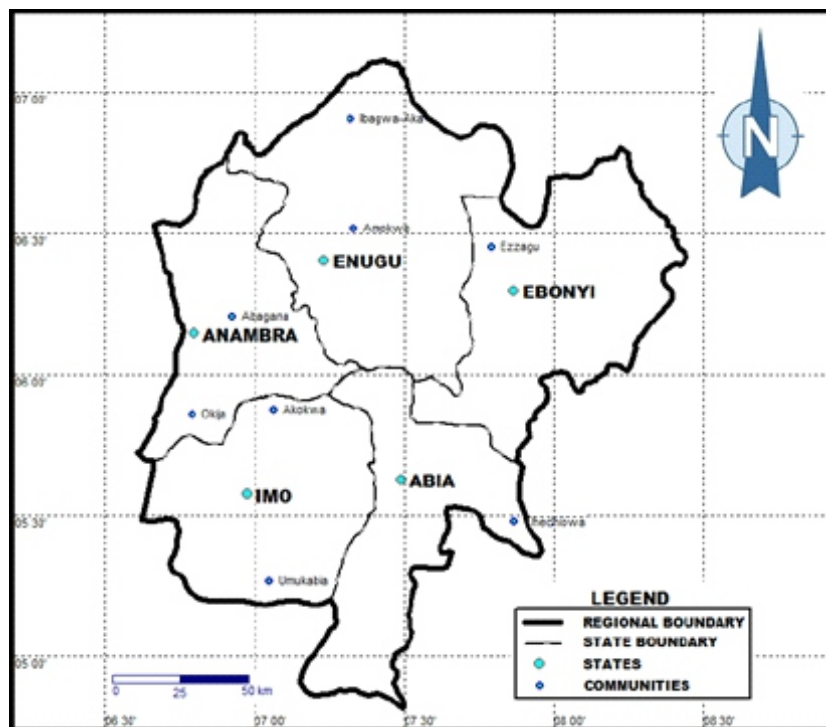
Valuation, Cultural Properties, Radiocarbon dating, Ikoro, Igbo people

Corresponding Author:

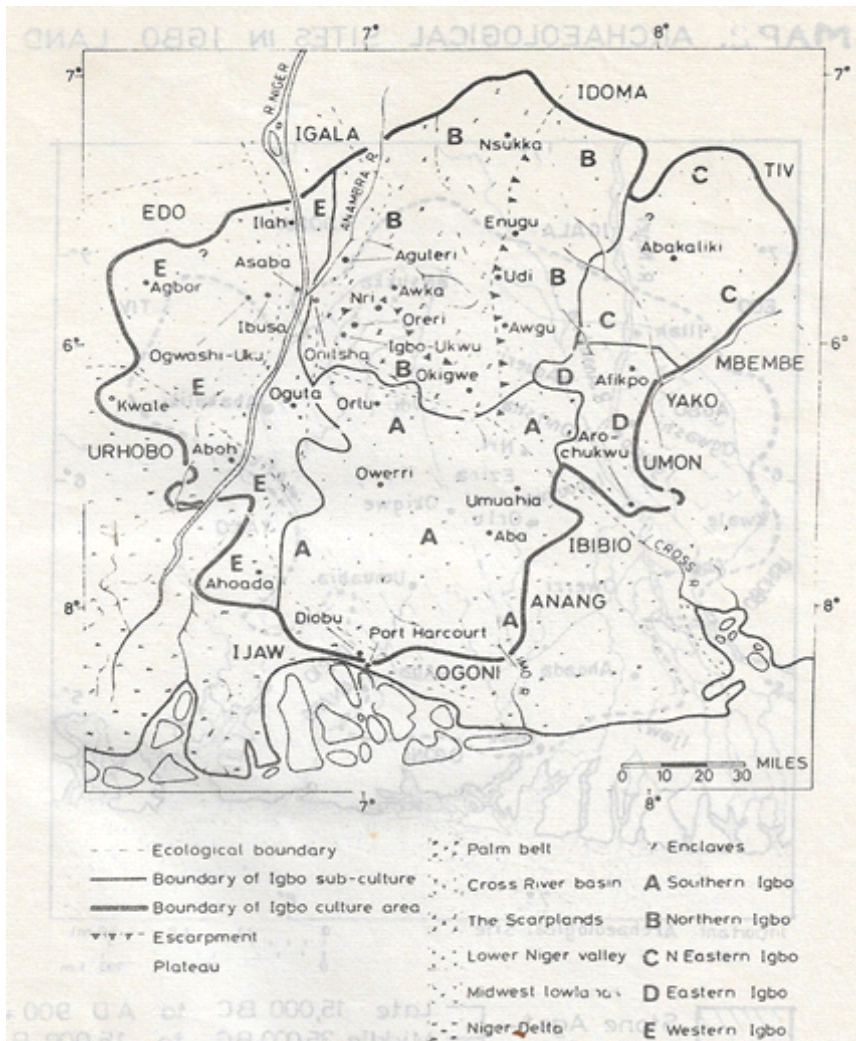
Chikezie Okoronkwo

### Background to the Study

This study was conducted among the Igbo people in South East Nigeria. It is one of the six geo-political zones of the country and home to the Igbo speaking people of Nigeria. The zone stretches from longitude 6° 43'E to 8° 22'E and latitudes 4° 45'N to 7° 14'N. Though it covers 28,987 square kilometers politically, the culture area occupies about 50,000km<sup>2</sup> of Nigeria's total area of 923,768km<sup>2</sup> (Okeke, Ene-obong, Uzuegbunam, Ozioko, Umeh, and Chukwuonye, 2006). South East Nigeria is bounded to the north by Benue and Kogi States, to the south by Rivers State, to the east by Cross River and Akwa Ibom States; and to the west by Delta State.



**Fig 1:** Map of South East Nigeria Showing the States under Investigation  
**Source:** <https://en.wikipedia.org/wiki/Igboland>)



**Fig. 2.** Map showing Igbo land and their neighbours  
**Source:** Onwuejiogwu (1984)

### Objectives of the Study

The aim of the study is to examine the applicability of radiocarbon dating in the valuation of cultural properties of Igbo people, South East Nigeria with particular concentration on Ikor0. These are properties that rarely change hands but are of immense value to the owners and users.

The objectives include

- To examine the ages of cultural properties of Igbo people of South East Nigeria
- To examine the relationship between age and value of cultural properties when radiocarbon dating is applied.
- To investigate the applicability of radiocarbon dating in the valuation of Ikor0 as a cultural property of Igbo people, South East Nigeria.
- To correlate the outcome of (b) and develop a model that could be used in the assessment of the value of cultural properties.

### **Research Questions**

- a) Does the age of cultural objects of Igbo people overlap within the South East region?
- b) Does value of cultural objects differ when radiocarbon dating is applied?
- c) Is Radiocarbon dating applicable in the valuation of cultural objects?
- d) What model could be developed to aid the valuation of cultural properties using radiocarbon dating?

### **Statement of Research Hypotheses**

**Ho1:** There is no relationship between age and value of cultural properties.

**Ho2:** The application of radiocarbon dating has no effect on the valuation of cultural properties of Igbo people of South East Nigeria.

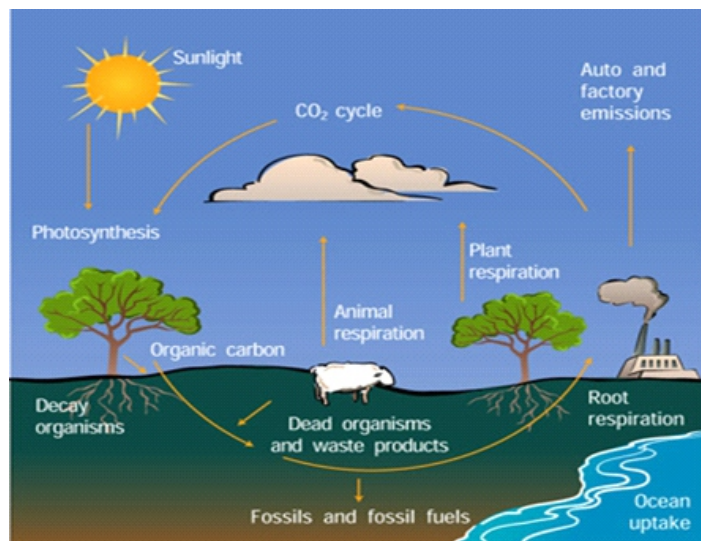
### **Literature Review**

The task of explaining the worth and importance of properties has been the underlying basics of economic principles. Early writings and forays into this discipline exposed the problem of worth and importance. Eucken (1992) was one of those who were challenged by the inability of most economic scholars of his time to explain the causes of economic events surrounding worth and inflation to the extent that he became among German economists, the foremost opponent of the historical school, which he criticized in several publications. The exasperation of most scholars in demystifying these concepts is evident in their writings and notable quotes. An economist might approach the problem from the starting point of a paradox that baffled Adam Smith in the 18th century when he stated that *"We cannot exist without water, but can get by without diamonds--and yet we value diamonds so much more highly than water."* Adam Smith's 'Diamond-Water paradox', differentiating value and price, insists that water is considerably more valuable than diamonds, yet diamonds command a much higher price (IUCN 2017).

Later economists, notably Menger (2007) and Jevons (1996) found an explanation in the notion that value is not inherent but subjective. In other words, prices are determined by the ability of a product to satisfy a human want, not what it costs to produce. To be technical, the actual value of a product depends on how useful its least important use is; its so-called marginal utility. Even at that, time is a great resource without which the past is unknown and the future cannot be predicted. The essence of knowing the age of properties in relation to its value therefore becomes more compelling if the latent ingredients of valuation must be put into proper perspective (Okoronkwo, 2016). In one epic study, Diaz, Hansz, Cypher, and Hayunga (2008) recognized the non-linear relationship between property age and value in a study of conservation districts, suggesting that older residential properties may have a higher value due to their unique characteristics and limited ability to reproduce the same structure. This view seems to alter the notion earlier always held that the newer a property, the higher the value. Though the view is still under investigation our enquiry into the applicability of radiocarbon dating to the valuation of cultural properties will shed much light on it.

Radiocarbon dating has for close to a century presented itself as the surest way of near accurately studying and estimating the age of properties. The concept of radiocarbon dating was developed in 1945 by Willard Libby a professor of chemistry at the University of Chicago. The process of radiocarbon dating starts with the analysis of the carbon 14 left in a sample. The proportion of carbon 14 in the sample examined provides an indication of the time elapsed since death of the sample's source. Radiocarbon dating results are reported in un-calibrated years BP (Before Present), where BP is defined as AD 1950.

This study is anchored on the theory of the carbon cycle. Carbon-14 was first discovered in 1940 by Martin Kamen (1913–2002) and Samuel Ruben (1913–1943), who created it artificially using a cyclotron accelerator at the University of California Radiation Laboratory in Berkeley. American Chemical Society (2016) reports that further research by Libby and others established its half-life as 5,568 years (later revised to  $5,730 \pm 40$  years).



**Fig. 3:** Carbon Cycle

**Source:** The National Center for Atmospheric Research Washington D.C.

### Value of Cultural Objects

Value of cultural objects is described in this study across a variety of dimensions and three main beneficiary groups. The dimensions include instrumental, intrinsic, institutional and use values. The beneficiaries of these values can be individuals, communities and the economy. Instrumental value describes the utilitarian and instrumental benefits that culture can provide for individuals, the economy and for society. The instrumental value of culture is sought through economic benefits such as civic branding, tourism, employment and the multiplier effect on local economies, through social benefits including increased social capital, inclusion, social cohesion, tolerance for cultural diversity, urban regeneration and civic participation and through benefits to individual such as learning, personal wellbeing and health. Intrinsic value gets to the heart of the

intangibles of museum and artifacts' experiences. The core of the valuation of cultural properties is the intrinsic value which is not only relative but also emotional to the owner. Intrinsic value refers to the value of a property determined through fundamental analysis without reference only to its market value. For individuals, intrinsic values are experienced as a 'state of absorption', or 'focused attention', 'captivation', and the 'deep satisfaction' that the 'pleasure' of seeing an art work, cultural object or having a cultural experience that is moving and meaningful, can generate. Other intrinsic benefits may be experienced collectively. Symbolic value is generated through culture's 'expression of communal meanings', through the 'creation of social bonds' that 'make connections between people' and 'reinforce a sense of unity and identity' (Ellis, 2005). The Ikoro is one cultural property of the Igbo people that satisfies this genre and is the focus of the study.

Ikoro is a cylindrical wooden instrument that serves several purposes in Igbo land. They are hewn from well groomed and sacred trees. Trees are important in Igbo spirituality as symbols of life and channels to the earth force. They are at the centre of shrines. In Igbo tradition, a child's umbilical cord is buried with a newly planted fruit tree (ili alo); this becomes the child's tree of life (nkwu alo) which secures lands, confirms the child's blood relation to the patrilineage, and forms a bond between the child and the Earth Mother, Ala. There are so many trees with ritual symbolism but four of the most revered are the ogirisi often used for the deceased, the abosi, the ngwu tree which is a symbol of wisdom and the oji (iroko) and the African pear revered for its excellent sound as well as its longevity when used for Oji, (*chlorophora/milicia excelsa*) most commonly known by the Yoruba name Iroko, is a very large tree considered to have mystical powers like many trees. The oji was planted near shrines to give the same impression as a cathedral. Oji also stands as a metaphor for strength, nobility, and resilience. Its wood is used for titled men's stools, compound doors/gates, and large ikoro slit drums, as well as other important ritual items. Other trees used for the ikoro drum include the Ube tree (*Dacryodes edulis*), and the Ngwu tree (*Baillonella toxisperma*). The Ngwu tree is sacred and mystic; it is a symbol of magic and super natural power (*Black Orpheus, 1967*)



**Fig. 4:** Ritual performance at the base of a sacred Ngwu tree at Ugwuoba Enugu State of Nigeria preceding the cutting of the tree for carving into an Ikoro

**Source:** <https://www.tumblr.com/search/ikoro>

The ikoro is a messenger connecting man and his environment as well as connecting man and his God. It is at very important and conservative occasions such as new yam festivals, war and ceremonies with deep cultural underbellies. The sound of Ikoro signifies a message very peculiar to the beat as a means of communication, a call for war, a call to duty, announcing the death of an influential personality in the community, defilement of the land, or an emergency. At the sound of the Ikoro, all members of the community are expected to gather immediately at the village square where the specific reason for the beating is communicated to the people.

As a watchdog to the community, the Ikoro is not beaten by everyone. Persons authorized to beat the Ikoro must be trained in the art, a good communicator and spiritually empowered to beat it whenever the necessity arises.

The centrality of Ikoro in the culture of the Igbo people is seen in its strategic location. Ikoro is usually located in the village square, from where its sound is expected to reach the various parts of the village. It is mostly unmovable and a roof built above it as shelter. It is indeed a beautiful and historic sight to behold. In most communities, the Ikoro is located at the market where it guards the people and goods bringing good fortunes to all those who are dexterously inclined and protecting the community from harm. The Ikoro at

Akokwa (Imo State) Uga and Umunze Anambra State and some others are all located in the market most times with a roof for protection from the weather. It was discovered during investigation that most Ikoro do not stand alone. They do this with children (umu Ikoro) either attached as at Akokwa or separated as at Umunze. The Chairman of Ugwuagbadaa Welfare Association Orumba South L.G. A Anambra State Chief Okeke explained that the Igbo people believe so much in family and community since a tree cannot make a forest.

Ikoro is a slit drum that consists of two horizontal slits and produces a distinctively hollow sound, usually vigorously played with two sticks. Sometimes, it is played using fists with tremendous effort. Ikoro experience involves architecture, music, dance drama, sculpture, politics, and warfare, religion and orature. It is believed that the tree for the construction/carving of an Ikoro is picked by the deity.. While larger Ikoros are played during wars, festivals and other great events including emergencies like wars conveying messages across communities that own them, smaller ikoros are played for entertainment during new yam festivals and other lighter ceremonies of the community.



**Fig. 5:** Ikoro Akokwa with motifs and carvings expressing the worldview of Igbo people on duality of nature.

### **Methodology**

A pilot study was conducted in which ten (10) cultural objects from different parts of Igbo land were selected as samples (two samples from each of the five states of the region). The objects were made of wood from the “ikoro” family. These were subjected to observations in four phases 1-4. The phases abut and were non-overlapping periods which in other words mean that the samples were considered under distinct periods. The test population (10) is a small fraction of the population of the main study since cultural objects and properties of the Igbo people of South East Nigeria are many and varied. A small scale interview was administered to test run the choice of cultural objects chosen for the study. This was essential to obtain opinion on the cultural objects that are very important for the study in view of the purpose and scope of the investigation. Field survey, controlled experiment and process tracking methods were adopted in this investigation.



Communities and local government areas were randomly selected from the South East geopolitical zone of Nigeria. Each of these communities was represented by an elder of the community chosen by consensus among members of the community. In most communities, recourse was to the “Chief priest” who presides over the relics and culture of the community and shrine/deity or “Akajiofor” who nonetheless is usually the oldest male representing the community. The population of the study area was 16,381,729 (NPC, 2006). This population was projected to 21,450,000 (NPC, 2018). Taro Yamane Formula was adopted in determining the sample size of 399.99 approximately 400. Spiegel and Stephen (2006) observed that any sample size of above 30 is a large sample. Indeed our sample size of 400 was large but considered appropriate for the nature of the study. The study employed the use of Chi Square primarily in the analysis. F-test and Regression Analysis were thereafter relied upon in assessing Correlation Coefficient and Coefficient of Determination. The study also tested data with Analysis of Variance (ANOVA). These acted as checks in the analysis of data. These were carried out using the Statistical Package for Social Sciences (SPSS) version 20.

#### **Presentation and Analysis of Data**

A pilot study was conducted in which ten (10) cultural objects from different parts of Igbo land were selected as samples. Two samples were selected from each of the five states of the region. The objects were made of wood from the “ikoro” family. These were subjected to observations in four phases 1-4. The phases abut and were non-overlapping periods which in other words mean that the samples were considered under distinct periods and variables. The test population (10) is a small fraction of the population of the main study since cultural objects and properties of the Igbo people of South East Nigeria are many and varied.

**Table 1:** Pilot Study

S/No.	State	Sample/ Age	valuation (Variability Model)	Valuation (application of Radiocarbon Dating)	Final Value
1	Abia	A - 90	75,000	NA	75,000
		B - 520	489,000	85 1,3 1,9 2,5 5,7 60, 04, 71, 50 64 89 61 2 9 3	2,571,613
2	Anambra	A - 70	56,000	NA	56,000
		B - 450	728,000	1,3 2,2 3,3 4,5 54, 34, 29, 27, 08 23 00 44 0 2 6 6	4,527,446
3	Ebonyi	A - 60	70,000	NA	70,000
		B - 370	335,000	62 1,0 1,4 - 3,1 34, 79, 00 34 11 6 5	1,479,115
4	Enugu	A - 60	48,000	NA	48,000
		B - 380	250,000	44 75 1,1 - 7,5 1,8 50, 00 00 25 4	1,150,254
5	Imo	A - 30	68,000	NA	68,000
		B - 460	385,000	72 1,2 1,8 2,4 3,8 19, 05, 90, 00 60 01 91 3 2 7	2,490,917

NA - Not Applicable

Phase 1:- 100 – 200 yrs; Phase 2 :- 201 – 300 yrs; Phase 3:- 300 – 400 yrs; Phase 4:- Above 400 yrs. Note that the four phases abut but are non-overlapping.

It would be seen from Table ... which is the result of the pilot study under 100 years, all properties were valued by application of the variability model. Restated, this model recognizes the input of different variables on the value of cultural objects. These include craftsmanship, labour/man hour, philosophy/worldview, medium and influence on society.

$$A = \sum f(w,c,l,m,i)$$

Where w = 5 (50%); c = 2 (20%); l = 0.5 (5%); m = 1 (10%); I = 1.5 (15%)

Medium was recourse to in obtaining the cost element. Thereafter the model was applied in which medium was allocated it due value (1 = 10%).It follows as was the case of the

youngest sample from Abia State with a radiocarbon age of 90 years where the cost of the medium was established to be N7,500.00 (Seven Thousand, Five Hundred Naira) only; the value of the property was  $\frac{100 \times 7500}{10} = \text{N}75,000$

**Research Question 1:** Does the age of cultural objects of Igbo people overlap within the South East region?

Forty four (44) samples were collected for the study viz Abia State (8), Anambra State (12), Ebonyi State (5), Enugu State (9) and Imo State (10). The samples were members of the “ikoro” family whose radiocarbon ages are tabulated in table 10.

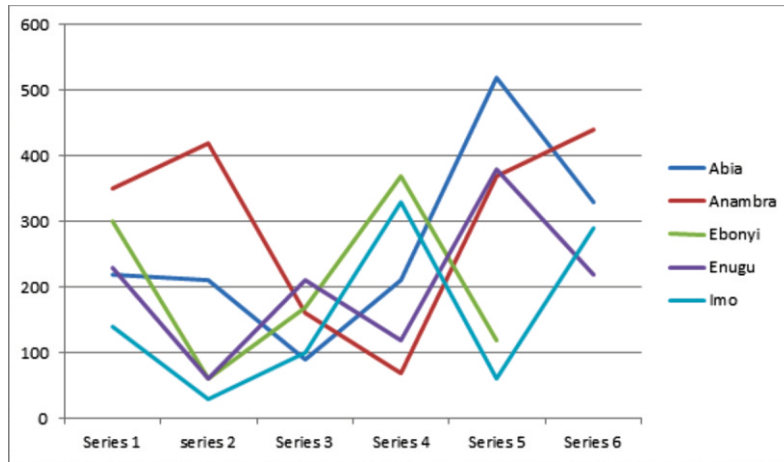
**Table 2:** Radiocarbon ages of samples selected from South East Nigeria

Abia	Anambra	Ebonyi	Enugu	Imo
220	350	300	230	140
210	420	60*	60	30
90	160	170	210	100
210	70	370	120	330
520*	370*	120*	380	60
330*	440		220*	290*
190	330		210	170
110	300		90	460
	260*		210	160*
	210			200
	450			
	350			

**Source:** Okoronkwo, C. (2018, 2019). Field Survey of ikoro samples.

Notes:

- 1) The data obtained in 2018 are the ages recorded as years before 2018.
- 2) \* Data obtained in 2019 are the ages recorded as years before 2019
- 3) Each of the samples observed was associated with Igbo civilization and culture. They are all wooden cultural objects of the “Ikoro” family.



**Fig. 5:** Ages of cultural objects in South East Nigeria

The table shows that within the South East region, age of cultural objects overlap significantly. This shows that civilization within the region spread evenly although spot evidence indicated that Abia and Anambra States seem to have older cultural objects than other states within the region.

**Research Question 2:** Is Radiocarbon dating applicable in the valuation of cultural objects

**Table 3:** Applicability of radiocarbon dating in the valuation of cultural objects.

Variables	SA	A	D	SD	TOTAL
Applicability of radiocarbon dating	91	49	63	42	245
Valuation of cultural objects	35	28	21	21	105
					350

Calculated  $X^2$  - 212.5; Table value of Chi - 7.82; Level of significance - 0.05; Degree of freedom - 3. Decision: Since the computed Chi-square (212.5) is greater than the tabular value (7.82) we ignore the null hypothesis that radiocarbon dating is inapplicable in the valuation of cultural objects and accept the alternative that radiocarbon dating is applicable in the valuation of cultural objects

**Table 4:** Applicability of radiocarbon dating

Category	O (observed frequency)	E (expected frequency)	O - E	(O - E) <sup>2</sup> *	(O - E) <sup>2</sup> / E *
SA	91	61.25	29.25	885.063	14.45
A	49	61.35	-12.25	150.063	2.45
D	63	61.25	1.75	3.063	0.05
SD	42	61.25	-19.25	370.063	6.05
	245	245		23	

Df=3; Chi-Square=23; Chi-Square value needed to reject null hypothesis = 7.82  
*Result: Reject the null hypothesis that radiocarbon dating is not applicable in the valuation of cultural properties.*

**Research Question 3:** Does value differ when radiocarbon dating is applied to the valuation of cultural objects?

The valuation of the oldest Ikoro among the samples was undertaken using the different methods and approaches to valuation. This cultural object aged 520 years according to radiocarbon date obtained from AMS laboratory in Trondheim Norway in 2018 was one of the samples from Abia State, South East Nigeria. Application of the Variability model produced a value of N489,000. However when the world view of the people was analyzed as the age of the object increased, values increased at different rates resulting in the valuation as typified in Table 5.

**Table 5:** Valuation of cultural objects using conventional, contemporary and radiocarbon dating methods

Age (520 yrs)	Conventional	Contemporary valuation	Radiocarbon valuation (N)
<100 yrs	470,000	415,000	489,000
101-200 yrs	-	-	855,750
201-300 yrs	-	-	1,360,642
301-400 yrs	-	-	1,904,895
>400 yrs	-	-	2,571,613
<b>Final Value</b>	<b>470,000</b>	<b>415,000</b>	<b>2,571,613</b>

It is therefore evident that values differ when radiocarbon dating is applied to the valuation of cultural properties.

**Research Question 4:** What model could be advanced for the valuation of cultural objects (properties)?

The application of radiocarbon dating indicates as seen from the Table 5, indicated that the value of cultural property increased with age whereas the application of other methods indicated that values remained. The percentage difference between the categories enumerated in years was computed with the result as depicted in Tables 6.

With repeated valuation exercises, the mean of the categories were determined which showed that cultural objects

- a) Below 100 yrs (< 100 yrs) = 1,
- b) 100 yrs – 200 yrs = 0.6987 (0.70);
- c) 201 yrs – 300 yrs = 0.6544 (0.65);
- d) 301 yrs – 400 yrs = 0.3988 (0.40);
- e) Above 400 yrs (> 400 yrs) = 0.3480 (0.35).

It was evident that the percentage difference hereinafter referred to as (differential) showed an anomalous behavior by decreasing non homogenously as the years increased. Consequently the value of cultural objects could be deduced from

- b = a + 0.70a for cultural objects (101 yrs – 200 yrs)
- c = b + 0.65b for cultural objects (201 yrs – 300 yrs)
- d = c + 0.40c for cultural objects (301 yrs – 400 yrs)
- e = d + 0.35d for cultural objects (above 400 yrs)

Where a = the initial value obtained using the variability model of valuation.

The information in the dataset of Table 14 were analyzed using regression analysis to determine Correlation Coefficient (r) and Coefficient of Determination (r<sup>2</sup>). This was necessary in examining the proportion of the variance in the dependent variable (age) which is predicted or explained by linear regression and the independent variable (value).

The Correlation Coefficient is a measure of how closely two variables move in relation to one another. Since this study investigated the relationship between age and value, correlation coefficient was adjudged the best statistic to employ.

Where n = 44; x = ages; y = Final Values

**Table 6.**

Property/ Age	<100 yrs (a)	100 – 200 yrs (b)	201 -300 yrs (c)	301 – 400 yrs (d)	>400 yrs	Final Value
A1 (90)	75,000	-	-	-	-	75,000
A2 (110)	115,000	0.90				218,500
A3 (190)	80,000	0.89				151,360
A4 (210)	120,000	0.87	0.685			378,114
A5 (210)	205,000	0.80	0.68			619,920
A6 (220)	150,000	0.79	0.66			445,710
A7 (330)	317,000	0.83	0.60	0.41		1,308,714
<b>A8 (520)</b>	<b>489,000</b>	<b>0.75</b>	<b>0.59</b>	<b>0.40</b>	<b>0.35</b>	<b>2,571,613</b>
B1 (70)	56,000	-	-	-	-	56,000
B2 (160)	74,000	0.81	-	-	-	133,940
B3 (210)	156,000	0.78	0.61	-	-	447,065
B4 (260)	125,000	0.79	0.65	-	-	369,187
B5 (300)	250,000	0.78	0.55	-	-	689,750
B6 (330)	90,000	0.85	0.65	0.50	-	412,088
B7 (350)	85,000	0.892	0.695	0.495	-	407,522
B8 (350)	160,000	0.89	0.70	0.51	-	776,260
B9 (370)	258,000	0.78	0.65	0.48	-	1,121,464
B10 (420)	475,000	0.75	0.67	0.51	0.32	2,766,936
B11 (440)	300,000	0.70	0.63	0.47	0.33	1,625,275
B12 (450)	728,000	0.86	0.65	0.49	0.36	4,427,448
C1 (60)	70,000	-	-	-	-	70,000
C2 (120)	85,000	0.84	-	-	-	156,400
C3 (170)	350,000	0.81	-	-	-	633,500
C4 (300)	272,000	0.84	0.69	-	-	845,811
C5 (370)	335,000	0.86	0.66	0.43	-	1,479,115
D1 (60)	48,000	-	-	-	-	48,000
D2 (90)	87,000	-	-	-	-	87,000
D3 (120)	200,000	0.78	-	-	-	356,000
D4 (210)	156,000	0.84	0.59	-	-	456,394
D5 (210)	95,000	0.87	0.68	-	-	301,644
D6 (210)	200,000	0.89	0.65	-	-	623,700
D7 (220)	179,500	0.80	0.68	-	-	542,808
D8 (230)	400,000	0.78	0.69	-	-	1,203,280
D9 (380)	250,000	0.79	0.68	0.53	-	1,150,254
E1 (30)	268,000	-	-	-	-	268,000
E2 (60)	45,000	-	-	-	-	45,000
E3 (100)	200,000	0.83	-	-	-	366,000
E4 (140)	156,000	0.89	-	-	-	301,080
E5 (160)	195,000	0.88	-	-	-	366,600
E6 (170)	350,000	0.84	-	-	-	644,000
E7 (200)	420,000	0.82	-	-	-	764,400
E8 (290)	305,000	0.89	0.65	-	-	951,143
E9 (330)	250,000	0.90	0.69	0.49	-	1,196,098
E10 (460)	385,000	0.88	0.685	0.48	0.38	2,490,098
<b>Mean</b>	<b>-</b>	<b>0.6987</b>	<b>0.6544</b>	<b>0.3988</b>	<b>0.348</b>	

The Correlation Co-efficient ( $r$ ) = 0.79028;

Coefficient of Determination ( $r^2$ ) = 0.62455

The correlation coefficient value (0.79028) shows a strong uphill (positive) linear relationship though not perfectly positive. This means that the model strongly and positively predicts future outcome. The Coefficient of Determination  $r^2$  value (0.62455) indicating a 62.5% in the variation of the outcome has been explained just by predicting the outcome using the covariates included in the model.

### **Summary, Conclusion and Recommendations**

We have been able thus far to establish that value increases with age especially for cultural properties of a people. This is because the value is not of exchange but intrinsic and buried within the philosophy and world view of the people owning the cultural property. Our investigation also revealed that the application of the variability method which nonetheless captures all the parameters and ingredients of value is the preferred first step in the valuation process which will thereafter incorporate appropriate differentials and the age increases. It was eventually observed that there will reach a point when the value of the property will no longer increase with age at which time the value will be static or eventually begin a diminish. Our study further revealed the anomalous nature of values of cultural objects as they increase with age being neither uniform nor steady.

The study concluded that radiocarbon dating is applicable to the valuation of properties especially cultural objects. It seems to be the only method that will exhume and reflect the importance of age and time in the determination of intrinsic values of a people. Curators and preservation experts submit that the method is most important in the valuation of objects classified as antiquity.

### **Recommendations**

- a) It is very unfortunate that Igbo people have neglected the things that hold them together as a people of one stock and identity. It is a wise saying that “he who fails to recognize where he began will neither know where he is nor where he is headed”. The flagrant abuse of Christianity and Christian faith in disregard of the ethos and basics of the religion is reprehensible and should be discarded. The incessant destruction of our relics and cultural properties for the erroneous sake of civilization and salvation must be seen as dangerous, reprehensible and condemnable; and must be checked.
- b) Valuation is an art as well as science. It is neither philosophy nor astrology. The factors and forces affecting value must be thoroughly examined before arriving at a value that could represent in its entirety, the worth of the asset / property; not merely financial but spiritual and cultural as well.
- c) The curriculum of Estate Management in our tertiary institutions did not make adequate provision for the teaching and learning of the valuation of cultural properties. It is suggested that this be critically examined with a view to ameliorating the situation.
- d) The proliferation of non Estate Surveyors & Valuers in the practice of Estate Surveying and valuation has always been attributed to laxity in regulatory



framework. Notwithstanding however true this may be, it is recommended that the institution and implementation of learning standards through the College of Estate Management will go a long way in expanding the frontiers of the practice of the profession.

- e) The establishment of radiocarbon laboratories is important in the application of the method to the valuation of properties. Unfortunately, it is only at University of Witwatersrand, Johannesburg in South Africa that an Accelerator Mass Spectrometry (AMS) laboratory was established in 2014. Even at that, most samples are better analyzed in Europe and Asia than at South Africa obviously owing to certain hiccups in accessing the services. Nigeria is more than qualified to host an AMS laboratory. It is such a pity that our universities teaching archaeology and tourism spend so much time and resources in analyzing their samples overseas.

## References

- Acholonu, C. O. (2005). *The gram code of the African Adam*. Abuja: CARC Publishers..
- Acholonu, C. O. (2009). *They lived before Adam: Prehistoric origins of the igbo the never-been-ruled*. Abuja: CARC Publishers..
- Acholonu, C. O. (2010). *The lost testament of the ancestors of Adam: Unearthing Heliopolis/Igbo Ukwu - The Celestial cities of the Gods of Egypt and India*. Abuja: CARC Publishers.
- Afigbo, A. E. (1981). *Ropes of sand*, Ibadan: Caxton Press,
- Afigbo, A. E.. (1975) Prolegomena to the study of the culture history of the Igbo-Speaking Peoples of Nigeria', *Igbo Language and Culture*. Oxford University Press. London.
- AHD Inc. (2015). *Affordable housing development*. Bethesda Metro Center Publications. Bethesda, MD
- AIREA (1973). *The appraisal of real estate*, American Institute of Real Estate Appraisers. Chicago.
- Ajayi, C. A. (1997). Towards a new direction for property valuation practice in Nigeria, *The Estate Surveyor & Valuer*, 20, (10), 20 - 27.
- Ajayi, C. A. (2006). Towards a new direction in property valuation paradigm. *Covenant University Ota Ogun State Nigeria*. Ota: Covenant University Ota Ogun State Nigeria.
- Akerson. (1978). *Valuation of hotels and motels*. American institute of real estate appraisers. Chicago.

- American Chemical Society. (2016). *Chemists and chemistry that transformed our lives*. National Historic Chemical Landmarks Program. Washington, D.C.
- American Chemical Society. (2016). Discovery of radiocarbon Dating: *National historic chemical landmarks*. (accessed October 31, 2017). <https://www.radiocarbon.com/about-carbon-dating.htm>
- Anapur E. (2017). *History of wood carving in art*. <https://www.widewalls.ch/wood-carving-wooden-sculpture-art/> retrieved 15.04.2019
- Archer, D. (2010). *The global carbon cycle*. Princeton University Press. Princeton.
- Asimeng-Boaheme, L.; Baffoe M. (2018). African traditional oral literature and visual cultures as pedagogical tools in diverse classroom context. Information Age Publishing Inc. Charlotte N.C. [www.infoagepub.com](http://www.infoagepub.com)
- Babcock, H. A. (..) *Appraisal principles and procedures*. Irvin
- Baum A, Cosby, N. (1995). *Property investment appraisal*. International Thomson Business Press. Toronto.
- Baum, A. | & Mackmin, D. (1983). *The income approach to property valuation*. Routledge and Kegan Paul. London.
- Baum, A. E. (1992). The initial yield revealed.: Explicit valuations and the future investments. *Journal of Property Valuation and Investments*, 10, 709-726.
- Bonbright, J. C. (1937). *The valuation of property*. Mcgraw-Hill Education Company. New York.
- Brandeis, J. S. C. (2018). *Southwestern bell telephone Co. Vs. Public Service Commission of Missouri*. Thomson Reuters. New York.
- Corcoron, S. & Moreland, H. (1998). Categorization and representation of physics problems by experts and novices. *Cognitive Science*, 5, (2), 121-152
- Dada, F; Jibrin, M. & Ijeomah, A. (2006). *Secondary atlas*. Macmillan Nigeria Publishers Ltd. Ibadan.
- Diaz, J. (2002). Behavioural research in appraisal and some perspectives on implications for practice. RICS Foundation Research, [www.rics.foundation.org](http://www.rics.foundation.org)
- Diaz, J., Hansz, A., Cypher, M. & | Hayunga, D. (2008). Conservation status and residential Transaction Prices: Initial Evidence from Dallas, Texas. *Journal of Real Estate Research*, 30 (2), 225-248. American Real Estate Society. Clemson.

- Ellis, A. (2003). Valuing culture', paper presented at the Valuing Culture event held at the National Theatre Studio on 17th June 2003, organized by Demos in partnership with the National Gallery, the National Theatre and AeA Consulting, Retrieved 25th July, 2018. <http://www.demos.co.uk/files/File/VACUAEllis.pdf>
- ENCYCLOPEDIA OF SCULPTURE © visual-arts-cork.com. All rights reserved. <http://www.visual-arts-cork.com/sculpture/wood-carving.htm>
- Eucken, W. (1992). Foundations of economics: History and theory in the analysis of economic Reality. Springer-Verlag Berlin Heidelberg.
- European AVM Aliance. (2017). *Standards for statistical valuation methods for residential properties in Europe*. European AVM Aliance. London.
- Eva Casado de Amezua (2016). *Dictionary of digital humanities*. Medium corporation. New York.
- Frazer, G. J. (1926). *Worship of nature*. Macmillan Publishers. London
- Harsluck, P. M. (1984). *Manual of traditional wood carving*. <http://store.doverpublications.com/0486234894.html>
- Harsluck, P. M. (1990). *History of wood carving*. [https://en.m.wikipedia.org/wiki/History\\_of\\_wood\\_carving](https://en.m.wikipedia.org/wiki/History_of_wood_carving)
- Hartle, D. (1967). *Archaeology in eastern Nigeria*, Lagos: Nigeria Magazine..
- Hartle, D. (1972). *Antiquities in Igbo land in Africa notes, special bulletin of the Institute of African studies*, Ibadan: University of Ibadan.
- Hewison, R. & Holden, J. (2006). *Public value as a framework for analyzing the value of heritage'* in Clark, K. (ed.) (2006) *Capturing the Public Value of Heritage: The Proceedings of the London Conference 25-26 January 2006* London: English Heritage pp14-19
- Ifediora, G. S. A. (2009). *Appraisal framework*. Institute for development studies, University of Nigeria. Enugu.
- International Union for Conservation of Nature. (2017). *Valuing nature's water infrastructure*. World Forum on Natural Capital. Edinburgh.
- Isichei, E. (1976). *A History of the Igbo people*, London: Macmillan Publishers.
- Jacobs, J. (1996). *Subject matter of valuation*, London Estates Gazettes Limited.

- Kluchkohn, C. (1963). *Mirror for man*, Greenwich: Fawcett Publications.
- Litchfield, N. (1969). *Economics of planned development*, London: Estates Gazettes Limited.
- Linton, R. (1964). *The study of man*. New York: D. Appleton-Century Co.
- Mackmin, D. (1995). *Income approach to property valuation*. New York: Taylor & Francis Amazon books.
- Mackmin, D. (2008). *Valuation and sales of residential property*. London: Amazon Books
- Martha de la Torre. (2002). *Assessing the value of cultural heritage*. London: Getty Conservation Institute. Los Angeles.
- Martyn S. (2009). *Construct validity*. Retrieved Jul 19, 2018 from Explorable.com: <https://explorable.com/construct-validity>
- Menger, C. (2007). *Principles of economics*. Create Space Independent Publishing Platform. North Charleston.
- Merryman, J. H. (1989). *The public interest in cultural property*, 77 *Cal. L. Rev.* 339 Available at: <http://scholarship.law.berkeley.edu/caifornialawreview/vol77/iss2/3>. Retrieved 21st July, 2018.
- Monanu, P.C. (1975a). *Temperature and sunshine*. in Nigeria in maps: Eastern States.
- Ofomata, G.E.K. (ed.). *Benin: Ethiope Publishing House*, Benin City, Pp. 16-18.
- National Association of Independent Fee Appraisers (1978). *Residential real estate appraisers*.
- National Oceanic and Atmospheric Administration. (2018). *Climate education research: Carbon cycle*. US department of commerce. Washington D. C.
- National Population Commission. (2018). <https://www.google.com/search?q=national+population+commisonession+data+on+geopolitical+z&ie=utf-8&oe=utf-8&client=firefox-b-ab>. Retrieved 1<sup>st</sup> August, 2018.
- Navrud, S. & Ready, R. C. (2002). *Valuing cultural heritage*. London: Edward Elgar publishing limited..
- O'Brien, D. (2010). *Measuring the value of culture: A report to the Department for Culture Media and Sport*. Art and Humanities Research Council. Swindon.

- Ofomata, G.E.K (2002), *Relief, drainage and landforms, In A Survey of Igbo Nation Ofomata, G.E.K. (ed.)*. Onitsha: Africana Publishers Ltd. Pp. 83-98.
- Okoh, V. P. (2008). *Real estate investment appraisal*. Lagos: Victor Okoh & Co.
- Okoronkwo, D. F. C. (2010). *The Aro people of Arondizuogu*, Janefred Publishers Inc. Owerri.
- Okoronkwo, D. F. C. (2014). Evolving a methodology for the valuation of artworks. *International Policy Brief Series-Education and Science Journal* 4, (1).
- Okoronkwo D. F. C. (2016). Examining the past for the future: a study of nsibidi writings. Janefred Publishers Inc. Owerri.
- Okoronkwo, D. F. C. & Egolum, C. C. (2016). Exploring value to the owner concept in the valuation of artefacts, sacred objects and grounds. *Journal of Real Estate Economics*. 1 (7). Centre for real Estate Economics. Owerri.
- Onokala, P. C. & Phil-Eze, P.O. (2001). *Environmental problems of rural transport development in Nigeria*, In Geographical Perspectives on Environmental Problems and Management in Nigeria. Ofomata, G.E.K and PhilEze, P.O. (eds.). Enugu: Jamoe Enterprises Nigeria.
- Onwuejiogwu, M. A. (1970). *The typology of settlement in the Igbo culture area" in African notes, Institute of African Studies, University of Ibadan*. Ibadan.
- Parrinder, E. G. (1976). *African traditional religion*. Sheldon Press. London.
- Procter, P. (1978). *Longman dictionary of contemporary English*. London.
- Preston, B. (1974). *Education in real estate appraisal*. American Appraisers Association. Milwaukee.
- Rescher, N. (1969). *Introduction to value theory*. Prentice – Hall, Englewood Cliffs, N.J.
- Riebeek, H. (2011). Carbon cycle. National Aeronautics and Space Administration Earth Observatory. Washington, D. C.
- Rossi C. (2017). *Culture: Engine of civilization*. Barnet & Southgate College Press. London.
- Salau, T. U. (2012). *Basics of Property Valuation*. Liberty Graphiclink Nigeria. Bauchi
- Sandra P. (1996). *Economics of W. S. Jevons*. Routleg. London

- Selinger, H. W., & Shohamy, E. (2007). *Second Language Research Methods*. Oxford: Oxford University Press.
- Selwood, S., Hall, R., Hutchison, R., Macnaught, B., O'Neill, M., Pinnock, A., Steele, D. & Tait, S. (2005). John Holden's Capturing Cultural Value: How culture has become a tool of Government policy' *Cultural Trends* 14 (1) 113-128
- Seyed A. H. & Kenneth R. J. (2016). *A neural network approach to efficient valuation of large portfolios of variable annuities*. Elsevier B. V. Amsterdam.
- Shaw, T. (1977). *Unearthing Igboukwu. Archaeological discoveries in eastern Nigeria*. Oxford University Press. Ibadan.
- Shaw, T. (1970) *Igbo Ukwu: An Account of Archaeological Discoveries in Eastern Nigeria*. Faber and Faber. London.
- Slattery, K. (2005). *The Igbo people - Origins & history*. Queen's University Press. Belfast. <http://www.faculty.ucr.edu/~legneref/igbo/igbo1.htm> Retrieved 16th July, 2018.
- Smith D. & Fittman G. (1989). *Essentials of investing*. Richard & Darwin Inc. Chicago.
- Spiegel M. & Stephen, L. (2006). *Schaum's outlines of Statistics*. McGraw-Hill Companies. London.
- Steele, W. (1974). *National instructions on real estate appraisal*. American Appraisers Associates, Inc. Evansville.
- Trochim, W. M. (2006). *Research methods knowledge base*. Science and Education Publishing, SAGE Publications Inc. New Jersey.
- Trompenaars, F., Hampden-Turner, C. (1997). *Riding the waves of culture*. Edward Elgar publishing limited. London.
- Uchendu, V. C. (1987). *Extended family in Igbo civilization*. Ministry of Information and Social Development. Owerri.
- Washa A. J. (1974). *Residential real estate appraisal*. National Association of Independent Fee Appraisers, Inc. Missouri.
- Williamson K. (1988). In Alagoa, E. B.; Anozie, F. N.; Nzewunwa, N. (eds.), *The Early History of the Niger Delta*. London: Macmillam Publishers.