

## Influence of Agricultural Activities on Housing and Settlement Patterns of Rural Communities in Benue State Nigeria

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### Abstract

Physical, social, and economic elements, such as agricultural occupation, impact the forms of house and settlement patterns such as shape, space enclosure, appearance, and organization. This research aims to investigate the impact of agricultural activities on the housing and settlement patterns of the Benue people of central Nigeria. The exploratory sequential research approach was utilized where qualitative and quantitative attributes and consequences were elicited based on the Means-End Chain mode. The study was done in stages between June 2020 and March 2022, with 24 individuals first interviewed and 474 nominal survey questionnaires completed and returned. Preliminary data checks for the subsequent 241 ordinal surveys returned to reveal a significant Bartlett's Test of Sphericity, a Kaiser-Meyer-Olkin value of 0.872, and a Cronbach's alpha of 0.934. While the interviews and nominal surveys provide considerable correlations between agricultural activities and the people's settlement patterns, statistical validations of the ordinal survey yield minute evidence of the associations. The conclusions of this study are consistent with prior studies, which connect agricultural activities to people's house form and settlement patterns. It is recommended that authorities make transformative efforts to nucleate the fragmented communities to free up more area for mechanized farming, combat insecurity, and reduce competition for territorial resources.

**Keywords:** Agricultural occupation; Benue state Nigeria; House form; Means-end chain; Settlement pattern.

## 1. Introduction

A variety of physical, social, cultural, and economic elements, including agricultural activities, influence the components of home shape and built environments across time [1, 2]. The notion of house form as the plan shape, as opposed to its style or elevation, has been broadened to encompass additional features of the built environment, such as space sizes, space utilization, spatial planning, layout, and overall compound organization [3-5].

Although the home form variables may appear to differ according to people's history, culture, agricultural vocations, and living situations, among other considerations, the human freedom of choice tends to favor socio-cultural freedom in house form impacts [1, 6, 7].

Though in the book "House Form and Culture," Rapoport [8] investigated the determinants of house form, the conclusion that socio-cultural elements primarily influence housing and settlements has been called into reservation by scholars through time. Because social and cultural influences include a wide range of variables such as family size, livelihoods, norms, values, and religion, this study aimed to explore the impact of agricultural occupations on the housing and building environments of the Benue people in central Nigeria.

In their study, Osuji [9] establish a positive correlation between household size and agricultural productivity, indicating an innate association between the two variables. In some villages in Bangladesh, Rahman and Amit [10] discovered that female farmers who received training in maize production could build homes, increase their income, and raise their living level, lifting their families out of poverty. This practice implies that the houses built from proceeds of agricultural productivity will reflect their occupations like provision for storage of farm produce and implements.

Similarly, the Benue people of central Nigeria have established their own built environments based on particular socio-cultural values, agricultural techniques, climate, and locally accessible building materials [11, 12]. Furthermore, Isah and Khan [13] observe that the curved home shapes of the Benue people's indigenous building styles share comparable characteristics, with few apparent differences in their housing patterns, particularly in compound settings and construction methods. Because the population is primarily farmers, one might investigate the relationship between the home form and occupation.

Therefore, the premise that socio-economic occupations impact indigenous settlements and livelihoods [14, 15] requires further investigation and domestication, particularly in emerging societies such as Benue state Nigeria.

Thus, this study investigates the impact of agricultural practices on the development of housing and settlement patterns of Benue people in central Nigeria. Using the Means-End Chain (MEC) research model of eliciting attributes, consequences, and values, an exploratory sequential mixed method research strategy was employed for this study. The qualitative interviews provided a foundation for the subsequent quantitative surveys in this exploratory sequential research.

The robust data from the exploratory sequential research combine to form more reliable and valid information for replication and conclusions.

## 2. Materials and Methods

This study used the exploratory sequential strategy for data gathering and analysis, with information acquired through interviews and nominal and ordinal surveys. However, the data collection was based on the MEC model, in which tangible qualities in the built environment were identified, and their associated effects were discussed. The research purpose was to determine the degree of agriculture as the primary activity of the people, among other things, impact the construction of housing and built environments of the people of Benue State in central Nigeria. The data was collected at various points between June 2020 and March 2022 to identify the fundamental themes, rank them, and statistically assess the relationship between agriculture as the primary socio-economic profession of the people and the construction of their built environment.

For the first step of laddering, 24 individuals were interviewed, and a wide range of themes was elicited. Laddering entails around 30 minutes of the conversation focused on the "why" specific elements of a product, in this case, the built environment, are essential to the people [16-18]. According to previous research, a minimum sample size of 20 interviews is necessary for an efficient MEC investigation [19, 20].

In this study, as shown in Table 1, respondents were drawn from three local government areas (LGAs) in Benue State, Makurdi, Ukum, and Vandeikya, using non-probability sampling. The interviewees were community leaders, local builders, and indigenous homeowners chosen for their knowledge, experience, and proficiency in traditional agricultural techniques and housing procedures.

**Table-1.** Demographic distribution for interview, nominal and ordinal Respondents

Variable		MEC Interview		Nominal Survey		Ordinal Survey	
Item	Category	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Gender	Female	3	12.5	349	26.4	42	17.4
	Male	21	87.5	125	73.6	199	82.6
Age	Below 30	1	4.2	4	0.8	45	18.7
	30 – 39	2	8.3	163	34.4	86	35.7
	40-49	12	54.2	263	55.5	72	29.9
	50 Above	9	37.5	44	9.3	38	15.8
State of Origin	Benue	24	100	451	95.1	235	97.5
	Non-Benue	0	0	23	4.9	6	2.5
House status	Owner	13	54.2	205	43.2	78	32.4
	Rented	4	16.7	152	32.0	114	47.3
	Builder	4	16.7	54	11.3	14	5.8
	Female	3	12.5	37	7.9	8	3.3
	Other	0	0	26	5.6	27	11.2
Occupation / Employment	Government	2	8.3	62	13.1	43	17.8
	Private	6	25.0	164	34.5	106	44.0
	Business	4	16.7	69	14.6	30	12.4
	Farming	12	45.8	146	30.7	28	11.6
	Other	0	0	34	14.1	34	14.1
Highest Education Level	Primary	8	33.3	79	16.6	0	0.0
	Secondary	9	37.5	120	25.4	32	13.3
	Graduate	6	25.0	176	37.2	119	49.4
	Post-graduate	1	4.2	85	17.9	76	31.5
	Other	0	0	14	2.9	14	5.8
Total Respondents		24	100	474	100	241	100

For the second phase of the nominal survey, 474 questionnaires were filled out and sent back from the three LGAs, which is more than the 384 minimum sample recommended by Krejcie and Morgan [21] for a population of more than 75,000 people.

Each of the three LGAs was sampled using the Area Clusters Probability sampling method. The nominal survey was a paper-based physical inquiry conducted with the assistance of research assistants and agents native to the studied locations. The goal of the second part of the nominal survey was to rank the perceptions of the respondents based on some descriptive information.

The final stage, on the other hand, involves an ordinal survey based on a 5-point Likert scale, with "1" representing highly disagreement and "5" standing for highly agreement. For this phase, 241 responses were received from the online survey conducted through Google. The "required" restriction was activated for all sections of the online survey to check incidences of missing data. For a study area where about 50% of the people do not have access to the internet, the sample was deemed sufficient for statistical analysis.

### 3. Results

The results were presented and discussed based on the exploratory sequence of interviews and nominal and ordinal surveys, respectively.

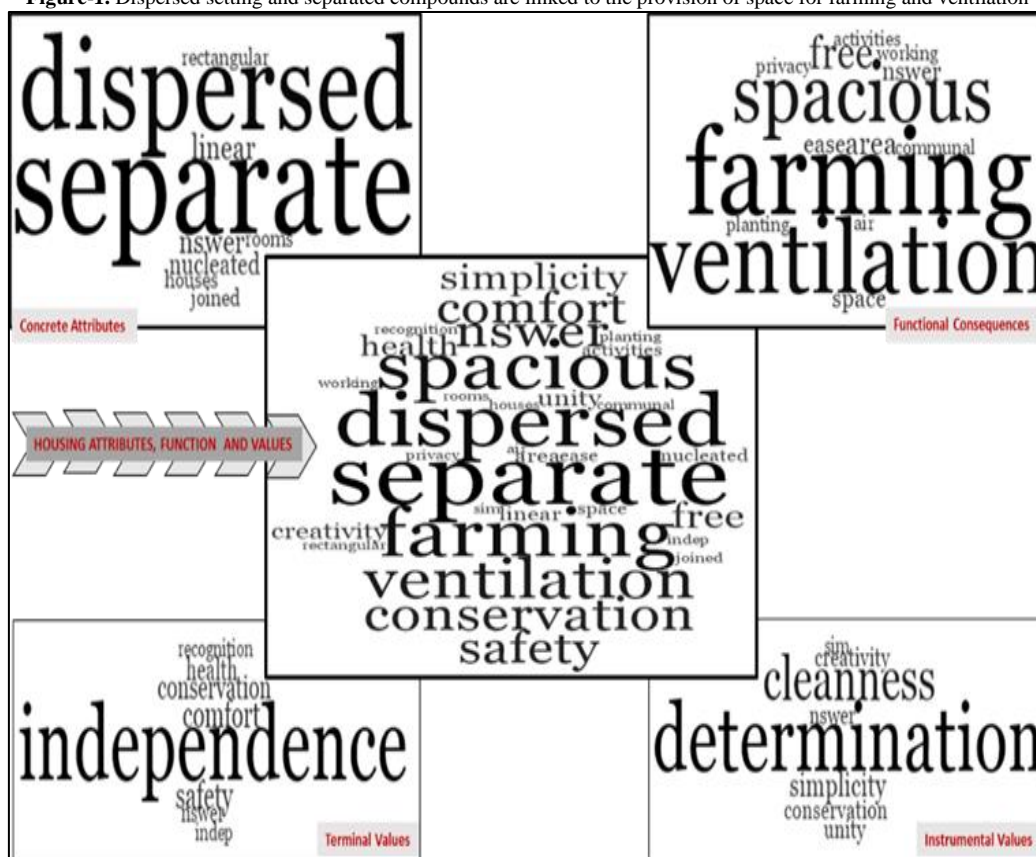
#### 3.1. Results of Laddering Interviews

The laddering interviews were conducted between June and September of 2020 to investigate how agriculture, being the primary socio-economic occupation of the Benue people, influences the house forms, materials, and settlement patterns of their dwellings.

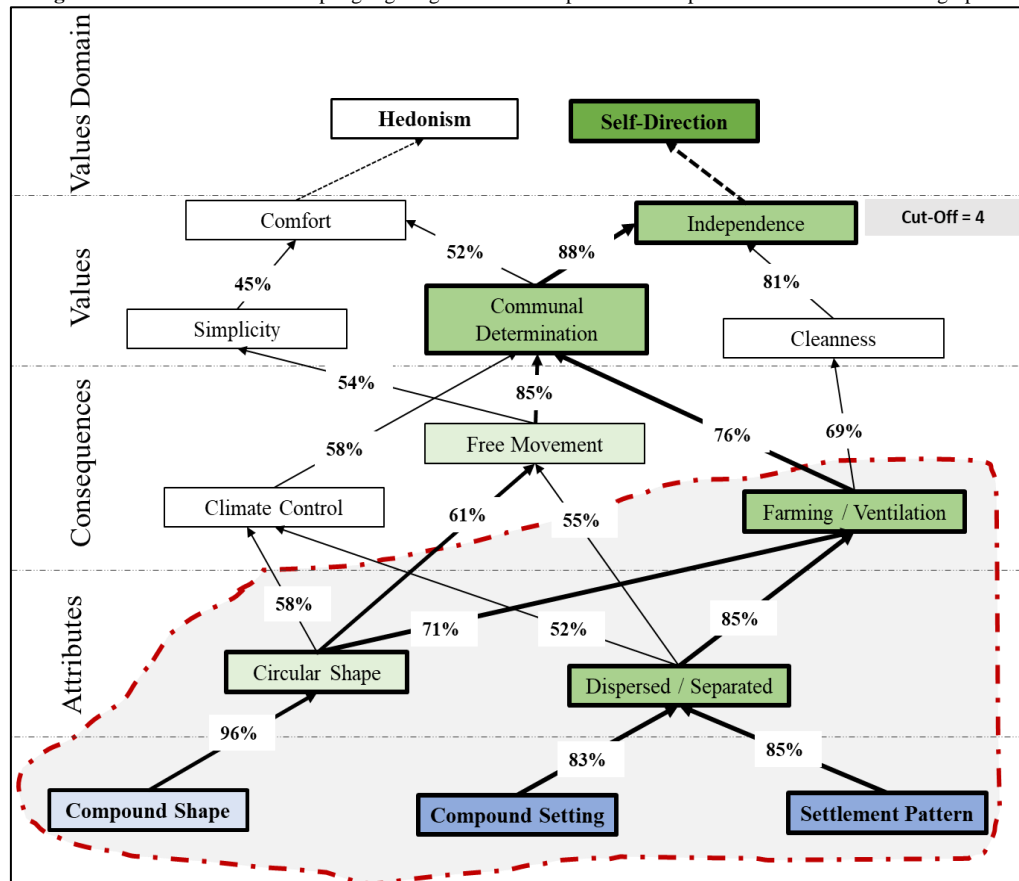
From the visible concrete features to the intangible meanings and uses [16-18], different parts of people's built environments were connected to their respective consequences and values.

The gathered data was coded into hierarchical nodes using the NVivo 12 computer software, and the content was created using word clouds. The word cloud, as shown in Figure 1, was used in place of bars and charts because it conveys broader themes evoked by the 24 interview participants. According to the Content Analysis, the dispersed setting and separated pattern of the people's constructed environment provides adequate space for farming operations, coincidentally ensuring profuse ventilation in their natural setting. The consequential utilities were further connected to the people's collective determination and desires to live independent lives in their compounds.

**Figure-1.** Dispersed setting and separated compounds are linked to the provision of space for farming and ventilation



In addition, as shown in Figure 2, a visual depiction of the linkages was created using a Hierarchical Value Map (HVM) approach, demonstrating the link between the people's dispersed settlements and their agricultural preoccupation.

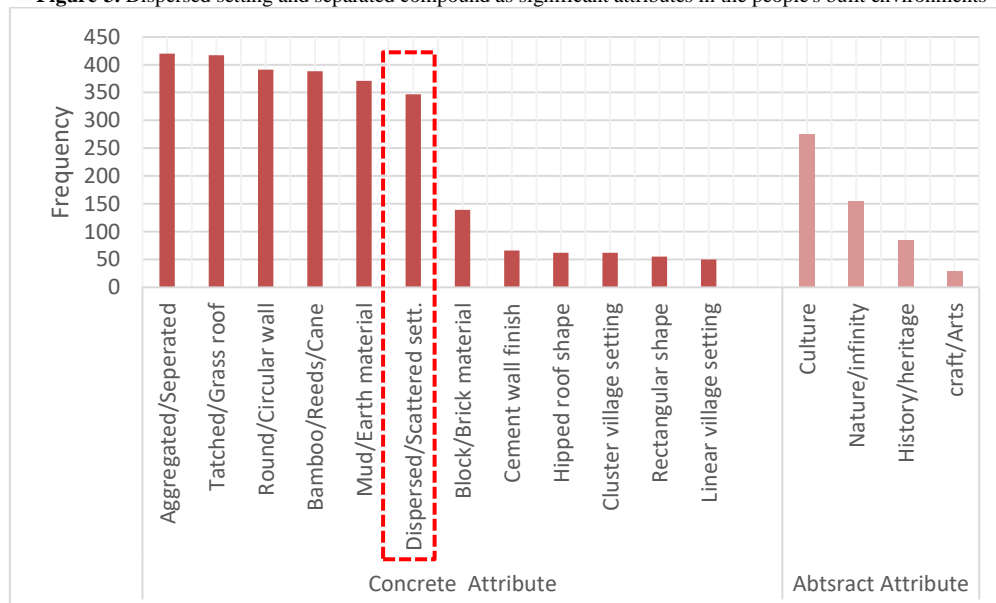
**Figure-2.** Hierarchical Value Map highlighting the relationship between Dispersed Attributes and Farming Space

The replies were also categorized using the MEC Attributes, Consequences, and Values hierarchy. Links are generally represented in the HVM by arrows of various sizes, with thicker lines signifying stronger relationships [22]. Alongside the directional arrows are the average frequency of mentions by interview participants, shown as a percentage of connections inside a node.

Components are regarded valid with up to four direct linkages with 24 individuals, above the required minimum of 20 [19, 23] implying 20% frequency in more extensive sampled studies. As a result, relationships with less than four interconnections are not deemed strong enough to be mapped. Connections with four to nine links are moderate, but those with ten or more are extremely strong.

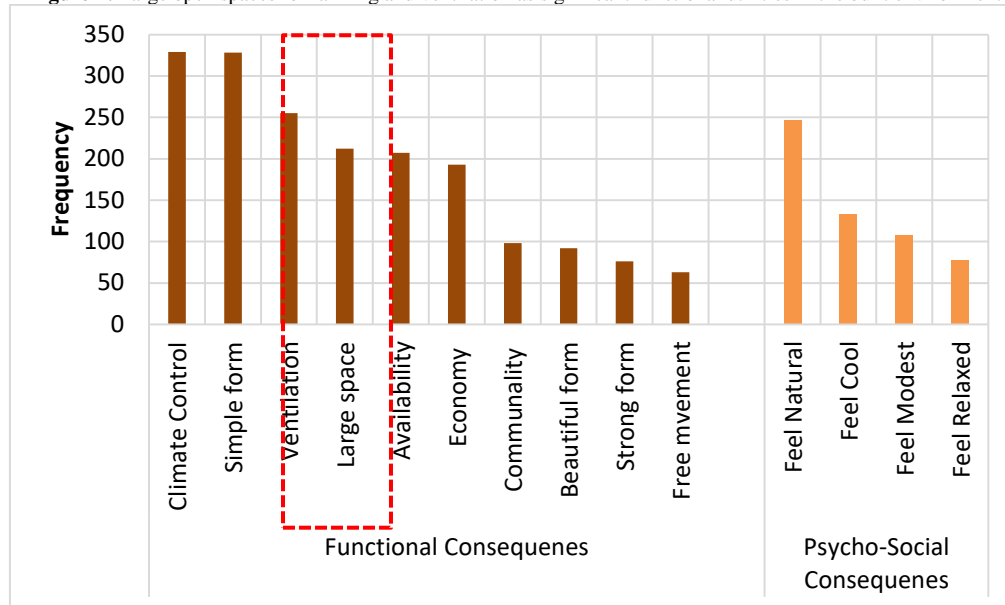
### 3.2. Results of Nominal-Scale Survey

The second data collecting sequence comprises a nominal-scale hard laddering carried out by physical contact in Benue State, Nigeria, between October 2020 and January 2021. According to the findings of the nominal survey, separated compounds and dispersed settlements are among the top tangible features, as shown in Figure 3.

**Figure-3.** Dispersed setting and separated compound as significant attributes in the people's built environments

On the other hand, the significant functional consequences for the nominal survey also include open space for ventilation, ample space for farming, climate control, simple forms, availability, and topping the ranking, as shown in Figure 4. The psycho-social consequences were topped by the natural, calm, modest, and relaxed psychological feeling. Some negative consequences were also identified, ranging from insecurity, porosity, weak materials, and complex materials; these are not directly related to this study.

**Figure-4.** Large open spaces for farming and ventilation as significant functional utilities in the built environment



As highlighted in Table 2, some of the physical attributes with significant frequencies are those of detached houses in the compounds and the dispersed settlement pattern of the communities. These are seen to have a direct relationship with the socio-economic occupation of the people.

**Table-2.** Significant attributes and consequences of Nominal survey

ATTRIBUTE				
S/N	Concrete Attribute		Functional Consequences	
i	Separated houses	420	Climate Control	329
ii	Thatched/Grass roof	417	Simple form	328
iii	Round/Circular wall	391	Ventilation	255
iv	Bamboo/Reeds/Cane	388	Large space	212
v	Mud/Earth material	371	Availability	207
vi	Dispersed/Scattered set	347	Economy	193
Vii	Block/Brick material	139	Community/togetherness	98

### 3.3. Results of Ordinal-Scale Survey

The third round of data collecting entails a cross-sectional ordinal-scale survey conducted between January and March 2022 utilizing online Google forms. Following recommendations by Pahlevan Sharif and Sharif Nia [24], some preliminary tests were carried out using SPSS to determine the data consistency and reliability. Initially, an Exploratory Factor analysis was undertaken, revealing appropriate cross-loading and communalities, with most variables having regression weights more significant than 0.5.

In addition, the Principal Component Analysis (PCA) was performed on data with good Kaiser-Meyer-Olkin (KMO) values of 0.872 and a substantial Bartlett's Test of Sphericity value of 0.000. Finally, with a reliable Cronbach's alpha measure of 0.934, as presented in Table 3, the data set was suitable and acceptable for Confirmatory Factor Analysis (CFA) [25].

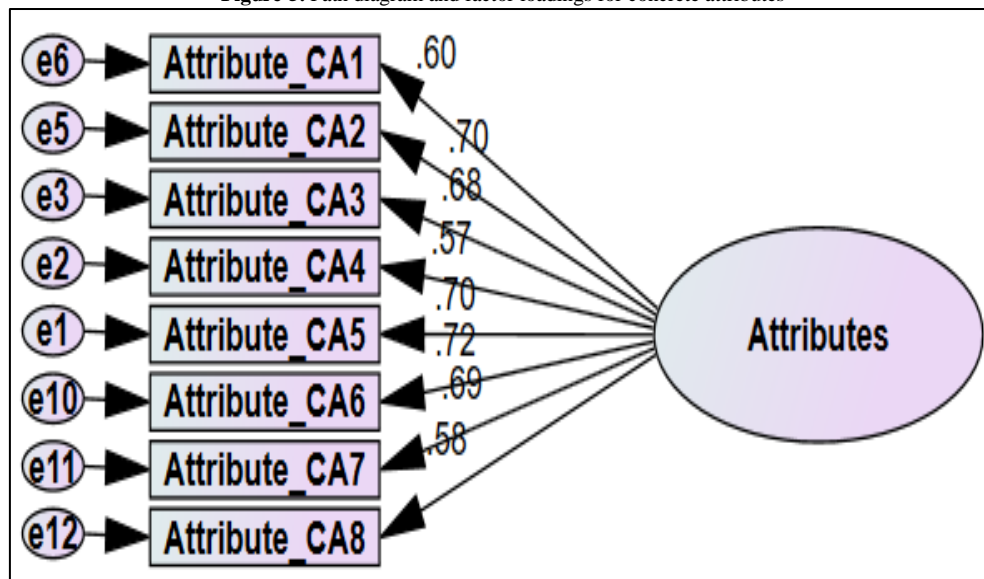
**Table-3.** Acceptable KMO, Bartlett's Test of Sphericity, and Cronbach's alpha

KMO and Bartlett's Test		Reliability Statistics
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.872	
Bartlett's Test of Sphericity	Approx. Chi-Square 6438.240	Cronbach's Alpha N of Items
	df 1225	.934 50
	Sig. .000	



The CFA was performed using the Analysis of Moment Structures (AMOS) software version 22. The components for tangible qualities were loaded into the path diagram, and the corresponding standardized regression weights were generated, as presented in Figure 5.

Figure-5. Path diagram and factor loadings for concrete attributes



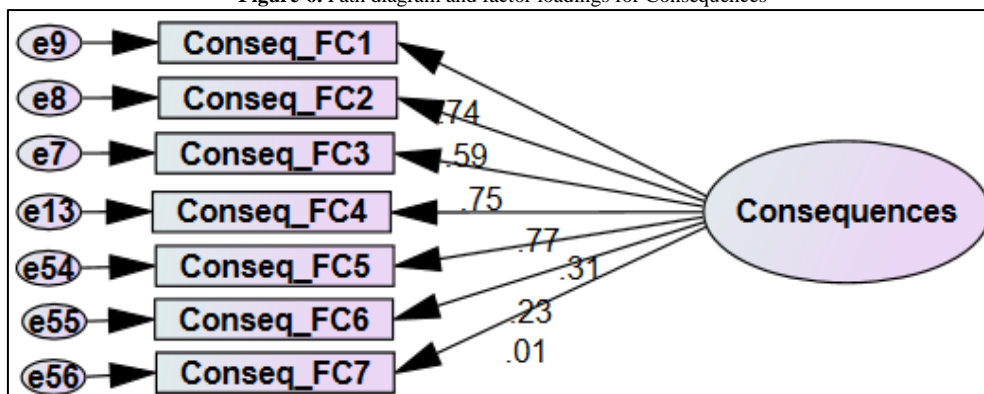
The standardized regression weights indicate that separated aggregated compounds and dispersed or scattered settlements have higher loadings than 0.5 minimum values, as presented in Table 4. These two attributes in the built environment are seen to have a direct relationship with the agriculture occupation of the people.

Table-4. High Regression Values for attributes of separated compounds and dispersed

Construct	Code	Variable	SRW ( $\lambda$ )
Concrete Attributes	CA6	Aggregated or separated houses	0.72
	CA2	Earth mud materials	0.70
	CA3	Use of sun-dried adobe bricks	0.68
	CA7	Central Ate for sitting and meeting	0.69
	CA5	Use of roofs thatch and grass	0.70
	CA1	Round or circular house shapes	0.60
	AC8	Dispersed or scattered settlements	0.58
	CA4	Bamboo, reeds, and canes materials	0.57

Furthermore, factors for the functional consequences were also loaded, as presented in Figure 6. The respondents' perception from the survey indicates that the standardized regression weights that the large open spaces in the built environments of the Benue people for farming and ventilation produced nominal values compared to other utilities.

Figure-6. Path diagram and factor loadings for Consequences



Though the utility of open spaces for farming and ventilation produced the least loadings below the 0.5 level of significance, as shown in Table 5, they are passively seen to combine with other social and economic utility consequences to influence the built environments of the people.

**Table-5.** Functional utilities for open space for farming and ventilation below significant weights

Construct	Code	Variable	SRW ( $\lambda$ )
Functional Consequences	FC1	Insulation from heat and rainfall	0.74
	FC4	Cheap and economical to construct	0.77
	FC3	Simple and easier to construct	0.75
	FC2	Free movement of people	0.59
	FC5	unity and togetherness	0.31
	<b>FC6</b>	<b>Open space for ventilation space</b>	<b>0.23</b>
	<b>FC7</b>	<b>Open farming space</b>	<b>0.01</b>

Further statistical analysis indicates that consequences, including the utility of open space for farming and ventilation, have a positive and significant relationship with the attributes of separated compounds and dispersed settlement patterns. The unstandardized regression weights, as presented in Table 6, indicate a high P-value significant at 95 and 99 percent confidence levels.

**Table-6.** Significant Correlation between Attributes and Consequences

			Estimate	S.E.	C.R.	P	Label
Consequences	<---	Attributes	.537	.134	4.009	***	
Values	<---	Attributes	.209	.085	2.458	.014	
Values	<---	Consequences	.626	.086	7.276	*** significant at 99% confidence level	
Preferences	<---	Attributes	.600	.144	4.153	***	
Preferences	<---	Consequences	-.891	.244	-3.651	***	
Preferences	<---	Values	1.054	.329	3.208	.001	

## 4. Discussions

The exploratory sequential study, at various phases, tried to link the separated house forms and dispersed built environments of the Benue people as being influenced positively by their agricultural occupations. From the content analysis of the first phase of laddering interviews, participants elicited the dispersed settings and separated compound shapes to be connected to the agricultural occupation of the people. While the dispersed settlement pattern and separated compounds featured prominently in the word cloud of Figure, the utility consequences of agriculture and ventilation were linked with the attributes. The 24 interview participants at this stage were purposively selected from local chiefs, indigenous builders, compound heads, and women leaders with knowledge and experience in traditions, meanings, and values; their responses were valid and significant.

The second phase nominal survey also produced significant results, linking the separated compounds and dispersed settlements to the quest for ample space for farming activities and copious air circulation. The table shows high-frequency values for the physical attributes of separated compounds and dispersed settlements among the Benue people. The agricultural utility and ventilations garner more than the 20 percent frequencies for valid variables. The 474 responses returned in this nominal survey, with a blend of young persons and the elderly, both male and female in the study area, was meant to generalize the finding of the first phase interviews and rank the variables using a more comprehensive sample frame. Therefore, this phase also gives significant results, linking the people's dispersed settings and separated compounds to their agricultural preoccupation.

The final phase of the ordinal survey on one part produced significant values for the concrete attributes of separated compounds and dispersed settlement patterns of the Benue people. It, however, yields insignificant weights for the utility of farming space and ventilation. Since the ordinal survey was conducted online, most respondents could likely be young persons and city dwellers who might not have the requisite knowledge of indigenous meanings and values. Another reason could be the difficulty in perpetrating agricultural utilities from the other consequences, thereby selecting the most visible ones. Since some traces of agriculture are embedded in the other utilities, it was convenient to test the general relationship between attributes and consequences. Subsequently, the attributes included separated compounds and dispersed settings, while consequences encompass ample spaces for agriculture utilities and ventilation. With this arrangement, attributes have a positive and significant relationship with consequences. Therefore, the dispersed settlement pattern and the separated compounds are influenced by the agricultural occupation of the Benue people.

Previous research indicates that farming is the primary profession of the Benue people, and the immense output from this occupation is responsible for the state's designation as the "food basket" of Nigeria [26-28]. In particular, most of the people are farmers whose main crops are yams (*Dioscorea* spp.), bulrush millet (*Pennisetum* sp.), and guinea corn (*Sorghum* sp.), among other things [29, 30]. According to Ogundele [31], the people generally reputed yam cultivation as their birth-right and obliged themselves to its labor with dutiful enthusiasm in several states of Nigeria. In the same vein, [32] see Yams as the primary and the most prized crop of the Benue people, planted at the start of the crop rotation cycle before other crops follow. Aside from farming, traditional fabric weaving is a significant activity in the state, and it is frequently regarded as a hereditary industry, passed down from generation to generation as a family profession [27, 28].

In summary, Makar [33] ranks agriculture as the most important occupation of the Benue people, followed by hunting, fishing, raising livestock, weaving, smiting, and carving. The fact that most Benue people work in agriculture shows in their homes and other built environments. No doubt, the fact that most Benue people work in agriculture is reflected in their homes and built environments.

In addition to farming being the primary economic activity of the Benue, their dispersed settlements allow the cultivation of plantations, orchards, and garden crops, all of which contribute to the growth of a lush, soft environment [1, 34].

Though some scholars view Benue compounds as nucleated, isolated, individualized, and spread over challenging terrain [35, 36] many views their built environments as dispersed, scattered, and spontaneous [37, 38] reflecting their socio-economic focus on agriculture, which requires spacious land for shifting cultivation practices [34]. Agreeing with the modern needs of mechanized agriculture, this study supports the call to nucleate settlements into clusters to avail more land for farming and tight security [36, 39].

In general, this study confirms prior results that farming, the primary occupation of the Benue people, has a substantial effect on the separated house form and dispersed built environments. This study provides in-depth empirical data through an exploratory sequential mixed method technique, allowing for the replication and subsequent validity of its findings by other scholars.

## 5. Conclusion

This study investigates the effect of agricultural activities on the indigenous home design and settlement patterns of the Benue people in central Nigeria. The MEC model extracted utility consequences using exploratory sequential mixed method research. First, laddering interviews were conducted to elicit the elements linking built form and agricultural activities. The results provide the bases for a subsequent nominal survey where the variable was generalized and ranked. A 5-point Likert scale ordinal survey was finally conducted for statistical validations and relationships.

The results show that most separated compounds and dispersed settlements are linked to the consequential utility of providing ample space for the people's farming activities. The more robust mixed-method approach for this study provides reliable data for replication by other scholars and valid information across different phases.

Though the people may still prefer to live in expansive environments to carry out their socio-economic activities, this study aligns with other scholars for authorities to make conscious efforts in aggregating the settlements based on their respective socio-cultural delineations. Nucleating the settlements into larger towns and settlements can also ensure more farmland for mechanical cultivation, improved productivity, security, and mitigating clashes due to the contests for farmlands. To ensure the agricultural productivity, comfort, and cultural sustainability of the people, housing developments in the future should consider their mainstream values and settlement preferences. This recommendation should be relevant to Nigeria's government, developers, designers, planners, and other housing stakeholders.

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## Conflict of Interest

No potential conflict of interest for this study.

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