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Assessment of Crowdfarming Diversity in Lagos State using Shannon's Entropy Index

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Abstract- The global growth rate of equity crowdfunding of which Crowdfarming is a brand has surpassed the projected limits. Crowdfarming serves as alternative finance and platform for interested small scale investors in farming in many countries. This Paper investigates the diversity of crowdfarming platforms among investors in all the five administrative divisions of Lagos state. Three hundred participants were selected using purposive sampling techniques and used for the study. The data were summarized using frequencies and percentages, while Shannon Entropy Index was applied to analyse the diversity of crowdfarming among participants in the administrative divisions. The results showed majority of the participants were male (59%) with average family size of all crowdfarming participants being 5.83. Average household size was highest in Lagos Island (Eko) (7) and Epe (7) and lowest in Ikeja (4). Younger respondents (22-55 years) constitute the majority of crowdfarming participants (72%). Average total amount invested was #566,634; highest in Ikeja (#230,000) and lowest in Epe (#95,155). Thus showing high rate of investment flow to crowdfarming. The Shannon diversity index was 1.16 depicting crowdfarming platforms were evenly distributed across the state. Ikeja and Badagry have uniform diversity of Crowdfarming participants (H=1.07), followed by Ikorodu (H=0.89). Lagos Island has the lowest diversity (H0.80). Even distribution of crowdfarming platforms investment should signal improved monitoring for financial security of Lagosians; and eye-opener to step up measures to stem or prevent market failures.

Keywords: crowdfunding, crowdfarming, alternative finance, farmers, shannon's entropy index, lagos state.

I. Introduction

Crowdfunding is the practice of funding a project or venture by raising small amounts of money from a large number of people, typically via the Internet. Crowdfunding is a form of crowdsourcing and alternative finance. In 2015, over US$34 billion were raised worldwide by crowdfunding (Calic, 2018). Crowdfunding has been used to fund a wide range of for-profit, entrepreneurial ventures such as artistic and creative projects, medical expenses, travel, and community- oriented social entrepreneurship projects. Though crowdfunding has been suggested to be highly linked to sustainability, empirical validation has shown that sustainability plays only a fractional role in crowdfunding. Its use has also been criticised for funding quackery, especially costly and fraudulent medical treatments.

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Globally, studies on Crowdfunding have revealed varied models defined by the way rewards are designed. World Bank (2013) modeled all crowdfunding business models into two categories namely Donation crowdfunding and investment crowdfunding. In Mas solution (2015) models, crowdfunding types include donation-based, reward-based, equity-based, pre-order, lending-based and hybrid. While According to Diya (2020) there are four broad types/models of Crowdfunding, namely, Donation-Based Crowdfunding, Loan-Based Crowdfunding, Reward-Based Crowdfunding and Equity Crowdfunding. Of note is equity-based model which according to Belleflamme et al., (2015) is an investment crowdfunding platform where a campaigner invites the public to invest in a project or idea in return for an ownership interest and due to concerns for financial security and growth, has continued to receive attention. However, in all of the categories or types, campaigner solicit for donations/charity or investment. The rewards could range from monetary to non-monetary, materials to non-material and tangible to non-tangible.

Crowdfunding regulation varies from country to country (Gabison, 2014). In Nigeria, crowdfunding is regulated by the Securities and Exchange Commission (SEC).The new rules for crowdfunding activities came into effect on June 21, 2021. The rules prima facie addresses several ethical concerns in Crowdfunding ranging from strict governance, reporting, accounting, and other requirements. Equity-based has grown considerably in the US and the UK with the help of enabling legislations. The World Bank (2013) forecasts equity crowdfunding to reach $90 billion by 2020 but as at 2017, the projection has been surpassed and the outlook today should be double what is projected. The equity model of crowdfunding is the basis upon which crowdfunding is considered as the alternative finance. This model provides that investors receive a proportion of ownership interest or returns in the project thereby entitling them to share in the profits accruable from the project.

Crowdfarming which is a new crowdfunding niche entails sourcing funds from several individuals to invest in smallholder agricultural enterprises. Crowdfarming is an equity-based alternative finance to smallholder agriculture. Alternative finance refers to financial channels, processes, and instruments that have emerged outside of the traditional finance system

such as regulated banks and capital markets. Examples of alternative financing activities through 'online marketplaces' are reward-based crowdfunding, equity crowdfunding, revenue-based financing, online lenders, peer-to-peer consumer and business lending, and invoice trading third party payment platforms (Schueffel, 2017). This modern crowdfunding model is generally based on three types of actors namely: the project initiator who proposes the idea or project to be funded, the individuals or groups who support the idea (the investor/funder), and a moderating organization (the "platform") that brings the parties together to launch the idea.

In Nigeria, Twenty platforms for crowdfarming exist with five being the major types namely, Farm Crowdy, Thrive Agric, Farmkart, Pork Money and E-farms Nigeria. Among the five, Farmcrowdy premiered crowdfarming in Nigeria by its establishment in 2016, eight years after emergence of crowdfunding in 2008 as first home-built platform for agricultural investment. Later, Farm by, payfarmer, farmfunded, farmkart, smart farm, Farm4me, Ez Farming, porkvest, agrecourse, farm sponsor, farm centa, e-poultry, Nigeria farmers group, farm partner, agro partnership, Farminvest came onboard. Rate of return isusually between 15-35%. However, Analysis on three agriculture- based crowdfunding bynairaland in 2019 reveals that Thrive Agric, Farmkart and E-Farmsrecordedhigh returns of up to 50 per cent on investment. Agrawal, Catalini, and Goldfarb (2013) Opined that the commercialization of the internet makes crowdfarming an alternative source of finance and investment to small and medium investors and farmers through many ways. First, matching funders with farmers is now more efficient and effective due to lower search costs online. Second, risk exposure is reduced because funding in small increments is economically feasible online. Finally, low communication costs facilitate better (though far from perfect) information gathering and progress monitoring for distant funders and also better enable funders to participate in the monitoring of the business.

Early research on crowdfunding outside Nigeria indicates that Funding is not geographically constrained, The propensity of individual funders to invest in a project increases rapidly with accumulated capital (Agrawal, Catalini, and Goldfarb, 2011), and that the acceleration is particularly strong towards the end of the fundraising campaign, similar to online lending platforms (Zhang and Liu, 2012). Friends and family funding plays a key role in the early stages of fundraising, generating a signal for later funders through accumulated capital (Agrawal, Catalini, and Goldfarb, 2011). Funding follows existing agglomeration - Despite the decoupling of funding and location, funds from crowdfunding disproportionately flow to the same regions as traditional sources of finance (Agrawal, Catalini, and Goldfarb, 2013), perhaps due to the location of human capital, complementary assets, referral or bandwagon effects. Funders and creators are initially overoptimistic about outcomes to deliver a tangible return on investment but may later be disappointed by reality (Agrawal, Catalini, and Goldfarb, 2013).

Studies on crowdfarming are scanty or non-existent in Nigeria to the best of the researcher's knowlegde. A study by Soreh (2017) in three cities of Nigeria –Lagos, Port Harcort and Yenagoa - on the level of awareness and the peoples' attitude regarding the crowdfunding, adopting qualitative approach found that crowdfunding awareness was very low with 24% of respondents not aware and being unable to identify or name crowdfunding platforms operational in Nigeria.

Quite frankly crowdfarming has become aninvestment niche and vital source of alternative finance to farming especially in Nigeria even though much research efforts have not focused on this model. The growth and multiplicity of crowdfarming platforms suggests that crowdfarming is enjoying patronages among Nigerians. Since it is equity-based depicting increased inward flow of investment, this paper seek to empirically examine the diversity of crowdfarming among possible funders or investors in Lagos state. To our knowledge, no studies have explored this gap in literature with respect to Nigeria.

II. Methodology

The study area, Lagos State, has territorial land area of 351,861 hectares and is made up of five administrative divisions, namely, Ikeja, Badagry, Ikorodu, Lagos Island and Epe. This divisions were created in May 1968 by virtue of Administrative Divisions (Establishment) Edict No. 3 of April 1968. Lagos is investment hub and home to economic actors and activities spread across the five administrative divisions, thus, the most congenial for an investment/finance study of this nature. All the five administrative divisions were covered in the sample survey. A total of sixty (60) crowdfarming investors were purposively selected from the metropolitan areas of each administrative division. Hence, a total of 300 respondents were randomly sampled. No attempt was made to discriminate on the basis of platforms as investors were selected not minding which out of the twenty platforms he/her invested. Primary data was collected using questionnaire and semi-structured interview schedule. The instrument elicited information on socio-economics characteristics of respondents, level of investment and crowdfarming platforms they invested in. Respondents were also requested to identify and state if they have invested in multiple crowdfarming platforms. Information were collated on crowdfarming and summarized using Frequencies and percentage, and subjected to Shannon Index to test its diversity.

The Shannon index has been a popular diversity index. It is known as Shannon's diversity index, the Shannon -Wiener index, the Shannon- Weaver index and the Shannon entropy (Poole, 1974; Niklaus et al., 2001, Hixon and Brostoff, 1983; Sax, 2002). The measure was originally proposed by Claude E. Shannon to quantify the entropy (uncertainty or information content) in strings of text. The idea is that the more different letters there are, and the more equals their proportional prevalence in the string of interest, the more difficult it is to correctly predict which letter will be the next one in the string. The Shannon entropy quantifies the uncertainty (entropy or degree of surprise) (Shannon, 1948) associated with this prediction. It is most often calculated as follows:

$$H = -\sum_{i=1}^{R} P_i \ln P_i$$

Where,

H = The Shannon diversity index

Pi = fraction of the entire population (respondents/ investors) made up of species I (Particular crowdfarming platform), i.e. pi is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N)

S = Numbers of species encountered (crowdfarming Platforms)

ln= natural logarithm

$\sum$= sum from species 1 to species n (crowdfarming Platforms)

To calculate the index, we first divide the number of individuals on each crowdfarming platform from sample by the total number of individuals in all the crowdfarming platforms. This is Pi. Two, we multiply the fraction by its natural log (P_1ln* P_1). Three, Repeat this for all the different species that we have. The last species is species s. Four, Sum all the (P_i ln* products. Pi). Finally, the value which we get should be multiplied by -1, and then we get H. High values of H would be representative of more diverse communities. A community with only one species would have an H value of 0 because Pi would be equal to 1 and be multiplied by ln P_i which would equal to zero. If the species are evenly distributed then the H value would be high. So the H value allows us to know not only the number of species but how the abundance of the species is distributed among all the species in the community. We also calculate The Shannon Equitability Index to measure the evenness of species (Crowdfarming platform) in a community (the Divisions). The term "evenness" simply refers to how similar the abundances of different species are in the community.

Denoted as E_H, this index is calculated as:

$$E_H = H / ln(S)$$

where:

- H: The Shannon Diversity Index
- S: The total number of unique species (crowdfarming Platforms)

This value ranges from 0 to 1 where 1 indicates complete evenness.

III. Results and Discussion

a) Socio-demographic characteristics of Crowdfarming Participants

The socio-demographic characteristics of crowdfarming investors in the study area were summarized in Table 1. As shown in the table, majority of the participants were male (59%) with average household size of all crowdfarming participants being 6. Average household size was the samein Lagos (Eko) (7) and Epe (7) and lowest in Ikeja (4). Younger respondents (22-55 years) constitute the majority of crowdfarming participants (72%) while the older respondent (>55 years) were just 28%. The socio-demographic analysis further showed that 94% were economically active with 43.4% engaged in farming related activities and 56.6% in non-farm activities. 56% of the crowdfarming participants owned smart phone and was not clear how the rest engaged the platforms/ transaction since crowdfarming is largely internet dependent. The literacy level is considerably moderate with about 86% being either Primary school certificate (22.4%) or secondary school certificate (36.4%) or tertiary education certificate (27. 6%) holders. The highest numbers of illiterate participants was found in Epe (N=12) and Badagry (N=9). Average total amount invested was #566,634; highest in Ikeja (#230,000) and lowest in Epe (#95,155).Thus showing high rate of investment flow to crowdfarming and calls for measure to mitigate market failure.

Table 1: Socio-demographic Characteristics of Respondents (N=300)

Characteristics	Lagos State	Ikeja	Badagry	Ikorodu	LagosIsland	Epe
Sex:						
Male	177(59)	34(56.66)	48(80)	48(80)	34(56)	30(50)
Female	123(41)	26(43.33)	12(20)	12(20)	26(44)	30(50)
Age group (year):						
20-55	216(72)	46(76)	38(64)	49(82)	29(48)	54(90)
>55	84(28)	14(24)	22(36)	11(18)	31(52)	6(10)

Education group:						
No education	42(13.6)	2.4(4)	10.8(18)	6(10)	7.2(12)	14.4(24)
Primary	66(22.4)	14.4(24)	20.4(34)	10.8(18)	13.2(22)	8.4(14)
Secondary	108(36.4)	19.2 (32)	16.8(28)	16.8(28)	22.8(38)	33.6(56)
Tertiary	84(27.6)	26.4(44)	12(20)	26.4(44)	16.8(28)	3.6(6)
Mean household size	6	4	6	5	7	7
Economically Active	282(94)	57(86)	58(96)	56(94)	58(96)	59(98)
Farming Related	130(43.4)	17.(30)	35(60)	20(36)	10(17)	42(71)
Non- Farm	152(56.6)	40(70)	23(40)	36(64)	48(83)	17s(29)
Own Smart Phone	158(56)	47(82)	17(30)	40(72)	44(76)	12(20)
Mean Amount Invested(₦)	566,634	230,000	110,234	222,567	340,122	95,155

Percentages are in parentheses

b) *Shannon's Entropy Index of Crowdfarming in Lagos State*

Table 2 shows the calculated Shannon's entropy index of crowdfarming in Lagos State. The Shannon diversity index is 1.16 depicting crowdfarming platforms are evenly distributed across the state. In other words, not only were the crowdfarming platforms increasing in their numbers but were also disperse across the state in their activities. A critical look at Table 2 further shows Farm Crowdy, Thrive Agric and Farmkart were among the most diversified in terms of participants on their platforms.

Table 2: The Shannon's Entropy Index of Crowdfarming in Lagos State

S/No.	Crowdfarming Platforms	Ikeja (n)	Badagry (n)	Ikorodu (n)	Lagos Island (n)	Epe (n)	Lagos (N)	Pi	ln(Pi)	Pi*ln(Pi)
1	FarmCrowdy	10	2	10	0	0	22	0.08	-1.06	-0,09
2	ThriveAgric	5	1	10	0	10	26	0.10	-0.98	-0,10
3	Farmkart	5	2	7	15	0	29	0.11	-0.94	-0,11
4	PorkMoney	6	2	7	0	0	15	0.06	-1.22	-0,07
5	E-farms Nigeria	3	2	6	8	5	24	0.10	-1.02	-0,10
6	Farmby,	1	1	0	0	0	2	0,01	-2.10	-0,02
7	Farmfunded,	3	1	0	0	0	4	0,02	-1.80	-0,03
8	Payfarmer,	2	1	3	5	10	21	0,08	-1.08	-0,09
9	Smart farm,	2	0	0	0	5	7	0.03	-1.55	-0,04
10	Farm4me,	3	10	2	5	8	28	0.11	-0.95	-0,11
11	EzFarming,	3	7	3	0	0	13	0.05	-1.28	-0,07
12	Porkvest,	1	3	0	0	0	4	0.02	-1.80	-0,03
13	Agrecourse,	0	0	0	0	0	0	0	0	0
14	Farmsponsor,	3	4	0	0	0	7	0.03	-1.55	-0,04
15	Farmcenta,	0	3	0	0	0	3	0.01	-1.92	-0,02
16	e-poultry,	3	1	2	5	7	18	0.07	-1.14	-0,08
17	Nigeria farmers group (NPG)	0	8	0	7	0	15	0.06	-1.22	-0,07
18	Farm partner,	0	2	0	0	5	7	0.03	-1.55	-0,04
19	Farminvest	0	0	0	0	0	0	0	0	0
20	Agropartnership,	0	0	0	5	0	5	0.02	-1.70	-0,03
									H=	1.16

Shannon Equitability Index= $E_H = H / ln (S)$
$= 1.16/\ln (20)$
$= 0.89$

The Shannon Equitability Index of 0.89 is high as is very close to 1, indicating similarity among the abundances of different platforms of crowdfarming in Lagos State.

c) *Comparison of Crowdfarming diversities in the Administrative Divisions of Lagos State*

Table 3 shows the comparison of the Shannon diversity index of all the five administrative divisions of Lagos State. The Table shows the Administrative division with lowest and highest diversity of crowdfarming platforms. The Table shows that, Ikeja and Badagry have uniform diversity of Crowdfarming participants (H=1.07). This is followed by Ikorodu (H=0.89). Lagos Island (Eko) has the lowest diversity (H0.80). The Table further shows Equitability Index is highest for Epe division and lowest in Badagry. This indicates that Crowdfarming participants were evenly distributed in Epe and Badagry divisions than all other three divisions. Even distribution could indicate visibility of the various platforms, depicting that all the platforms have equal effects in their outreach or promotions to attract investors to their platforms.

Table 3: The Shannon's Diversity Index of Crowdfarming for Lagos Divisions

S/No	Administrative Divisions	Shannon Index (H)	(S)	Ln(s)	Equitability Index (*H* / *Ln*(s))
1	Ikeja	1.07	14	1.15	0.93
2	Badagry	1.07	16	1.20	0.89
3	Ikorodu	0.89	9	0.95	0.94
4	Lagos Island	0.80	7	0.85	0.94
5	Epe	0.83	7	0.85	0.98

(S)= No. of indicated Crowdfarming platforms by respondents in a division

IV. Conclusion

The study of Crowdfarming diversity among funders or investor in Lagos state shows that awareness about crowdfarming among respondent has risen and it is widely dispersed among the respondents across the five administrative divisions. The diversity and evenness of the abundances of platforms and investors signals potentials of crowdfarming to compete on variations in market design, employing different rules for engagement and tools for reputation, crowd due diligence, and provision point mechanisms, among others. New markets for trusted intermediaries will likely emerge. While it is economically plausible that fierce competition among crowdfarming platforms will stimulate innovation and reduce market failure, it is envisaged that without proper regulations, supervision and monitoring there will surely be spectacular failures. Funders will lose significant sums, not only to fraud, but also to incompetent managers, bad ideas, and bad luck. Agribusiness owners will litigate their investors, and investors will litigate Agribusiness owners. As expected, the benefits from crowdfarming will not be uniform across platforms due to capacities differentials of managers and uncertainty nature of agriculture in the developing world. Since crowdfarming occurs online, many of the actions of Agri business owners and investors are in digital form and thus leave a data trail. These data and the analyses they enable will be a valuable tool for policy makers and platform designers for addressing market failure, thus, enhancing their ability to harness the upside potential of crowdfarming and realise the social gains from trade that may result from financing an important yet potentially undercapitalized sector of the economy. Arising from the foregoing, the study Recommends as follows:

- The high level of awereness should be sustained by funders and investors.
- More Farmers should be encouraged to acquire smartphones. Since crowdfarming is majorly done online.
- There should be proper regulation, supervision and monitoring by the Regulating Body to mitigate maket failure and enshrine security of investments in crowdfarming.

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