INDIVIDUAL FACTORS AND SHOPPERS' ACCEPTANCE OF ANTHROPOMORPHIC AUTONOMOUS SERVICE ROBOTS IN SHOPPING MALLS, LAGOS STATE, NIGERIA

By

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Abstract
This study examined individual factors and shoppers' acceptance of anthropomorphic autonomous service robots in shopping malls in Lagos State. This study is essential because the acceptance of anthropomorphic autonomous service robots in shopping malls is still at its nascent stage, and remains a contemporary issue among marketers, consumer researchers and practitioners most especially in Nigeria. Three specific questions were raised and aptly answered by subjecting them to hypothesis testing. Survey research design was employed. A sample size of 420 was determined from the targeted population. Data was collected via questionnaire in online setting, out of which 391 copies of questionnaire were found useful. Descriptive and inferential statistics were conducted for the data analysis. Findings show that individual factors – trust, enjoyment, and social influence have positive significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State, Nigeria.
Keywords*: Anthropomorphic, Enjoyment, Robot, Social influence, Trust,*

1.0 Introduction

Nowadays, retail platforms are rapidly witnessing digital disruptions, and shopping mall as one of this platform is not an exception (De-Bellis and Johar 2020). Coupled with effects of digital disruptions, is global outbreak called COVID - 19, both are exerting more pressure on the management of retail shopping malls as regard their product offerings; as well as looking for new and sustainable ways to manage relationships with their customers, employees and other stakeholders (Popovici, 2023). Furthermore, the technology revolution is making automation to move toward the age of autonomy and technologies are gradually becoming autonomous (Schmitt, 2019). Existing studies have also established that emergent of new technologies influence customers' journey in various ways (Evanschitzky et al., 2020), thereby making countries around the world to consider how autonomous service robots can be introduced into the public domain, and become useful in shopping malls, airports, schools, museums, and hospitals (Niemela, Heikkila, Lammi and Oksman, 2019), both in the developed and developing countries. For instance, Nigeria launched Omeife, its first humanoid robot in Africa with 6.8 billion dollars as estimated market value in African markets and other parts of world (Abeku, 2022). Although, it may have a promising economic value however, it is very crucial to investigate how shoppers' individual factors will influence acceptance anthropomorphic autonomous service robot when introduced into shopping malls in Lagos state, Nigeria.

Anthropomorphic autonomous service robot (AASR) is a robot that has human – like features in appearance and behaviour with built-in AI with capability of using knowledge of big – data from customer database, and can switch in performing different tasks independently, such as assisting shoppers in navigating stores, finding products and information, as well as completing purchasing transactions (Niemela et al., 2019). AASRs are considered useful to different categories of shoppers in shopping malls in terms of time savings, convenience, quality customer service in the area of more accuracy, faster results, polite interactions, among many others (Pettinico and Milne, 2020). On the other hand, the individual factors are shoppers' personalized factors that influence anthropomorphism during human – robot interaction (such as trust, enjoyment and social influence). Extant studies revealed that anthropomorphized individual factors have impact on acceptance of autonomous robot; and bulk of these studies were carried out in developed countries. Therefore, there is need to investigate this study in developing countries such as Nigeria with special reference to shopping malls in Lagos State.

1.1 Aim and Objectives of the Study

The aim of this study is to investigate individual factors and shoppers' acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State, Nigeria, while the following are the specific objectives:

(i) to examine the influence of trust on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.
(ii) to determine the influence of perceived enjoyment on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.
(iii) to examine the influence of social influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.

1.2 Research Hypotheses

The following are the null hypotheses for the study:

$H0_1$: Trust has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.
$H0_2$: Enjoyment has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State;
$H0_3$: Social influence has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.

1.3 Scope of the Study

This study focuses on three individual factors (trust, enjoyment and social influence). It also restricted to shoppers ranging from 18 years and above, who have shopped in any shopping malls in Lagos State, and are IT users (at least have the knowledge of operating a smartphone).

2.0 Review of Literature

2.1 Theoretical Review

2.1.1 Elicited Agent Knowledge Theory of anthropomorphism

Elicited agent knowledge increases anthropomorphic judgment, as individual employ the use of self-related knowledge related or general human related knowledge when accessing non-human entities (Epley, Waytz and Cacioppo, 2007). In this study, the theory is applicable to human robot interaction in order to find out whether shoppers will employ their self-related knowledge to boost their assessments and actions with anthropomorphic autonomous service robots (AASR) in shopping malls.

2.1.2 Service Robots Acceptance Theory (SRAT)

This theory posits that consumer acceptance of helpful social robots depend on how robots can efficaciously perform as regards social-emotional needs, relational and needs functional needs for the purpose of achieving role congruence (Wirtz et al., 2018). The original TAM - Technology Acceptance Model serves as the basis for Service Robots Acceptance Theory, by incorporating social-emotional and relational needs. Therefore, this theory was employed because it dealt with individual factors and the dependent variable considered in this study.

2.2 Conceptual Review

2.2.1 Anthropomorphized Individual Factors

Anthropomorphized individual factors refer to shoppers' personalized factors that make them perceive autonomous service robots as being human-like during human-robot interaction. And they are considered as trust, enjoyment and social influence (Nicholson, Compeau and Sethi; 2001; Davis, Bagozzi and Warshaw, 1992; Lin, Chi and Gursoy, 2020).

2.2.1.1 Trust

Trust is defined as the extent to which a party has willingness in depending on something or someone in a specific situation with a perception of relative security (Josang and Lo Presti (2004), even though counter consequences are inevitable (Parasuraman and Miller, 2004).

2.2.1.2 Enjoyment

Perceived enjoyment is conceptualized as extent to which the act of engaging a specific technology is perceived to be pleasurable apart from any anticipated consequences from its performance (Davis, Bagozzi, and Warshaw, 1992). Igbaria, Ivari and Maragahh (1995) also found that perceived enjoyment as an important factor in computer technology acceptance.

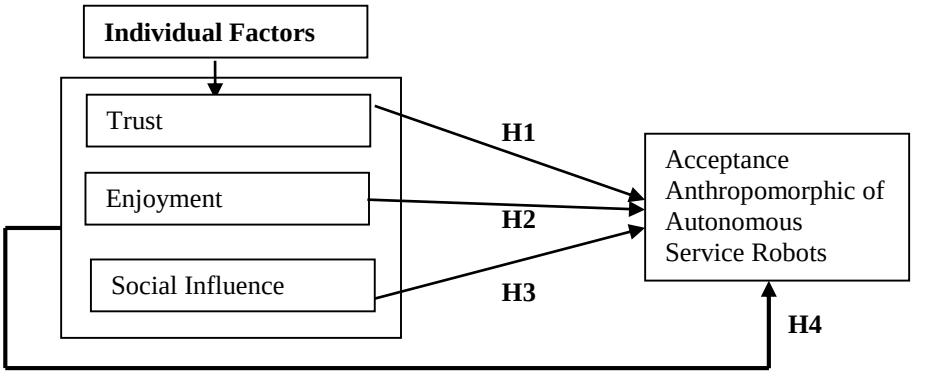
2.2.1.3 Social Influence

Social influence can be conceptualized as the degree that the social group of a customer for instance friends, family etc. believe that using artificial intelligent - based robots in shopping malls are relevant and congruent with group norms (Lin, Chi and Gursoy, 2020). Thus, if a shopper's social network has positive opinion toward anthropomorphic autonomous service robots' usage in the shopping malls, thus the shopper's acceptance of AASRs will be activated, since using such robots will benefit the shopper's social identity (Gursoy, Chi, Lu and Nunkoo, 2019).

2.2.2 Acceptance of Anthropomorphic Autonomous Service Robots

Acceptance is generally referred to as a combination of attitudinal, intentional and behavioral (Davis, 1989). Previous evidences revealed that robot acceptance somehow similar to acceptance process of other technologies, and full integration of robots in the people's day-to-day tasks seem to depend on how they anthropomorphize robots (De-Graaf, Allouch and Klamer, 2015).

Fig 1: *Conceptual Framework of Individual Factors and acceptance anthropomorphic autonomous service robot*



Source: Researcher (2023)

2.3 Empirical Review

Gursoy, Chi, Lu and Nunkoo (2019) conducted a study on consumers' acceptance of artificial intelligent (AI) device in USA. A sample size of 439 was selected with the use of convenience sampling technique. Online questionnaire was administered. Data was analyzed with the aid of structural equation modelling. Findings showed that social influence and hedonic motivation such as enjoyment positively influence performance expectancy which determines customer acceptance of artificial intelligence device usage in the service context.

Similarly, Bishop, Van, Maris, Dogramadzi and Zook (2019) conducted a study to examine how human and robots' characteristics affect acceptance of social robots. Experimental research design was adopted. Population of the study comprises of University students from West of England. A sample size of 86 participants was drawn via random sampling. Data collected was analysed with the use of online survey coupled with robot video clips and was analyzed using descriptive, correlation and regression statistical methods. Finding showed that social capability, social influence, perceived usefulness and anxiety influence attitudes toward human – robot interaction, and in all human characteristics affect acceptance of social robot.

Likewise, Lin, Chi and Gursoy (2020) conducted a study to examine antecedents of customers' acceptance of Artificial Intelligence robotic device usage in hotels. Quantitative method was adopted. Data was collected via online questionnaire. A sample of 605 respondents was selected through convenience sampling technique. Data was analyzed via SEM. Findings showed that anthropomorphism, hedonic motivation such as enjoyment, social influence and emotions influence customers' acceptance toward artificial intelligent robotic service usage.

Furthermore, Della, Sepe, Gursoy and Prisco (2023) carried out research on trust role of customer behaviour towards social robots. Experimental approach was used. Sample size of 716 was selected via judgmental sampling technique. The study was carried out in two different settings that is an airport and a hotel using social robot and a short video clip that revealed human - robot interaction. Data collected were analyzed via Partial Least Square method. Findings reveal that acceptance level of social robots' usage is ascertained by a multistage process whereby trust perceptions play crucial roles. In addition, enjoyment as an hedonic motivation and other individual factors positively influence trust in social robots.

Finally, Chi, Chi, Gursoy and Nunkoo (2023) conducted a study on trust role in customer's acceptance of Artificial Intelligence (AI) robots across two countries. Quantitative approach was employed. Two different sample sizes of 491 and 495 were selected using random sampling technique among adults in United States and China respectively. Questionnaire was distributed via online method. Data collected were analysed with the use of Partial Least Square - SEM. Findings suggests that trust in interaction with Artificial Intelligent robots is a higher-order construct that has significant influence on the intention to use thereby leading to acceptance.

3.0 Methodology

A cross-sectional survey research design via quantitative method was employed in this study to derive the necessary information. The study population comprises of all shoppers who resided in Lagos State and who have shopped in shopping malls that are situated in Lagos State. Due to the infinite nature of the study population, Cochran formular $n = Z^2 (pq)/e^2$ (Cochran, 1963) was employed to determine the sample size at 323 with 30% attrition rate increased it to 420. A purposive sampling technique was adopted to approach the calculated sample size. Primary data was collected using a structured questionnaire in an online environment aided with a short video clip of autonomous service robot named "Pepper". 7 points Likert ranging from Strongly Disagree (1) to Strongly Agree (7). Scales were adapted for trust McCroskey and Teven (1999), enjoyment Heerink et al. (2010), and social influence (Gursoy, Chi, Lu and Nunkoo, 2019). Adjustment was made to the items and pre-tested during pilot study process. 25 copies of the questionnaire were administered using separate respondents for determining validity and reliability of the questionnaire. In addition, the reliability test revealed that all the Cronbach alpha coefficients exceeded .60 which confirmed high level of internal reliability of the research instrument (Nunnally and Bernstein, 1994). Data collected were analysed using descriptive and inferential statistics. The descriptive focused on percentage frequency distribution, while regression analysis was considered as inferential statistic for the hypotheses testing via SPSS 23.0. Out of 420 copies of questionnaires administered, 391 were found usable for this study.

4.0 Data Analysis Results

4.1 Respondents' demographic data analysis was analyzed based on the valid 391 online questionnaires that were considered usable in this study. The percentages and frequency distributions were employed as explained below:

The gender distribution of respondents displays little more male respondents 205 (52.4%) than female 186 (47.6%). Respondents age group displayed that majority were between 20 and 29 years 164 (41.9%), followed by 30 to 39 years 98 (25.1%), then, 40 to 49 years 61 (15.6%), below 20 years 44 (11.3%), and 50 and above 24 (6.1%). Also, the marital status result displayed more single 220 (56.3%) than married 142 (36.3%), while 18 (4.6%) were separated, and 11 (2.8%) widow/er. According to their religion, 283 (72.4%) were Christians, while 103 (26.3%) were Muslims, and others 5 (1.3%). As regards their highest educational qualification, 163 (41.7%) were Bachelor's degree or equivalent holders, 100 (25.6%) were secondary school holders, 70 (17.9%) holds Masters, 45 (11.5%) holds National diploma and equivalent, 9 (2.3%) were Doctorate degree holders, and 4 (1.0%) holds others qualifications. As regards the occupation, 138 (35.3%) were employed, followed by

student 125 (32.0%), then self-employed 114 (29.2%), unemployed 8 (2.0%), retired 4 (1.0%), and others 2 (5%). In addition, concerning their income level on monthly basis, 101 (25.8%) earned between N80,000 and N109,000, 94 (24.0%) earned from N110,000 and above, 85 (21.7%) earned between N50,000 and N79,999, 69 (17.6%) earned N20,000 and below, while 42(10.7%) earned between N20,000 and N49,999. Finally, regarding the years of shopping experience, 125 (32.0%) were within 1 to 5 years, followed by 119 (30.4%) within 5 to 8 years, 104 (26.6%) were 8 years and above, while 43 (11.0%) were with less than 1 year shopping experience.

4.2. Hypothesis Testing

Hypothesis 1

$H0_1$: Trust has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.

Table 2. ***Summary of Regression Analysis of Trust and Acceptance of Anthropomorphic Autonomous Service Robot***

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	7.533	.511		14.741	.000
	TRS	.210	.033	.303	6.273	.000

R = .303
R^2 = .092
Adjusted R^2 = .090
ANOVA: F value = 39.349; Sig(0.00)
a. Predictors: (Constant), TRS
b. Dependent Variable: ACP

Source: SPSS Output of Survey Data (2023)

Table 2 reveals that trust has a significant influence on the acceptance of anthropomorphic autonomous service robot with a *p-value* of 0.000. This is less than $\alpha = 0.05$ ($p<0.05$). The R^2 value of 0.092 indicates 9.2 percent variation in the acceptance of anthropomorphic autonomous service robot. The result also shows that this influence does not occur by a chance with an F-ratio value of 39.349 ($p<0.05$), indicating the strength of the trust as a predictor for acceptance of anthropomorphic autonomous service robot in shopping malls, Lagos State.

4.3. Hypothesis 2

$H0_2$: Enjoyment has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.

Table 3 Summary of Regression Analysis of Enjoyment and Acceptance of Anthropomorphic Autonomous Service Robot

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	6.929	.386		17.943	.000
	ENJ	.372	.037	.455	10.064	.000

R = .455[a]
R^2 = .207
Adjusted R^2 = .205
ANOVA: F value = 101.284; Sig(0.00[b])
a. Predictors: (Constant), ENJ
b. Dependent Variable: ACP

Source: SPSS Output of Survey Data (2023)

The Table 3 reveals that enjoyment has a positive relationship with acceptance of anthropomorphic autonomous service robot. Enjoyment with value of R square of .207 accounted for 20.7 percent variation in the acceptance of anthropomorphic autonomous service robot. The table also shows overall model from the ANOVA table as (F = 39.349; Sig. =.000) indicating that the model is statistically significant (P<0.005). Thus, the null hypothesis is rejected, while the alternative hypothesis is accepted stating that enjoyment has significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.

4.4. Hypothesis 3

$H0_3$: Social Influence has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.

Table 4 Summary of Regression Analysis of Social Influence and Acceptance of Anthropomorphic Autonomous Service Robot

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	7.461	.328		22.768	.000
	SIF	.191	.018	.464	10.338	.000
R = .464[a] R^2 = .216 Adjusted R^2 = .214 ANOVA: F value = 106.881; Sig(0.00[b]) a. Predictors: (Constant), TSIF b. Dependent Variable: ACP						

Source: SPSS Output of Survey Data (2023)

As shown in Table 4, there is positive relationship between social influence and acceptance of anthropomorphic autonomous service robot. The R-square of .216 indicates that social influence accounted for approximately 22 percent of variance in acceptance of autonomous service robot. The table also reveals that F-value is 106.881 and significant at 5% ($p < 0.05$), confirming the fitness of the model. Hence the rejection of the null hypothesis and acceptance of alternative hypothesis stating that social influence has significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State.

5.0 Discussion of Findings

The purpose of this study is to examine influence of individual factors on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State, Nigeria. Based on this main objective, three hypotheses were formulated. Data collected was analyzed empirically. Thus, the results are summarized as follows:

As regards hypothesis one which states that individual trust has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls in Lagos State, Nigeria. This study reveals that individual trust has significant influence on acceptance of anthropomorphic autonomous service robots, this finding corroborates Della, Sepe, Gursoy and Prisco (2023) as well as Chi, Chi, Gursoy and Nunkoo (2023).

In addition, hypothesis two states that enjoyment has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls, Lagos State. This study shows that enjoyment has significant influence on acceptance of anthropomorphic autonomous service robots, and this result is in line with findings of

Lin, Chi and Gursoy (2020), and Gursoy, Chi, Chi and Nunkoo (2019). The result also confirms the Service robot acceptance theory (Wirtz et al, 2018).

Furthermore, as regards hypothesis three which states that social influence has no significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls in Lagos State, Nigeria. This study reveals that individual' social influence has significant influence on acceptance of anthropomorphic autonomous service robots, and this result is in line with extant findings of Bishop, Van, Morris, Dogramadzi and Zook (2019); as well as Lin, Chi and Gursoy (2020).

5.1 Conclusion and Practical Implications

Based on this study's findings, all constructs with the use of simple regression analysis were significant when tested independently on acceptance. Therefore, this study concludes that individual factors have significant influence on acceptance of anthropomorphic autonomous service robots in shopping malls in Lagos state, Nigeria.

The findings from this study provide useful information on individual factors and shoppers' acceptance of anthropomorphic autonomous service robots. And the implication for shopping mall practitioners is that in introducing autonomous service robots having interface with shoppers, the management should be aware that shoppers' social influence, perceived enjoyment and trust influence acceptance of autonomous service robots in the shopping malls. In addition, the robot must be design to perform its shopping related activities in such a way that it will not jeopardize the trust of the shoppers, rather enhance their perceived enjoyment when interacting with the anthropomorphic autonomous service robots in the shopping malls in Lagos state, Nigeria.

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