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Acceptance of Web 2.0 in learning in Nigerian higher education: a pilot study

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Abstract: Technology acceptance has been studied in different perspectives. Though a few empirical studies on acceptance of Web 2.0 as a social networking tool in teaching and learning exist, none of such studies exist in Nigeria which is the focus of this study. This paper reports on a pilot study that begins to fill this gap by investigating the perceptions, attitude and acceptance of Web 2.0 in e-learning of this country. Based on literature review and initial primary study, a conceptual model of 9 variables and associated hypotheses. The model was operationalised into a questionnaire that was used to collect data from 317 students from 5 universities. The findings that came from data analysis indicate that all the variables except motivation co-vary with intention to use Web 2.0 in e-learning in Nigeria. Some of the validated variables are perceived usefulness and prior knowledge. The major conclusions and recommendations include the utilisation of Web 2.0 facilities to stimulate participation in learning. This work will contribute to the body of knowledge on acceptance of Web 2.0 social networking tools in teaching and learning. It will aid management decisions toward investing better on technology so as to improve the educational sector. This research will also be beneficial in the social development of individuals, local communities, national and international communities.

Keywords: Web 2.0, collaboration, active participation, enhanced learning, Web 2.0 acceptance, learning, higher education and technology based learning

Introduction
The usefulness of Web 2.0 tools has been empirically studied by few researchers. For example, Xie et al. (2010) studied blogs, Parker and Chao. (2007) researched Twitter, Ajan & Hortshorn (2008) researched acceptance, McKinney, et al. (2009) studied podcast, and Mayer (2009) studied wikis. Research on the impacts of Web 2.0 tools in higher education is increasing by the day in developed and developing countries (Alexander, 2006; Franklin & Van Harmelen, 2007; Redecker, 2009; Vlahovic 2010; and Echeng, 2011). Few studies are beginning to emerge in developing countries on the use of Web 2.0 in higher institution, for example Anunobi & Ogbonna (2012). Web 2.0 provides social networks as a student support feature (Selwyn, 2009; Madge et al. 2004). It enables the sharing of learning experiences, exchanging of information about the subjects being taught and assessment requirements, and provision of moral support. Web 2.0 technologies provide opportunities for students to construct and share knowledge with each other. Jucevičienė and Valiūniene (2010) concluded in their studies that there are four main factors that determine adoption of social network usage in higher education: academic service support; student support; social and cooperate learning; and achievement representation. This paper tests three models of acceptance and discusses the acceptance of Web 2.0 technologies in learning. The rest of this paper will present the need for Web 2.0 technologies in education, theoretical framework, method, findings and discussion, and summary and future work.

The Need for Web 2.0 technologies in education
Web.2.0 provides opportunities to develop very effective web-based collaborative systems. In order to achieve a better learner centred approach, there is need for education and training institutions to adopt the 21st-century technologies that improve learner engagement among other benefits. Being a relatively young technology a number of issues related to Web 2.0 are yet to be resolved. One of these is its acceptance and use in teaching and learning (Franklin and Van Harmelen 2007; Rollett et al., 2007). However, several studies for example, Redecker et al. 2009 have shown that Web 2.0 social computing tools and application in education and training enhances participatory learning, collaboration, knowledge and information sharing. Also research findings from Xie and Shama. (2008) show that students’ thinking level were increased as the students updated their blogs weekly. It also offers effective strategies for implementing what has been learnt by exploring other media.

Nevertheless, despite the opportunities offered by Web 2.0 technologies in learning, adoption is low (Anunobi and Ogbona, 2012). This research investigates this low adoption in Nigerian learning environment using an adapted technology acceptance model. The empirical
work using this model examines attitudes and perceptions of users in order to predict their acceptance of Web 2.0 technologies for learning.

Theoretical framework
This research used, as underpinning theories, the technology acceptance model (TAM) and the unified theory of the use and acceptance of technology (UTAUT). The TAM theory which origin is from Theory of reasoned action (TRA) (Ajzen & Fishbein, 1980) states that users’ behavioural intentions determine their acceptance of technology and their behaviour in turn influences their attitude (Davies, Bogozzi & Warshaw, 1989). Two variables, perceived ease of use and perceive usefulness, are the fundamental determinants of acceptance of technology Davies (1989). TAM has been tested and validated in business settings with few validations in educational sectors (Teo, Luan & Sing, 2008).

From research, various theories have been developed to predict acceptance of technology but these theories are applicable to few cultures mainly in developed countries. Researchers who have carried out empirical research using the existing models usually select variables from these models to measure general acceptance or adjust existing models to fit the technology being queried (Teo, Luan and Sing, 2008; Oshiyanki, Cairns, and Thimbleby, 2007; Thamer et al., 2010).

Technology Acceptance Model (TAM) which is frequently used by researchers to predict acceptance of technology was reported not valid across cultures. The differences were detected between Singaporean and Malaysian pre-service teachers. In that study, relationships between perceived usefulness (PU), perceived ease of use (EOU) and computer attitude (CA) on the one hand and behavioural intention (BI) on the other were validated as significant whereas the relationship between behavioural intention (BI) was not significant (Teo, Luan & Sing, 2008).

Unified Theory of Acceptance and Use of Technology (UTAUT) which was extended from TAM with seven others (theory of reasoned action, motivational model, theory of planned behaviour and model of PC utilization) have been used by few researchers to predict acceptance. The UTAUT was validated in eight countries (Venkatesh et al, 2003). Oshiyanki et al (2007), in a follow up study, collected data from eight other countries but analysed from three of the countries - United Kingdom, United States, and New Zealand who speak English language only. They measured and validated five out of the eight variables of UTAUT. These variables are effort expectancy, performance, attitude, social factor, self-efficacy and anxiety. This means that there is a need for the eight variables to be tested in other cultures to see if these variables would be valid or not.

The UTAUT was extended in a research to predict acceptance of technology. Thamer et al,(2010) with 290 participants. The result of the study showed that performance expectancy, social factors, facilitating conditions and system flexibility have direct effect on the employees’ intention to use technology for training, while, system enjoyment, effort expectancy and system interactivity have indirect effects on employees’ intention to use the system. From secondary studies with empirical researches done so far there is a lack of a good general framework of predicting user acceptance of the use of Web 2.0 technologies in learning and this research takes this challenge with regards to Nigeria from where data was collected.

The rest of this section will explain the variables of the research model and hypotheses that describe the relationships between them.

Perceived Usefulness
Perceived usefulness is the belief of an individual that technology will make their work better. Davies et al. (1989) argued that perceived usefulness is a factor that affects technology acceptance and the variable was valid across cultures. This research takes the same stand that perceived usefulness of Web 2.0 tools should positively influence acceptance of these tools in teaching and learning. Thus the hypothesis:

H1: There is positive relationship between Perceived Usefulness and Acceptance of the use of Web 2.0 tools in learning and teaching.

Social Factors
The social factor is an interpersonal agreement that binds individuals or people within a particular environment. Davies et al. (1989) argued that there are other external factors that may influence the acceptance of technology, and this research supports this argument that social factors can affect the behaviour intention to use Web 2.0 tools leaning.

Therefore:

H2: Social factors have a positive relationship with the Acceptance of Web 2.0 tools in learning.

Prior Knowledge
Prior knowledge is very important in learning environment. This affects the attitude of learner and from psychological point of view; people’s attitude are a large part of their behaviour (Ajzen & Fishbien, 1980). In the context of this study the prior knowledge of the learner toward the use of Web 2.0 tools social activities is considered an important factor to determine the behaviour intention in academic activity. Thus,

H3: Prior Knowledge has a positive relationship with Behavioural Intention to accept Web 2.0 tools in learning and teaching in Nigerian higher education.
Facilitating condition

Technology including the Web 2.0 cannot be used without internet facilities. Users need to have access to computers, PDAs, phones with internet facilities to utilize Web 2.0 in their activities. Effective use of Web 2.0 tools would require users to own or have access to internet facilities to a much greater extent (Venkatesh et al. 2003).

H4: There is positive relationship between Facilitating Condition and Acceptance of Web 2.0 tools in learning and teaching in Nigerian higher education.

Perceived Ease of use

Perceived ease of use is the feeling that the use of technology will be without much effort, but will achieve much in a short time. This has been used by Davies et al. (1989) to predict acceptance of technology, and this research supports the notion that perceived ease of use can predict acceptance of Web 2.0 hence the hypothesis

H5: There is positive relationship between Perceived Ease of Use and Acceptance of Web 2.0 in learning in Nigerian higher education.

Performance Expectancy

Performance expectancy is the degree to which an individual or group of people expect to be proficient in their work or education when they are using technology. Venkatesh et al. (2003) researched and validated the variable performance expectancy as one of the factors that can promote acceptance of technology and this research is in support of this. Therefore,

H6: There is positive relationship between Performance Expectancy and Acceptance to Use Web 2.0 tools in learning and teaching in Nigerian higher education.

Motivation

Motivation involves internal and external processes that give behaviour its energy and directions (Davies et al., 1989). Motivational perspectives were adapted in TAM model (e.g. perceived usefulness and enjoyment from both intrinsic and extrinsic motivation. Motivation to use Web 2.0 tools in learning is likely to influence attitude of the users, and motivation influences behavioural intention.

H7: There is a positive relationship between Motivation and Behavioural intention to use Web 2.0 tools in learning and teaching in Nigerian higher education.

Behavioural Intention

Ajzen and Fishbein (1980) emphasized that attitudes can be used to determine behaviour. Davis et al. (1989) in TAM argued that behaviour can influence acceptance of technology and this research supports the argument that the behavioural intention can be used to predict actual use, hence this hypothesis:

H8: Behavioural Intention has a positive relationship with Actual use to use of Web 2.0 tools in learning and teaching in Nigerian higher education.

Based on the hypotheses presented in this section a conceptual model was developed (see figure 1). This conceptual model displays constructs from the literature review and relates them to each other (each link represents a relationship between constructs and is reflected in the relevant hypothesis).

Figure 1. Model showing Acceptance to use Web 2.0 for learning

Method

A questionnaire was designed and used to collect data. This research measured eight constructs. The questionnaire was divided into three parts. The first part measured students’ level of satisfaction in learning and facilities available for teaching and learning; the second part measured the eight constructs in the research model (prior knowledge, actual use, perceived usefulness, perceived ease of use, social factor, behaviour intention, motivation to use and performance expectancy. Then the third part investigated demographics (e.g. age, gender, educational level, faculty, having personal computer, having internet access in the university). Items were measured using 5- and 7-point Likert scale with 19
questions. Those items were adapted from similar research (e.g. Davies et al, 1989; Venkatesh et al, 2003).

**Content Validation**
To achieve content validity, the questions had strong literature underpinning. Also, they were pilot-tested with knowledge experts as well as a few students who represented prospective respondents. The questionnaire was amended based on comments from this process (Zikmund, 2003).

**Participants**
500 questionnaires were administered to volunteers taken from five Nigerian universities (two federal, two states and one private university). The questionnaires were administered in class by lecturers and 317 were collected back making a response rate of 63%.

**Instrument Development**
A combination of some variables from the Unified Theory of Acceptance and Use of Technology (UTAUT) by Vankatesh et al. (2003), Technology Acceptance Model (TAM) (Davis, 1989), Technology Acceptance Model Extended (TAM2) by Davis et al (2000), and the Theory of Reasoned Action by Fishbein and Ajzen (1975) underpin this research. A combination of some variables from UTAUT model, TAM1, TAM2 and theory of reasoned action with one additional variable was used to extend the three models of acceptance. These variables were operationalised into a questionnaire and pilot tested in the University of the West of Scotland (see table 1 for the source of the variables and table 2 for the operationalisation). Some demographic questions (gender, age and educational level) were also included in the questionnaire. A few questions were added to investigate the level of satisfaction in teaching and learning. The rest of the questions assess how the adoption of social networking tools in teaching and learning are viewed and the pedagogical role social networking tools could play in improving learning outcomes.

### Table 1. Variables and source

<table>
<thead>
<tr>
<th>Variables</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior knowledge (PK)</td>
<td>Mine (new)</td>
</tr>
<tr>
<td>Social factors (SF)</td>
<td>TAM, UTAUT</td>
</tr>
<tr>
<td>Perceived usefulness (PU)</td>
<td>TAM</td>
</tr>
<tr>
<td>Performance expectancy (PE)</td>
<td>UTAUT</td>
</tr>
<tr>
<td>Motivation MtU</td>
<td>TRA</td>
</tr>
<tr>
<td>Perceived Ease of use (PEoU)</td>
<td>TAM</td>
</tr>
<tr>
<td>Facilitating condition (FC)</td>
<td>UTAUT</td>
</tr>
<tr>
<td>Actual use (AU)</td>
<td>TAM, UTAUT</td>
</tr>
<tr>
<td>Behavior intention (BI)</td>
<td>TAM, UTAUT</td>
</tr>
</tbody>
</table>

### Table 2. Operationalisation

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Questions</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAM (EoU)</td>
<td>How easy do you find using these Web 2.0 tools listed below to obtain the resources you need for your studies?</td>
<td>7</td>
</tr>
<tr>
<td>TAM, UTAUT (AtU)</td>
<td>How many times do you use Web 2.0 tools listed above for academic purposes per week?</td>
<td>5</td>
</tr>
<tr>
<td>TRA (MtU1)</td>
<td>To what extent do you agree that social part of e-learning platforms (e.g. Module and Blackboard) motivate learner to a great extent to achieve learning objectives?</td>
<td>8</td>
</tr>
<tr>
<td>TRA (MtU2)</td>
<td>E-learning platforms enable you to send mails, download course materials upload assignments, read announcements, access the library material and discuss with other students, professionals and your lecturers. To what extent do you think such system would motivate you to achieve your learning objectives?</td>
<td></td>
</tr>
<tr>
<td>UTAUT (FC1)</td>
<td>Regarding facilities available for learning and teaching in the university, how satisfied are you? Add any necessary comments regarding technology and facilities available in your university</td>
<td>4</td>
</tr>
<tr>
<td>UTAUT (FC2)</td>
<td>Do you own personal computers or phone with internet connection</td>
<td></td>
</tr>
<tr>
<td>TAM (PU)</td>
<td>To what extent do you agree that Web 2.0 tools would speed up acquisition of knowledge?</td>
<td>11</td>
</tr>
<tr>
<td>AtA (Mine)</td>
<td>To what extent do you agree that social computing should be adopted in education and training for sharing of knowledge and information?</td>
<td>9</td>
</tr>
<tr>
<td>TAM, UTAUT (SF)</td>
<td>To what extent do you agree that Web 2.0 tools will encourage active participation?</td>
<td>11</td>
</tr>
</tbody>
</table>
Findings and Discussion

The bar chart on Figure 2 shows the frequency distribution for perceived usefulness. The distribution is left-skewed with values: neutral, slightly agree and agree achieving higher frequencies as compared to other responses. This means that most of the users agree that the introduction of Web 2.0 tools will enhance students’ learning.

Figure 2: Frequency distribution for Perceived Usefulness

The correlation between Behavioral Intention (BI) and Perceived Usefulness (PU) is highly significant and reaches the value of 0.549. That means that there is a relationship between acceptance and usefulness in the case of Web 2.0 technologies. The rest of this section will investigate the relationships between BI and other variables.

The correlation between variables BI and Performance Expectancy (PE) is highly significant and reaches the value of 0.431. That means that there is a relationship between BI and PE in the case of Web 2.0 technologies in higher education of Nigeria.

The correlation between variables BI and Social Factors (SF) is highly significant and reaches value of 0.423 that means that there is a relationship between BI and SF.

The correlation between variables BI and Actual Use (AU) is significant and reaches the value of approximately 0.2 meaning there is relationship between BI and AC for academics purpose.

The correlation between variables BI and Prior Knowledge (PK) is highly significant with the value of 0.431. That means that there is a relationship BI and PK.

The correlation between variables BI and Motivation (MtU) is not significant.

The correlation between variables BI and Facilitating Condition (FC) that is available in the institution or personal (FC1 and FC2) is significant and reaches the value of approximately 0.3. That means that there is a relationship between BI and FC.

The table below is a summary of the correlation analyses.

<table>
<thead>
<tr>
<th>Variables (dependent)</th>
<th>Variable (independent and sources)</th>
<th>Correlations Coefficients</th>
<th>Significance</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>TAM (PU)</td>
<td>.549</td>
<td>Yes</td>
<td>H1</td>
</tr>
<tr>
<td>BI</td>
<td>UTAUT (PE)</td>
<td>.431</td>
<td>Yes</td>
<td>H2</td>
</tr>
<tr>
<td>BI</td>
<td>TAM, UTAUT (SF)</td>
<td>.520</td>
<td>Yes</td>
<td>H3</td>
</tr>
<tr>
<td>BI</td>
<td>TAM, UTAUT (AU)</td>
<td>.169</td>
<td>Yes</td>
<td>H4</td>
</tr>
<tr>
<td>BI</td>
<td>Mine (PK))</td>
<td>.153</td>
<td>Yes</td>
<td>H5</td>
</tr>
<tr>
<td>BI</td>
<td>TRA (MtU)</td>
<td>.932</td>
<td>No</td>
<td>H6</td>
</tr>
<tr>
<td>BI</td>
<td>TAM (EoU)</td>
<td>.134</td>
<td>Yes</td>
<td>H7</td>
</tr>
<tr>
<td>BI</td>
<td>UTAUT (FC)</td>
<td>.115</td>
<td>Yes</td>
<td>H8</td>
</tr>
</tbody>
</table>

Table 3 shows a summary of relationships between variables and links the relationships to hypotheses presented previously in the model. Correlations marked with a single asterisk are significant at level 0.05 and those with double asterisks are significant at level 0.01. All relationships except the one between motivation to...
use and behavioural intention are significant as individually presented in this section. The variables with the significant relationships are perceived usefulness, performance expectancy, social factor, behaviour intentions, prior knowledge or use for social purpose and facilitating condition. One of them, prior knowledge is a new variable that was generated by the researcher. The results generally confirms earlier research in acceptance of technology (Davies et al. 1989; Venkatesh et al 2003; Echeng and Usoro 2011; Echeng et al. 2013) The general implication of this research is that the use of Web 2.0 technologies would encourage active participation in teaching and learning. A specific implication is to increase each of the variables, if possible, so as to encourage greater use of these systems. For instance, the systems should be customised in a way that is as easy to use as possible so as to encourage its use. However many Nigerians are not familiar with these technologies for teaching and learning. This was also observed by Anunobi & Ogbonna (2012) in their research. Therefore, utilisation of these tools for academic purposes as well as awareness is needed to gain benefits from them.

Summary and Future Work
The research developed a model based on some variables of TAM, UTAUT and TRA along with one added variable to examine the intention to adopt Web 2.0 in learning in Nigerian higher education. The results showed seven out of eight variables to significantly co-relate with behavioural intention. These variables include perceived usefulness, performance expectancy, social factor, and prior knowledge. The implications of the study include the need to make the tools available in the first place in Nigerian higher education; and to deploy them in an easy-to-use way so as contribute to learning and teaching in this environment. As has been noted, motivation did not exhibit a significant influence on intention likely because most of the students were not using the system whereas the question on motivation was emphasizing the use of Moodle or Blackboard platform for learning. Therefore this variable will be tested again in the future after the students are exposed to LMS. A setting up of a LMS will also enable experiments that will engage the students and teachers in Web 2.0 technologies. Such experiments will produce useful qualitative data that will richly complement this quantitative study.

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Cooperative Artificial Intelligence in Strategy Games

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Abstract: In this paper we discuss the technical requirements and issues for achieving cooperation between human and artificial intelligence players in real time strategy games. Cooperation is closely tied to communication and perception. We investigate the challenges an artificial intelligence will have to overcome and present models for perception and deal with problems regarding noise and trust. Furthermore, we will take a look at the human end of communication, analyzing the usability requirements for communication and cooperation with AI players.

Keywords: Artificial Intelligence, Game Development, Cooperation, Communication, Strategic, Tactical, Reasoning, Usability, Believability, Trust, Sensors

I. INTRODUCTION

In recent years significant advances in technology have led to near photo-realistic graphics becoming commonplace in games. However, such advances have had much less impact in the area of Artificial Intelligence in games. While there has been quite an increase in complexity in game AI and new algorithms popped up or where imported from neighboring fields of science, like robotics, the overall approaches in AI of a game from 2000 are by far more similar to a game from 2010, than their graphical representations. AI systems in games still use about the same concepts they used a decade ago, like state machines, decision trees and so forth. While these approaches work well for many applications of Artificial Intelligence in games, there is one field that might require different concepts: Cooperation between an AI and a human player.

A. Real-Time Strategy Games

Although there are examples drawn from other genres in this paper, the focus is cooperation between human and AI players in real-time strategy games. In a stereotype real-time strategy game, the player is a general of some kind, commanding a base and an army. Players usually have to gather resources, expand their base and produce new units in order to destroy all hostile units on the map. Players are confronted with adversarial opponents. The map is usually a dynamic environment with environmental features or terrain affecting the game mechanics.

An important gameplay element is scouting. At game start, the map is hidden and needs to be scouted in order to find the hostile army. Yet, units only reveal the map in a certain radius. If no units present, the map is covered by a fog of war, hiding hostile movement. Players will therefore have to do their strategic reasoning with limited information and in a partially observable, concurrent environment. In additional, game mechanics are often not completely predictable, involving variable damage or random and changing environment effects, adding additional uncertainty.

Players do usually not have a direct in-game representation but act as omnipresent commanders. Armies consist of independent units. Players issue orders to these units, which are executed autonomously. Units are categorized in different types and provide counter mechanics. Tanks, for example, might be more effective against infantry, while helicopters are strong against tanks, but vulnerable to rocket-launcher infantry.

Not all units are available for production right from the start, but instead have to be unlocked through a tech tree, requiring resource investments.

The precise strategies available in a game are influenced by its gameplay, but certain concepts can be found in many examples of this genre. A very common one is the so called “rush”, which means an early attack with many cheap units. A “rush” strategy will usually mean to invest few resources in an early economy, but instead produce as many of the low-tech units available early as possible. Due to the weak economy, “rush” strategies are often vulnerable in later game stages, if an opponent survived the rush and is able to produce stronger high-tech units.

On the other end of the spectrum there is the “tortoise” gameplay, where players try to build up a strong economy and advance through the tech tree as fast as possible by skipping early attacks and instead focusing on a strong defense in order to fight of attackers.

II. ARTIFICIAL INTELLIGENCE IN GAMES

Almost all PC games released in the last few years use algorithms from the wide field of artificial intelligence in one way or another. Yet, its uses and the algorithms vary greatly from genre to genre and it’s not uncommon to find approaches and algorithms unique to a specific title. There are even many different applications of AI algorithms and systems within a single game. This paper will focus on player-level AI. In this section we will outline what we
mean by player-level AI, and distinguish it from other applications of AI in games.

A. Assistance AI

Path-finding algorithms are amongst the most common form of AI found in computer games. These algorithms and many others are an actual part of gameplay and are often not perceived as AI to a player. In a strategy game, for example, a player orders units to attack something. The units will have to find a good path to the target. They might also have to keep a formation, use their weapons in a meaningful way or even automate complex tactical decisions like seeking cover or withdrawing.

Some games do also offer an option to automate a certain part of gameplay. Many strategy games have abilities on units, which can be set to “auto-cast”, meaning that the unit will use these abilities at will without the player ordering it. An example of such an “auto-cast” would be the heal spell of the priest in Warcraft III (Blizzard Entertainment, 2002), which can be automated by right-clicking on it to automatically heal nearby damaged soldiers. Other games, usually economy simulations, offer assistance that take over a whole part of gameplay, like a science-advisor managing research and technologies in a 4X strategy game. Star Wars: Rebellion (Coolhand Interactive, 1998) even allows transferring control over whole aspects of the game, like unit production, to automated advisors.

B. Player-level AI

Player-level AI, in contrast to assistance AI, is perceived as an “AI player” by most human players. Usually, such a player-level AI is primarily concerned with decision making, whereas all the other fields of AI as described in Assistance AI are taken as granted by players.

A player-level AI typically appears in multiplayer, where the role of a human player can be replaced by an artificial intelligence player. Such an AI player will have to make all decision a human player would.

Commonly, a player-level AI may not be just a single algorithm, but a rather complex structure of algorithms, agents and data structures, often referred to as the AI-system or the AI-engine of a game (Ramsey & Rabin, 2004).

This paper will focus on these player-level AIs and the various challenges they encounter when interacting with humans. We will focus on their application in strategy games, or typical real-time strategy games. While most conclusions and ideas can be transferred to other genres, player-level AIs are always very specific to the actual game play (Laird & van Lent, 2001). A typical application of player-level AI in other game genres would be Bots in First Person Shooters (Laird & Duchi, 2001) or computer opponents in various sports games (Chaperot & Fyfe, 2006).

C. Cooperative and Competitive Games

The most straightforward interaction in real-time strategy games is combat. Most of these games focus on building up and commanding an army of units and use them to destroy your opponents. These are adversarial scenarios where an AI player competes with the human player for victory. Yet, there are two generic approaches to this problem: Have an AI that is built to win the game by any means allowed by the gameplay or have an AI that is built to entertain the human players as well as possible (Yildirim & Berg Stene, 2008).

We refer to an AI player designed to win the game as a Tournament AI. In tournaments, human players will often do everything that the gameplay allows and train as well as possible to achieve victory. An AI player designed to entertain the human player we refer to as an Entertainment AI, where players just want to have a good time.

In some cases it might be easier to develop a tournament AI, as the victory conditions and the allowed actions are usually well defined in the game mechanics either way. The problem of creating a competitive Tournament AI is a difficult problem in the first place, especially for genres like Real-Time-Strategy games (Buro, n.d.) yet, at least the goals are known. The concept of “entertaining”, however, is much more difficult to grasp due to its subjective nature (Yannakakis & Maragoudakis, 2005). While the concept of “victory” is constant, achieving maximum entertainment is closely tied to the human player and can vary greatly from player to player.

Another application in computer game AI with similar issues is providing scalable difficulty levels to a player (Charles, et al., 2005). The concept of “difficulty” is also closely tied to the current player and its abilities and knowledge. Scalable difficulty is often implemented by adding additional handicaps to a Tournament AI player, like increasing its reaction time or, like in Star Trek: Armada (Activision, 2000), even increasing the costs they have to pay for units. This approach can again be seen as prebaking information about complex subjective relations like difficulty or entertainment into hard rules for the AI.

While the approach of a Tournament AI works well for many competitive games, there is one situation where this approach is very hard to pursue: a cooperative AI (Orkin, 2012).

A cooperative AI is allied with a human player and tries to achieve victory over other human or AI-controlled players together with its human ally. This obviously includes the same requirements like a competitive AI, yet it also contains a wide collection of additional requirements. In order to be believable, a cooperative AI will have to interact with the human player in a more complex pattern: forging strategies together, exchanging information and synchronizing progress.

III. PERCEPTION

Perception is the process of gathering information from the in-game-universe. Closely linked to the actual perception are the post-processing and filtering mechanisms working on the perceived raw data to aggregate them in in a knowledge base of some kind.
To do so, an AI might access an API to query information from the game engine and store it in an AI-specific format. Some engines even use the approach to generate an AI-World per cycle, which contains the information of the current game state that the AI could perceive (van Lent & Laird, 1999), similar to how the renderer draws a picture for us.

Seeing games, especially strategy games, as a test bed for AI research (Buro, n.d.) (Buro & Furtak, n.d.) (Alpcan, et al., 2011), a nice approach becomes obvious, that is might not be considered in game development, but in robotics: modeling perception with sensors. Such an approach would involve creating numerous sensors, for example to detect the units that an AI player controls, the regions of the map that are visible and so on. Such sensors which can just be seen as a wrapper of the current game state information are not affected by any noise, except a certain time delay perhaps, which should be negligible.

IV. COOPERATION IN GAMES

A. Communication

The base for cooperative strategies, the ability to communicate, is a rather complicated topic. In this work the problem is reduced to the most essential areas of communication required to forge strategies and coordinate with an AI-controlled player. There are two basic requirements for rudimentary communication: To express your current state and to express your future plans.

B. Expressing the current state

The current state of a player – human or AI – is usually expressed by the game itself. While the current state of a player in a game is objective and given by the game logic, there are various sources of bias that lead to a subjective expression of that state in communication.

The first step in communication is usually to summarize the view of the current state. A communication statement like “I’m doing well” is not a detailed report of the player’s current game state, but a very abstract view. This abstraction and simplification is of course dependent to the values and strategies the player uses which makes it very subjective. A player who’s strategy is to build up a strong economy to build high-end units in a strategy game, will probably say “I’m doing well” if they command few military units in an early game phase, but a powerful economy. Another player who wants to do an early rush will most definitely disagree.

In games with only partially observable environments – like most RTS games – a player will also have to make certain assumptions about information they cannot access at the moment, like the strength of opponent forces or the locations of resources. The assumptions are obviously based on the approaches used to come up with them. Statements in communication referring to such assumptions will therefore also make the expressed state very subjective.

Having ten tanks under your command, for example, is an actual game mechanics description and could directly be gathered from the game as the tanks are roaming the battlefield. The statement “my army is superior” is a subjective statement about the same situation. It contains significantly more implicit information and is the result of many steps of reasoning:

- The statement implies that the player considers the ten tanks to be their available army. They could also be considered part of a base defense or split into multiple task forces. Yet, the term “army” in the above statement is ambiguous. It could be meant as the sum of all units available to the player, or the units the player is willing to spend to a certain task.
- The statement also implies a complex relation: That the available army to that player seems to be more powerful than a hostile army. Obviously, a statement relating the strength of troops is estimation. There might be situations where the hostile army wins, for example due to the influence of terrain. The statement could be seen as an approximation.
- The third implication is that information about hostile forces is available. Many strategy games require active scouting and reconnaissance to gather information about hostile troops. If that’s the case, information about hostile troops will often be incomplete or outdated. The statement implies that the player has high trust into the accuracy of the available information.

This example illustrates the complexity that can be involved in understanding a simple statement. In human communication, these are solved outside of the actual game. Ambiguous expressions are generally solved by an established common vocabulary. If two players play with each other a lot, they might know what they mean when saying “army”. Even if the players don’t know each other, they could still fallback to an established dictionary of the game’s community, like referring to an early attack strategy as a “rush” (Drachen & Smith, 2008) (Wadley, et al., 2007) (Dabbish, et al., 2012). Certain terms are often established to mean a specific game mechanic. A popular example is using the term “haste” in MMORPGs for effects that increase the number of attacks per second. Yet, this common vocabulary might still fail, of course. An AI can usually not build on community-established terms or other context-related terms. It might be possible for an AI to recognize the player it is playing with and use a vocabulary agreed by the player. Yet that’s typically not the case.

An obvious solution to this problem might be to drastically limit the channel of communication. This could be implemented by just allowing a small set of well-defined statements, instead of the almost infinite, ambiguous space of natural language. An ample system comes into mind where players can express how they feel about the strength of their army. This reduces the ambiguity of natural language, yet the reasoning problems remain.
It also resolves other problems with natural language communication between human and AI players in computer games – namely the processing overhead of speech and natural language processing. Modern games generally push the processing capabilities of computers towards their full potential, leaving limited amounts of processing power for performing speech recognition or for analyzing and interpreting natural language instructions.

C. Examples of Symbolic Communication in Strategy Games

1) Chat Commands

Some games, especially older games like Age of Empires (Ensemble Studios, 1997), offer chat commands which will play a certain audio file to a player, like “I need more gold”. Such features are less frequently found in newer titles, as live on-line chat between human players in multi-player gaming has become more commonplace – computer generated chat would interfere with player communications. Yet, such commands are just what an AI communication could look like: They offer a tightly defined set of commands to express your state and needs. Commands can be expressed visually or audibly. Yet, there is only very limited feedback involved, as the limited set of commands might allow to answer with “yes” and “no” to demands, but not enough commands to express complex answers, like “I don’t have enough gold for you, but I could send you some wood to build up some trading ships and I could secure your western border”.

2) Map Pings

An even simpler way of communication can be found in many modern real time strategy games. Games like StarCraft II: Wings of Liberty (Blizzard Entertainment, 2010) offer a “map ping” that allows players to mark a point of interest on the map for all their allies, as shown in Figure 1. This is often used to improve communication in tournament games, like players writing “attacking” in the chat, followed by a map ping. Such a map ping is a good method to enrich communication which is bound to a certain location. A statement with a map ping is a lot less ambiguous than a statement like “attacking the southern entrance of the main base”. Obviously, such a mechanic could also be used to communicate with an AI player. Yet, we have to keep in mind that the “map ping” itself does not carry any information about a current state or future plans. It can only help to enrich statements.

Such “map pings” could be combined with well-defined statements to combine semantic information, like “attack” with a location. One could think of “attack here”, “defend here” or “gather resources here” pings. Such “enriched map pings” can already serve as a very symbolic channel of communication, as they give a player the capability to express what they want their allies to do.

3) Semantic Markers

Similar concepts are already used by some games, not for communication but for storing information about an environment for the AI. Supreme Commander (Gas Powered Games, 2007), for example, stores markers on maps that mark spots as defense zones, resource expansions and so on, Figure 2. This information is added to the map by the game designers during development and then used by the runtime AI to aid in its decision making. However, these markers are neither visible to a human player, nor can they be created at runtime.

4) Freehand Drawing

Although not a strategy game, another interesting communication channel can be found in Guild Wars (ArenaNet, 2005) where players can draw freely on the map (see Figure 3). Most guilds developed a set of symbols for easier communication. This method can be used quite effectively, but requires a lot of context, like players...
agreeing on certain symbols and players identifying these symbols, which leads to a similar complexity as natural language processing.

Figure 3: Freehand drawing on the mini-map in Guild Wars

5) Diplomacy Dialogs
Many turn-based strategy games offer dialog-driven diplomacy systems that allow players to make offers and demands or forge treaties with each other. Civilization V (Firaxis Games, 2010), for example, offers a diplomacy menu where players can combine statements like “demand gold” and “offer military support” to come to diplomatic agreements (see Figure 4). These dialogs allow expressing a more complex offer or demand consisting of a set of parameterized, atomic statements. Usually, both the AI and humans can use this method of communication. Yet, diplomacy dialogs also require more time to communicate, which make them a good choice for turn-based games, but might be too time consuming for real-time games.

Figure 4: Part of the diplomacy menu in Civilization V allows a player to create a diplomatic offer from a number of predefined statements, for example: "I offer: Peace Treaty and 500 gold"

6) Reputation
Another example for diplomacy menus can be found in Anno 1404 (Related Designs & Blue Byte Software, 2009), (see Figure 5). AI players in this game are part of the very game mechanics and pursue different goals than the human players. They are closer to an Entertainment AI than to a Tournament AI. AI players have a certain personality, which defines how human players can gain reputation with them, for example by attacking their mortal enemies or granting economic aid. The reputation level defines what human players can request from the AI. In addition, human players can also intimidate or ingratiate them. Such actions add an interesting social layer to the interaction, although the possibilities are limited to just pressing the “intimidate” or “ingratiate”. The concept of reputation and its visualization are approaches to model personality and social interaction for AI players.

Figure 5: The diplomacy menu in Anno 1404 showing the reputation wheel and the interaction buttons from demanding a gift, intimidating, ingratiating and offering a gift, as well as the general treaty buttons for peace and war.

At the end of the day, there are quite a few possible methods for in-game communication channels with other players. Yet, in almost all games, they are just used to communicate with human, not AI, players.

D. Expressing future plans
In order to build a strategy, a player requires information to build upon, be it a human or an AI controlled player. On an abstract level, human reasoning and planning is not very different from algorithms. Our algorithms are usually influenced a lot by “gut feeling” or “trained behavior” which is an expression for inferring from our vast memory base, while algorithms usually rely on a fixed procedure to infer from limited data, which is usually tied to the current situation.

Information of any kind has many properties that are important for reasoning, especially when it comes to cooperation. An obvious one is the source of information. Information might be gathered through any means by an algorithm, as described above in Perception. This information can be seen as “first hand” information, as it is directly gathered by sensors of the reasoning system. That means that the gathered information might be incomplete or
affected by noise, but it should not be entirely wrong. Also, in many cases, the noise or incompleteness is known and can be taken into account by follow-up reasoning algorithms. An AI in a strategy game might, for example, count all known hostile units every ten seconds in order to measure their relative strength to its own army. The ten second intervals adds incompleteness to the perception, as units might get missed and the data might be outdated by a few seconds when reasoning takes place. A reasoning algorithm can take these limitations into account, for example by including certain safety margins.

In games where both players share knowledge about the game state, forging cooperative strategies involves communicating about future plans. When players differ in their knowledge about the game state, passing information about the current state will also usually be important in developing cooperative strategies. This “second hand” information was first perceived by the allied player A and then given to current player B for reasoning to come up with a cooperative strategy. In a generic case, player B has no information about the perception mechanisms used to gather this information. This means that the reasoning algorithms can neither take potential noise or incompleteness into account, nor is it able to validate if the information is even correct. Even worse, in a generic case, it is not even able to determine if the information is incomplete, wrong or noisy. An artificial reasoning algorithm will have to handle this special cases and threat perceived information and information gained from other players via communication differently.

There are only few strategy games that offer a dedicated in-game communication channel to talk about future plans. Obviously, methods used to express the state can also be used to express future plans, like drawing on the map or using map pings as described above.

One game with a very integrated communication channel for that is Sins of a Solar Empire (Ironclad Games, 2008). The game allows a player to offer missions to an ally, like “kill 10 spaceships of player X and you will get 2000 credits” (see Figure 6). The mission system is also accessible for the AI allowing it to not only accept missions from other players but also issue missions to other players, including humans. This allows an AI player, to a certain degree, to express what it thinks might be most efficient for other human players to do. Yet, there is no cooperative planning involved in these missions, as there is the only signal sent to the commissioning agent is that the mission has been accepted and when it is completed.

![Figure 6: A mission offered in Sins of a Solar Empire to destroy capital ships of the pink player for a resource award](image)

E. Trust

The first step to communication and cooperation is obviously to perceive the current game state. There are many implementations on how an AI player could perceive its environment and therefore its game state. We will continue with the sensor approach as mentioned above.

Communication, however, adds a new set of sensors: Those that deal with information not directly derived from the actual game state of the current player, but those that deal with information gained through communication. Imagine a generic RTS game, for example, where allied players don’t share vision. A “communication sensor” could sense that the human ally of an AI player just told it that the human-controlled army is in position to attack. If the AI cannot confirm this information directly from its game state, it has to have a certain trust into the human player to accept this information for future reasoning: Another aspect of reasoning under uncertainty for a game AI.

These “communication sensors” are highly affected by noise. As we described earlier in this paper, communication comes with an inherent noise, if just for the sake of wrapping up complex states in symbolic statements. Yet, it also involves an even more difficult problem involving the daily-life meaning of trust: Is the information from the human player actually correct? (Buntain, et al., 2012)

There are many sources why information from a human player could be considered incorrect by an AI. Obviously, a human could just use a different metric to judge the current situation, leading to a different result than the AI’s algorithms would. Besides this obvious case, a human player could of course make a wrong judgment or deliberately pass on inaccurate or false information to the AI.

Cooperation between humans and AI players will involve dealing with these trust-related problems, for example by arguing or questioning the human player (Parsons, et al., 2011). As many of the noise scenarios, especially “lack of experience” and “lying” would benefit from the AI having a concept of the human player, allowing it to remember with whom it is playing and how they acted in the past. Actually, as a player-level AI should be in the same position as a human player and should solve the same challenges as a human player would, experience and memory from earlier game sessions become more important. Human players will actively use knowledge from earlier game rounds, including the behavior and
performance of the AI. Meanwhile, for AI players, knowledge and learning (if any) from previous games are generally wiped and the AI starts again from a static set of memories shipped with the game. If looking at team play oriented eSport formats, for example the arena player-versus-player matches in World of Warcraft (Blizzard Entertainment, 2004), an important aspect for communication between human players is to practice and improve over the course of many game sessions (McGee, 2010). AI players could be capable of similar behavior, if they stored knowledge and experience from earlier game rounds. Such an AI could be described as a Meta-Player-level AI.

F. Believability

One of the most popular goals for AIs, especially in gaming, is the feature to “look and feel like a human player”, summarized by the popular Turing Test (Turing, 1950) (Livingstone, 2006). This problem is often nicely summarized by the term “Artificial Stupidity” (Lidén, 2003) in game development. This tries to express that there are inefficient actions a human player does, but an AI would not even consider, like aiming somewhere in the sky in a moment of panic following a surprise ambush in a first person shooter. In Halo (Bungie, 2001), for example, some of the weaker Covenant soldiers would panic in combat. When developing cooperation between humans and the AI, this becomes particularly important.

G. Usability

An important requirement for any control element in a game is its usability. This becomes particular important in games where reaction time is a vital gameplay element, like most first-person-shooters and also real-time strategy games, especially those built for eSport where “Actions Per Minute” became a popular measurement for player skill. These needs imply very fast interaction channels, using as few clicks as possible for an action.

A communication channel, like described above, will have to follow similar constraints. Human players would use speech to communicate fast and – most important – speech is a communication channel not generally used for input by computer games (although systems such as XBox Kinect and PS3 eyeToy do use it for some games). In most games, you can click to control the game and speak to communicate with other players at the same time.

Given we do not use natural language processing; the interaction with the AI will take place in a channel already used. Map-Pings, as described above, would require the user clicking buttons and the mini-map. An efficient cooperative AI will therefore also have to provide an efficient interaction channel which does not occupy too much of a human's awareness. That’s an interesting need, as we usually only think about AI resources when designing game AIs, not the “resources” available to a human player.

A diplomacy menu like in many turn-based strategy games like Civilization V (Firaxis Games, 2010) works well for these round-based games, as they don’t have such a hard time constraint compared to real-time strategy games like StarCraft II: Wings of Liberty (Blizzard Entertainment, 2010). A real-time strategy game requires a far simpler and faster interaction scheme. These requirements limit the complexity or the frequency of communication.

V. Outlook

We are currently working on a prototype implemented in the real-time strategy game StarCraft II: Wings of Liberty (Blizzard Entertainment, 2010) (Stiegler & Livingstone, 2013) using semantic nets to represent abstract knowledge of the AI, for example relation between units expressing that a Zerg Baneling is a good choice against a Terran Space Marine. The prototype uses a minimalistic game mode of StarCraft II, known as Tag of War, where players chose their units, but don’t control them directly. The human interface consists of mini-map pings enriched with a finite set of additional information like “tech up”, “tank for me” to allow a human player – or an AI – to express their future plans or communicate what they expect their ally to do. The communication channel is completely bidirectional as both the human player and the AI agent can use these flags and statements to express their state or plans.

Future development of such prototypes for different genres will allow to benchmark different reasoning algorithms and knowledge representations and develop new solutions to the “Cooperation Problem”.

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ICT for development by Nigerian NGOs: an initial conceptual paper

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Abstract: Much research has been done on the impact of ICT on development in both developed and developing economies. An area though that there is hardly an empirical research is its impact on not-for-profit organisations or the third sector. This research seeks to feel this gap by focusing on the third sector in Nigeria. To theoretically underpin this study, three variables (fun, culture and technology readiness) has been developed and incorporated in existing technology acceptance model. The research is at initial stage and though it develops a research model, the model will be further examined and refined before the full empirical work will be carried out to validate it.

Keywords: Economic development, NGO, third sector, technology acceptance, ICT, Nigeria

Background
Information technology has revolutionized the way organizations work. Information coordination and data share between organizations are better enabled with the use of IT (Omekwu, 2006; Tapia and Tchouakeu, 2012). Nations have enhanced their economic competitiveness and advantages through the use of information technology (Gani and Clemes, 2006; Kyobe, 2011; Apulu et al, 2011). Banks and other financial institutions largely rely on ICT for their day to day operations and transactions (Gidhagen and Pearson, 2007). Libraries and educational institutions employ ICT for better services and meeting the challenge of globalization (Spacey et al, 2004; Omekwu, 2006; Oye and Lahad, 2011; Gombachika and Khanganwa, 2013).

The globalization which ICT has enabled to promote makes ICT an important tool even to developing nations. Major organisations like the World Bank have advocated that developing nations cannot be left behind in the adoption of ICT (World Bank ICT strategy, 2012). The World Bank strategy for ICT adoption in developing nations stated that ICT can help developing nations in areas such as governance, health, education, financial services and job creation.

Governments and international organisations in the developing nations are encouraging both businesses and voluntary and non-governmental organisations to adopt ICT in their fight against poverty and economic deprivation (Ocean, G, in https://cit.mac.ac.uk). Writing on the importance of ICT, Ocean G. thinks that wealth creations and the fight against multiple deprivation and poverty cannot be tackled by economic measures alone. He thinks that ‘two of the most significant forces shaping organizations are globalization and … information technology’.

Developing nations have always transferred technology from the West in various sectors as technology has been seen to help in improving the standard of living (AL-Mabrauk and Soar, 2009). There has been various papers on ICT transfer and adoption in developing nations with its attendant successes and failures (Huang and Palvia, 2001; Apulu et al, 2011, Kyobe, 2011; Giovannis et al, 2012). These works have covered various ICT adoption issues in areas such as banking, education, SMEs, agribusiness, insurance, governance among many others. In almost all these areas, the economic return of ICT is easily measurable. This researcher assumes that the economic viability and competitiveness of these sectors must have influenced the increase in their ICT deployment and adoption.

This research on which this paper is based seeks to delve into one of the areas that have received little attention, perhaps because there may not be measurable return on investment. This is the non-profit organizations popularly called NGOs. An organization that researches on ICT among NGOs in Africa (www.potentialafrica.com) thinks that NGOs are having difficulties accessing funds for ICT investments because financial measures do not exist to measure such investments and so funders are reluctant to invest in them. This research will dwell on NGOs in Nigeria.

More and more non-profit organisations adopt ICT every year as they have seen that ICT is more readily available and costs less and they use tools such as the internet as a major driver in the role they play in a complex, connected world. As resources are lean from funders for ICT, it becomes important for NGOs to properly identify and implement their ICT solutions so as to maximize their minimum resources for greater developmental output as one of the problems of NGOs is inability to identify appropriate ICT solutions and link them to their missions (www.potentialafrica.com).
Research Problem

Improving the access to knowledge for poor nations has been the priority for development bodies (United Nations Summit on Information Technology, 2003). In her work with NGOs in India and their use of ICT, Jakimow (2012) states that the transformation of ICT has not had the anticipated effect on non-governmental organization. She stated that “the condition in which NGOs work are the same whether in India or Nigeria” (p.3) and so NGOs in both countries as in many other developing nations still have not explored the potentials of ICT in their work.

NGOs in developing nations can use ICT to amplify the voices of the poor and build alliance (p9). They can use ICT to enable access to resources as well as enabling the flow of information and knowledge reducing temporal and spatial constraints. Jakimow thinks that one of the problems NGOs have in their adoption of ICT is that there is “lack of empirical accounts on how people engage with these technology” (p.56). In other words, there are no adoption and implementation models or measurements.

This research hopes to respond to this gap by studying literature to see the ICT adoption models that exist and see if they can be adopted in the engagement of NGOs with ICT in a developing country such as Nigeria. It seeks to highlight variables that can enable a better adoption model for ICT by NGOs in Nigeria. Jakimow (2012) suggests further research in understanding behaviour in accessing information technology. What is it that makes people/NGOS to accept or use a medium of communication? A study of how people and organization interact with technology would involve looking at the models for technology adoption. The research concentrates on developing nations as technology is still in infancy in these places. Though the study hopes to concentrate largely on ICT adoption among NGOs in Nigeria, a cursory look into other areas technology have been adopted in developing nations will be necessary to understand better, the successes and teething problems associated with technology in a developing nation. These varied institutions include educational institutions, insurance companies, banks, SMES, libraries and agro-institutions.

In his study of a model for ICT acceptance in Nigeria for teachers in higher educational institutions, Oye and Lahad (2011) considered technology acceptance model (TAM) and suggests that a combination of this model and unified theory of acceptance and use of technology (UTAUT) will be a better model for understanding how these teachers interact with technology. Chatzoglou et al (2010) considers TAM a better model in their study of Greek SMES, they however noted that the model is insufficient as many more factors needed to be included in the model to fully understand how these SMES accept computer. Spacey et al (2004) had earlier looked at how public library staff adopts internet technology in the UK and suggested TAM as better model after looking at other models such as Theory of Planned Behaviour (TPB) and Theory of Reasoned Action (TRA). They considered TAM as further development of TRA and TPB to include constructs that better measured IT usage and lent itself to detailed factor analysis. Many other works that have utilized the TAM model for studying technology adoption in developing countries (Abbasi et al, 2011; Gidhagen and Persson, 2011; Kim 2012; Giovanis et al, 2012) all see TAM as a good model for technology adoption but most suggested inclusion of some other factors to fully understand technology adoption. Some of such factors include enjoyment, culture and technology readiness. They think that while TAM covers usage of IT in adoption, it may not have been too adequate for measuring intention to use and some other constructs. Building on these earlier works, this research will not dwell on repeating a study of these other models already considered.

UTAUT was proposed by Venkatesh et (2003) as a theory that combined seven earlier major theories including TAM and which covers all the variables for measurement included in TAM and other popular earlier models. This research will concentrate on studying technology adoption among NGOs in Nigeria using the UTAUT model. The research will attempt to answer the following questions: How has technology been adopted and used by NGOs in Nigeria? Is UTAUT model of technology adoption suitable for NGOs in Nigeria? Are there other constructs to include in UTAUT model in order to get a better adoption model for NGOs in a developing country such as Nigeria? These constructs will be measured to see how they support or disagree with the hypotheses that the research will propound and their suitability as either predicting or moderating factors for technology adoption among NGOs in Nigeria.

Non-governmental Organizations in Nigeria

Non-governmental organizations working in development have increased their profile in the last two decades (Lewis and Kaiyi, 2009). NGOs are seen as important actors-partners or opposition activists in various nations of the world. NGOs play important roles in shaping our society (Burgos, 2013). Nigeria has over 1000 NGOs including both local and non-local ones. These NGOs are supposed to register with a government body called Corporate Affairs Commission with headquarters in Abuja, Nigeria. NGOs, especially, the international agencies have been involved in development projects in Nigeria for a long time (Nkereuwe, 1996).

The failure of governance in Nigeria and the preponderance of corruption led to emergence of various local NGOs which complement the international ones in acting as advocates of good governance, social critics, empowerment and provision of skills for the masses (Brownberger William N, 1993; Osoba S.O, 1996; Smith Daniel J,
NGOs and ICT

NGOs especially in developed countries have used ICT in its various forms to enhance and improve their works. David and kanji (2009) states that the rapid growth in communication technology has changed the way NGOs work (p.155). Technology enables NGOs to react more promptly to events and open ways for NGOs in which they can deploy information for campaigning and advocacy. Aid agencies see the development of ICT as “a necessary adjustments to the overall development of the economy” (Nkereuwen, 1996, p25). The utilization of the internet has made NGOs reach a wider scope and bring their message to more global audience as well as link people to the state and resources (Burgos, (2013), Jakinow (2012)). The internet empowers NGOs with better access to Knowledge and ability to disseminate it.

Communication tools such as mass communication technologies, hand held devices with capability for fast data-transmission and wider connectivity helps NGOs reach global constituencies and raise funds. Most new media do not just allow NGOs to communicate faster but helps to communicate more effectively. There is a shift from mass media to interactive media (Bach and Stark, 2004, p101). Interactive media compresses space and time and combines real-time and enables many to many communications. It interprets information from various sources and transmits same to diverse audiences (op.cit).

Modern communication technology helps data to be shared at multiple points and this helps for better response times in cases such as where there are humanitarian needs (Tapia et al;2013). The sharing of data makes the work of NGOs easy and saves lives as there will be better information coordination and sharing. With information technology, information has shifted from being a discrete property to being “communication and distributed intelligence” (Bach and Stark, 2004, p.109). Advances in ICT are changing not just the way NGOs work but in some cases the NGOs themselves (Lewis and Kanji, 2009). NGOs which use modern technology react quicker to events than the traditionally non-technology aligned ones (op.cit. p.157). It is also possible for NGOs to measure their performance through the use of ICT. This information may be necessary for government and funding decisions.

Some NGOs in developing countries now use various forms of ICT in their jobs. In Bangladesh for example, a group of farmers in a village use mobile phone technology provided and enabled by an NGO to access up to date local market information and know the best place to sell their produce. They do not need to travel to remote rural areas with hope of finding buyers without prior information (Lewis and Kanji, 2009). Another Irish NGO (concerned worldwide) in partnership with safari.com used mobile phones to provide cash transfer to people in Kenya who were displaced following the 2007 post elections violence. This surely enabled speed and reduced bureaucratic and transportation costs. NGOs have used ICT to help people improve their health and welfare, access their rights and improve their lives (Jakinow, 2012). ICT helps create opportunities, easy dissemination of knowledge for development as well as better service delivery.

There has not been much research work on NGOs in Nigeria and the use of ICT. This research will delve into this area of study using the UTAUT model. This model will be extended to adapt it successfully for the adoption and use of technology by NGOs in Nigeria and other developing countries.

Proposed Research Model

The unified theory of adoption and use of technology is an attempt by Venkatesh et al (2003) to synthesize and integrate constructs from eight existing technology adoption models. UTAUT tried to study and integrate the constructs of each model, combining them together in order to propose one unified model.

The model was proposed and validated so as to provide a unified theoretical base for enabling research on information system adoption. Before UTAUT, TAM was the widely used theory for IT adoption (Venkatesh et al, 2003). The other existing models incorporated into UTAUT were: Theory of Reasoned Action (TRA), the Motivational Model (MM), the Theory of Planned Behaviour (TPB), the Innovation Diffusion theory (IDT), combined Theory of Planned Behaviour/Technology Acceptance model (C-TPB-TAM), the Social Cognitive theory (SCT) and the model of PC Utilization (MPCU).

The constructs from these models include Attitude, subjective norm, perceived usefulness, Perceived ease of use, experience, voluntaries, job relevance, Extrinsic motivation, intrinsic motivation, Affect, perceived behavioural control, Habits, social factors, relative advantage, complexity, self-efficacy, anxiety, among others.

Prior to the UTAUT model, no comprehensive instrument was available to measure these varieties of perceptions of IT adoption and diffusion until Venkatesh et al (2003) attempted to compare and review the existing user acceptance models and
developed one Unified theory of adoption and use of technology. This theory called UTAUT model, he proposed by integrating all the major constructs from other existing models.

The UTAUT theory hypothesized four indicators which influence behavioural intention and usage. These are moderated by age, experience, gender and voluntariness. Venkatesh et al (2003) also proposed that user behaviour is significantly influenced by behavioural intention. This integrated view of information system research forms the basis for this research. By studying existing literature on UTAUT and other technology adoption models in developing countries, this research hopes to extend this model by incorporating constructs such as culture, fun and technology readiness.

UTAUT theory offers a basic framework for explaining the influence of external variables towards behavioural (WU et al, undated paper). It also tries to understand how different people interact with and influence technology use. It looks at the relationship between ease of use, perceived usefulness, intention to use and how they are moderated by age, experience and gender. The initial study of UTAUT by Venkatesh et al (2003) concentrated on large organization. Our study will be based on both large and small NGOs.

According to Venkatesh et al (2003), four main constructs are directly determining the intention to use technology and in more than one of the individual models. Four among these will play a significant role in directly determining behavioural intention and use of technology while four others are moderators of the four constructs. They direct constructs are performance expectancy, effort expectancy, social influence and facilitating conditions. Some other constructs such as attitude towards using technology, anxiety and self-efficiency are theorized but they are not directly significant. The four key moderators are proposed; gender, age, experience and voluntariness of use.

UTAUT theory has been tested in different environments and various studies have shown that the theory is impacted by many external variables. There has been attempt to revise the model by the proponents in what is referred to as UTAUT 2. These shows the model is susceptible to modifications.

Our preliminary study of this model shows that it is set in developed countries. Various authors who have studied the model and who wrote on other models for developing countries emphasized the importance of culture in these countries. Culture is a necessary ingredient for understanding the adoption and diffusion of technology in developing countries (Omekwu, 2006; Abushanab and Pearson, 2007; Maldonato et al, 2011; Gombachika and Khangamwa, 2013). Even Venkatesh (2003) supported culture as a critical instrument that can influence adoption of technology when it suggested that future research should “identify the underlying mechanism” (p. 469) that could influence the technology adoption. The work mentioned social or cultural background as one of the candidates for this study. Our study of UTAUT in this research will extend to investigating the influence of culture on technology adoption. This research hopes to propose that culture will significantly impact on technology adoption.

H1: Culture has a positive effect on intention to adopt technology.

Another variable that cuts across literature is enjoyment or fun. Chitourou and Souiden (2010) think that fun is important factor to consider in technology adoption. Though individuals may still use technology due to its usefulness even if they have negative attitude towards it (Rachel et al; 2004). Enjoyment should be a critical factor that can influence ease of use of technology (Kim, 2012; Chitourou and Souiden, 2012). They suggest that there will be greater willingness to use technology if it is enjoyable to the user. This supports Venkatesh (2003)’s hypothesis that intention to use has a significantly influence technology adoption. So we can test a further hypothesis in our research.

H2: Fun has a significant relationship with intention to use technology among NGOs in Nigeria.

This may help to explain the reason NGOs may either accept or refuse to use a particular technology. A detailed discussion of these will be carried out in the course of the research

Another variable that may need to be considered is technology readiness of an organisation. Omekwu (2006) in studying African culture and libraries called for readiness of the libraries for the challenges of information technology. He thinks that if inevitable challenges of e-readiness are not addressed, technology adoption and diffusion will still lag behind in Africa. Omoride et al (2012) still on Nigeria libraries and ICT emphasise the need to have a comprehensive ICT plan and be ready for ICT technology in order to meet their challenges. In their study of ICT readiness and acceptance among TEVT students in university of Malawi, Gombachika and Khangamwa (2013) concluded that ‘technology readiness determine people’s predisposition to embrace and use new technologies’ (p.36). For them, attitude towards technology is related to technology readiness without any influence for the moderators suggested by UTAUT model. Even though Dada (2006) in his study of e-readiness for developing countries had argued that the fact that a country’s e-readiness did not mean that organisations in that country would adopt technology, this research proposes to test the influence of e-readiness on the adoption of technology by NGOs in Nigeria.

H3: There is a significant relationship between Nigeria’s technology readiness and the use of technology by non-governmental organisations in Nigeria.
The research model to be tested in this study will also include some of the hypotheses of UTAUT model. According to UTAUT model, it is hypothesized that behavioural intention and facilitating conditions are determinants of use behaviour. Effort expectancy, social influence and performance expectancy following the UTAUT model will determinants of the behavioural intention of NGOS in Nigeria to adopt technology. This study will not include nor test the moderators of age, gender, experience and voluntaries of use. This is because, as we noted in our discussions above, information technology is relatively new in developing countries and NGOS in Nigeria have been a new development. It is assumed that users of technology in them will be relatively young in age and experience and an organization is more likely to limit voluntariness of use of technology among its staff in a developing country such as Nigeria.

All the other research hypotheses in this research are proposed in line with the original UTAUT model hypothesis except that the moderators are excluded.  

**H4:** Performance expectancy has a positive effect on behavioural intention to use technology by NGOS in Nigeria.  

**H5:** Effort expectancy has a significant relationship on behavioural intentions to use technology by NGOS in Nigeria.  

**H6:** Social influence has a positive effect on behavioural intentions to use technology by NGOS in Nigeria.  

**H7:** Facilitating conditions significantly influence behavioural intentions to use technology by NGOS in Nigeria.

The proposed research model is presented below:

![Research Model Diagram](image)

The shaded variables are extensions to existing technology acceptance model.

**Summary and areas for further studies**

This paper has reported a preliminary conceptual study of the impact of information technology in the third sector of the Nigerian economy. An extended technology acceptance model is used as a theoretical underpinning. The added variables are fun, culture and technology readiness. Associated hypotheses are also developed. These hypotheses will be fully proposed, supported and tested in the research and the results presented as contribution of this research to IS/IT studies and adoption models especially for Nigeria and likely with extended applicability to other developing countries.

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Land monitoring in Nigeria using geo-spatial data mining approach
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Abstract: The survival of human beings is in relation to the availability of land for the use of agriculture and other conservative activities. In Nigeria, a country in the Sub-Saharan Africa, improper land use is on the increase while farming at either small or large scale is being neglected and this has led to the increase in food security problem. The challenge is that the government has not been able to make crucial decisions, planning and sustainable policies on land use. In this work, Geo-spatial data analysis of a typical land area is done using filtering, feature extraction and Bayesian classifier. The result shows 92.7% classification. This will help ameliorate the challenge facing the government and lead to land adequate monitoring thereby facilitating its proper use.

Keywords: Land use, geo-spatial, data mining, Nigeria

I Introduction
Land occupies a unique place in the development process of any individual or society. The supply of useable land is, however, limited. No society therefore, exists without a regulation of some kind peculiar to it to rationalize the mode of ownership and the use of land (Laarakker, 2013)

According to Obaseki (1988) Land includes land of any tenure, buildings or parts of buildings (whether the division is horizontal, vertical, or made in any other way), and other corporeal hereditaments. In Nigeria’s traditional setting, for instance, land was not viewed as a mere economic tool, rather it had religious and other social functions. Thus, native rule was rightly seen to depend upon the native land system. In the strict native rule and custom, land was believed to belong to the living, the dead and the unborn. Land, therefore, had metaphysical content and was viewed as an inherent part of social relations process between people, society and gods (Carlisle, 1999).

The promulgation of the Land Use Decree in 1978 was an exercise to redirect the general philosophies of pre-existing land tenure systems in our society through the application of a uniform statutory regulation of ownership and control of land rights. Hence, sustainable land use implies activities that are ecologically sound, socio-culturally acceptable, economically viable as well as equitable in terms of access to land resources, benefits and decision-making process (Schwabe, 2001, Atilola, 2013).

Government is faced with the aforementioned problems of making crucial decisions on deforestation, agriculture, and food security amongst others. These problems have constituted a stumbling block against the millennium’s development goal and proper land use monitoring is a key for food security. Craig (2005) reported the major challenge in Africa to be that many countries on the continent do not have the foundational geo-information needed to create the spatial layers of information for use in the implementation and monitoring of national and regional development strategies such as the New Partnership for Africa’s Development (NEPAD).

II Land Use Availability and Usage
In many countries, projected population increases superimposed on existing land holding pattern will result in an incredible increase in poverty as a result of accelerated erosion, deforestation and desertification along with continued loss of the genetic resources needed to provide a steady stream of new seed varieties (USAID, 2000). Land use coupled with the effort of small farmers is the key instruments for achieving sustainable increases in yield and productivity. However, insecurity of tenure, especially among small-scale farmers, has been known to act as a disincentive to the conservation of resources, including reforestation and soil conservation projects.

In Nigeria, land use problems that result into land pollution and are accorded highest priority range from the many causes of deforestation, soil erosion and dumping or disposal of both industrial and domestic wastes that are hazardous or harmful and consequently render land unproductive or degrading and unsustainable (Akponmre and Nyorere, 2012).

An important resource on land which has been grossly abused and unsustainably used is our forests. Forests provide human beings with a wealth of benefits including contribution of about 19% of the energy supply of lower income countries through fuel wood resource, provision of resource base for agriculture, tourism, recreation, religion, culture, music, etc. Despite these functions/benefits our forests have been degraded through unsustainable logging, shifting agricultural
practices, fuel wood gathering, bush burning and overgrazing of land (Ladan, 2007). For centuries, shifting cultivation and trans-human pastoralism systems allowed people to derive their livelihood in a sustainable manner from nature. When soil fertility declines or pasture vegetation disappears, people move to new lands and allow natural regeneration of used lands to its original state. The fallow period could be between 10-20 years. With increase in population, farming and pastoral land has become scarce and new forest lands have been opened up for both traditional and mechanized farming, even in urban centres land use poses a serious challenge (Ibrahim and Kwankur, 2012). An example can be found in Nigeria where forests were reserved for palm and rubber plantation development (FEPA, 1998). By 1994, about 83,672 hectares of such area were de-reserved. Fallow periods have been shortened while in several communities repeated farming on the same piece of land is carried out using the same traditional systems that are suitable only for shifting cultivation. The effect is non-restorable soil fertility, low crop yield and farmers’ migration to marginal land that encroaches into forests.

A Federal Government study showed that firewood is the source of energy for 80% of the rural population. With increasing cost of fossil fuel energy, it is likely that there will be increased dependence on firewood for energy supply. The increasing demand for firewood accelerated the rate of woodland destruction, soil degradation, river silitation, desertification and general environmental degradation (David, 2011). Other factors are bush burning, overgrazing of land as a result of cattle rearing.

A Geo-Spatial Data Mining
Geo-spatial data mining is a branch of data mining, but differs from the general spatial data mining and data mining associated with business databases. Geo-spatial data mining has large space dimensions vis-à-vis the general data mining. Spatial data mining extracts existing knowledge, the space relation or other meaningful features of database space. Shekhar et al (2003) described spatial data mining as the process of discovering interesting and previously unknown, but potentially useful patterns from large spatial data sets. Useful patterns extraction from spatial datasets is more complex than the corresponding patterns from traditional numeric and categorical data.

III Conceptual Land Use Monitoring Model and Model Analysis

Figure 1: Conceptual Land Use Monitoring Model
The pre-processing of geo-spatial data is stored in the database by removing noise and smoothened using the Gaussian filter.

Feature extraction of features is essential for accurate classification (Hermosillo, 2010). It concerns finding shapes in computer images. In feature extraction, the invariance is calculated.

A The naive Bayes probabilistic model
The probability model for a classifier is a conditional model

\[ P(C|F_1,\ldots,F_n) \]

over a dependent class variable \( C \) with a small number of outcomes or classes, conditional on several feature variables \( F_1 \) through \( F_n \). The problem is that if the number of features \( n \) is large or when a feature can take on a large number of values, then basing such a model on probability tables is infeasible. We therefore re-write the model to make it more tractable.

Using Bayes' theorem, we write

\[ P(C|F_1,\ldots,F_n) = \frac{P(F_1,\ldots,F_n|C)P(C)}{P(F_1,\ldots,F_n)} \]  

The above equation can be written as

\[ \text{Posterior} = \frac{\text{prior} \times \text{likelihood}}{\text{evidence}} \]  

In practice, only the numerator of that fraction is of interest, since the denominator does not depend on \( C \) and the values of the features \( F_i \) are given, so that the denominator is effectively constant. The numerator is equivalent to the joint probability model

\[ P(C,F_1,\ldots,F_n) \]  

which can be re-written as follows, using repeated applications of the definition of conditional probability:

\[ P(C,F_1,\ldots,F_n) = P(C)p(F_1,\ldots,F_n|C) \]

\[ = P(C)p(F_1|C)p(F_2,\ldots,F_n|C,F_1) \]

\[ = P(C)p(F_1|C)p(F_2|C,F_1)p(F_3,\ldots,F_n|C_1,F_1,F_2) \]

\[ \text{etc.} \]
The "naive" conditional independence assumptions come into play: assume that each feature $F_i$ is conditionally independent of every other feature $F_j$ for $j \neq i$. This means that $p(F_i|C, F_j) = p(F_i|C)$ for $i \neq j$, and so the joint model can be expressed as

$$p(C, F_1, ..., F_n) = p(C) \cdot p(F_1|C) \cdot p(F_2|C) \cdot p(F_3|C) \cdot \cdots \cdot p(F_n|C)$$

This means that under the above independence assumptions, the conditional distribution over the class variable $C$ can be expressed like this:

$$p(C|F_1, ..., F_n) = \frac{1}{Z} p(C) \prod_{i=1}^{n} p(F_i|C)$$

where $Z$ (the evidence) is a scaling factor dependent only on $F_1, ..., F_n$, i.e., a constant if the values of the feature variables are known. Models of this form are much more manageable, since they factor into a so-called class prior $p(C)$ and independent probability distributions $p(F_i|C)$. If there are $k$ classes and if a model for each $p(F_i|C = c)$ can be expressed in terms of $r$ parameters, then the corresponding naive Bayes model has $(k-1) + nr$ parameters. In practice, often $k = 2$ (binary classification) and $r = 1$ (Bernoulli variables as features) are common, and so the total number of parameters of the naive Bayes model is $2n + 1$, where $n$ is the number of binary features used for classification and prediction.

IV SYSTEM IMPLEMENTATION

The proposed model used for this project makes use of the supervised method of classification which classifies the extracted attributes from aerial images into different categories based on the attributes (features).

A Implementation of Naïve-Bayes approach

Let $X_1, ..., X_m$ denote our features (attributes), $Y$ is the class number, and $C$ is the number of classes. The problem consists of classifying the case $(x_1, ..., x_m)$ to the class $c$ maximizing $P(Y = c| X_1 = x_1, ..., X_m = x_m)$ over $c = 1, ..., C$. Applying Bayes’ rule gives

$$P(Y = c| X_1 = x_1, ..., X_m = x_m) = \frac{P(X_1 = x_1, ..., X_m = x_m| Y = c) \cdot P(Y = c)}{P(X_1 = x_1, ..., X_m = x_m)}$$

which $X \cap Y$ is the intersection of the two events, $X$ and $Y$. This indicates that if the events, $Y$, and $X$, can both occur, then the probability of such an occurrence is equal to the probability of the $X$ occurrence multiplied by the probability of $Y$, given that $X$ occurs,

$$P(X \cap Y) = P(X) \cdot P(Y|X)$$

The denominator is invariant across classes, and therefore can be ignored. Under the NB’s assumption of conditional independence, $P(X_i = x_i, ..., X_m = x_m | Y = c)$ is replaced by $\Pi P(X_i = x_i | Y = c)$ and the NB classification reduces the original problem to that of finding $i=1$ (that is, the group 1 class)

$$\hat{c} = \arg\max_i P(Y = c| X_1 = x_1, ..., X_m = x_m)$$

All discrete (categorical) features estimating the probabilities in (1) can be done using frequency counts. In other words, $P(X_i = x_i | Y = c)$ is estimated as $(#(X_i = x_i, Y = c))/#(Y = c)$, where $#()$ denotes the number of cases in the training data set satisfying the condition in parenthesis.

B The pre-processing

In this stage, the geo-spatial data undergoes filtering so as to achieve enhanced data. The images to be filtered are gotten from Google maps (Akure as a case study). The image shows the land use.

Figure 2: Aerial image of Akure metropolis (2010)

Pre-processing of the image is done using a filtered image of standard deviation of 1, 7 x 7 matrix using Matlab. The filtered image is stored for feature extraction.

C The Feature Extraction phase

The filtered image is shown below, in which desired area is extracted. This was input into the program TerraView which has geoDMA. TerraView is used for land analysis and other functions pertaining to land while geoDMA which means geographical data mining...
analyst does a lot of things ranging from segmentation to classification. Figure 3 shows the aerial image on left and the processed image on right.

Figure 3: Unfiltered and filtered image
Extraction, normalization, training, visualization and classification were done. Segmentation was initially carried out, and then features were extracted. Features with prefix \( p_ \) are spatial (use polygons), and with prefix \( c_ \) are cell-based (use cells.). Features with prefix \( r \) are spectral, combined with polygons \( r_ p \) or with cells \( r_ c \). Normalized features in the next tap have the \_n suffix.

The attributes are shown below.

![Segmented image showing its database](image)
Features such as \( p_\text{angle} \), \( p_\text{area} \), \( p_\text{box_area} \) are extracted.

**D Classification**
The classification is done using GeNIe which makes use of the Bayesian network classifier embedded in it to classify extracted data. The network is graphically displayed in the Graph View. This is used for building graphical decision-theoretic models. Geospatial data extracted is stored in the GeNIe. The mean, variance, standard deviation, minimum, maximum and count are computed and displayed in a relational database mode and also the correlation matrix is gotten. Figure 5 shows the statistics interface displaying the mean, variance, standard deviation, minimum and maximum and also the count of data mined from the aerial image.

**E The Network Bayesian MACRO**
The text of the macro for Naïve-Bayes classification is shown below. It has five parameters:
- training data set (contains classified cases);
- score - data set containing cases to be classified;
- nclass - \# classes (C);
- target - name of the variable in the ‘train’ data set that has the class number (Y); ‘target’ is assumed to be a numeric variable with values 1,2,... for classes 1, 2, and so on; if it is not, it has to be recoded before running the macro;
- inputs - the list of features’ names \( (X_1, \ldots, X_m) \).

Table 2.0 illustrates the classification results. The training data includes 3,377 observations of which 92.7% \((153151+39061)/3377\) were correctly classified by the NBC, and the testing data includes 3377 observations of which 92.7% \((76521+19565)/3377\) were correctly classified.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Increase</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train (Training)</td>
<td>153,151</td>
<td>1,321</td>
</tr>
<tr>
<td>Test (Testing)</td>
<td>76,521</td>
<td>645</td>
</tr>
<tr>
<td></td>
<td>6944</td>
<td>19565</td>
</tr>
</tbody>
</table>

**V CONCLUSION**
A 3-phased conceptual model based on Bayesian classifier for a given geo-spatial data is presented. It comprises geospatial image processing, features extraction and classification using Bayesian classifiers. The result shows 92.7 classification. Consequently, if adopted, land use monitoring will become easier for the government. Thereby enhancing decisions making, planning and policies formulation. The multiplier impact will enhance the citizens’ livelihoods as well as achieving sustainable development in Nigeria with Vision 2020:20.

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Social media for knowledge sharing in African development institutions: a viewpoint paper

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Abstract: Social media and its use have been studied in many contexts. An area that still needs to be explored is development institutions. This is a viewpoint paper that focuses on Africa. It is intended to wet the ground for a future systematic secondary and empirical study that should investigate the dynamics of using social media in development institutions.

Keyword: Social media, development institutions, knowledge sharing, communication, collaboration.

Background: Before answering the question of how African development institutions can use social media to share knowledge, it may be appropriate to establish what development institutions are, why share knowledge, why social media.

This topic takes me on a memory lane to my undergraduate days that culminated in 1983 with a dissertation on the impact of NACB (Nigerian Agriculture and Development Bank) on the agricultural sector of Cross River State. I realized that commercial contributions to economic development are limited because of their short-term view of lending. Investment banks improve in their lending term but are still inadequate perhaps because of their primary profit motive.

Sometimes too, government funds are inadequate to lend long-term for essential economic development. Thus development banks like the NACB come in and are able to attract funding from international agencies like the World Bank to needed areas. Among the clients of NACB involved in my primary research was a retired chief executives of a government department who was then in the fishing industry, poultry farmers and feeds producers and other agriculturists. I saw them perform at a scale to not only increase the food production but also generated employment to citizens.

Development banks are not the only institutions on the list of development institutions. At http://www.devdir.org/files/AfricaA.PDF is a 1,155 page directory of development institutions in Africa. The institutions range from international organizations, government institutions, private sector support organisations (including fairtrade), development consulting firms (including references to job opportunities and vacancy announcements), information providers (development newsletters and journals), to grant makers. So wide is the range of institutions that it would be difficult to cover in details how each of the institutions can use social media for knowledge sharing and collaboration.

Nonetheless, the common denominator for development institutions is the aim to fight poverty and to improve people’s lives. Development banks for instance played a crucial role in the rapid industrialization process of Continental Europe and Japan (Aghion, 1999). They counteracted underinvestment and under-transmission of expertise in long-term industrial (and I would add, agricultural) financing. How does knowledge sharing come into their business?

The need for knowledge sharing
Knowledge or intellectual capital is increasingly recognized as a greater contributor than physical assets to organizational wealth (Hislop, 2013). Perhaps the most crucial aspect of managing this capital is sharing. Explicit knowledge is easier shared because it has been codified eg on computer databases but tacit knowledge is implicit and may not even be realized by the owner. In recognition of the importance of tacit knowledge, modern knowledge management systems do not stop at developing data or knowledge bases but also provide collaborative and communication tools.

The basic email system and intranets facilitate knowledge sharing. However, to take advantage of the innovative interactive and content-sharing facilities of Web 2.0 which was launched in the early 2000s, social media has emerged as a very important tool.

The rest of this paper will present (a) the need for knowledge sharing; (b) the need for social media; (c) how social media can be used for knowledge sharing in African development institutions; and (d) conclusion and areas for further investigation.

The need for social media
Social media can be defined in the broadest sense as any online service that enables users to design, create, edit and share a variety of content. Some of the common features of social media are (Li, 2011):

- Blogging: users can upload materials (photos, diaries, videos etc) which are chronologically organized;
- Grouping: users can join a group of people with something in common such as same college, company or city.
• Networking: users can add or remove friends at any time;
• Instant messaging: users can send instant messages to their friends.

Initially social media was for entertainment but its dynamism, interaction, collaboration, participation and trusting environment turn them into normal business and organizational tools. The technological support of Web 2.0 social networks and virtual communities creates an avenue for people to learn together and share experiences (Elia et al, 2009). Utilising the engaging power of social media in virtual relationships, organisations are immersing themselves into “people’s internet” and learning to transform the “likes,” “shares” and “comments” into useful customer knowledge (Andriole, 2010). It is therefore common to see businesses launch Facebook pages, Twitter accounts, YouTube channels and blogs to endeavor to maintain relevance among competition and to establish and strengthen bonds with clients (Mitic and Kapoulas, 2012).

Facebook was originally for sharing of personal information mainly with the use of blogging but organisations are using them too. LinkedIn is mainly for professional information sharing in the social networks. YouTube is for sharing of videos, Flickr for photographs, DocStoc for documents and SlideShare for presentations and these platforms also allow other’s evaluations and opinions on what are shared.

RSS (Really Simple Syndication), podcasting, Atom (a web publishing language) and widgets are some of the new ways of broadcasting real-time text, video and audio information to customers or shareholders.

Wikis are special websites which allow entries and edits from different users. A good example is the Wikipedia (http://www.wikipedia.org/) which is internationally and freely written with the objective of collectively creating accurate and up-to-date common knowledge.

According to Bonsón and Flores (2011), social media is a good means for corporate dialogue even for financial institutions in this age that transparency is demanded of organisations.

How social media can be used for knowledge sharing in African development institutions

Many organisations such as IBM, General Electric and Shell have replaced cumbersome knowledge management systems with social media applications such as blogs (individuals’ publishing sites that allow others to make comments online in chronological order) and wikis because they share the belief that social media is the antidote to many barriers in knowledge sharing (Grace, 2009). How can social media be used for knowledge sharing in African development institutions? Since social media is all about two-way communication, the question is, with whom? We can break down into these three main groups:

Customers

Development institutions have organizational and individual customers who they serve. For example, as already explained, a development bank can have individual and corporate customers to lend money to. A development institution can use RSS feeds to update the clients on new information from their websites. Tweets can also be used. In a wider sense, the general citizens of the society can be considered as customers of development institutions because eventually, the institutions want to alleviate their poverty and better their welfare. Since mobile devices (phones, tablets and laptops) are becoming very common even in developing economies and they are the main carriers of social media, there is plenty of communication among citizens of different groupings.

By tapping into these communications (eg through membership of groups) whether in the form of blogs or tweets, development institutions can guess their needs and their reactions to services provided. This useful information can aid them to create new products and services or even to adjust current ones. The social media can also aid them to gain accurate knowledge of their customer profiles which is crucial for organizational survival (cf Cader et al, 2013).

Development institutions can also set up Wikis to allow immediate and easy feedback on ideas and services. They can be used to monitor corporate social responsibility (Anonymous, 2012). Another interesting way social media can be used is to easily produce video material and post it on YouTube. That would more easily communicate to the public than just texts.

Staff (internal)

Organisational members constitute important source of intellectual capital by virtue of their qualifications, skills and experience. Successful organisations are those that can orchestrate these resources in a way that optimizes goals and objectives. Social media provides an easy and non-formal approach to unlocking this capital especially tacit knowledge. The University of the West of Scotland, for instance uses Yammer as a platform. Internal use of social media has not caught up as much as external. What development institutions may observe is that technology savvy staff have created a social media to share problems and solutions (Anonymous, 2013). In time, they may extend this effort to go beyond the organizational boundaries. Managers should take advantage and encourage the efforts including promoting staff use of LinkedIn to tap from internal and external knowledge stock.

For internal social media set up by institutions to work, institutions first have to adopt the qualities of a learning organization that makes members free to express themselves. However, to avoid disruption of
such freedom, reasonable boundaries have to be placed. For instance, unreasonable personal attacks (character assassinations) can be outlawed. The employees’ social media can also be used to enforce, re-enforce or introduce useful organizational culture. There is a known challenge of getting members to share knowledge. The social nature of the network should engender willingness to share. Besides, managers should consider different rewards (both intrinsic and extrinsic).

Inter-organisational
Most development institutions need to collaborate with sister organisations with whom they co-invest or operate and other organisations eg grant-makers. A Wiki can help the organisations to air their views on a common concern eg funding. Social networks of communities of practice can also be set up on individual basis but crosses organizational boundaries. For example, members across institutions who are in charge of organizing and managing events can share a social media to exchange information as well as to advertise their activities. The same social media, eg Face Book, can collect blogs (information) from their customers. Vuori and Okkonen (2012) found out in their research that a mey motivation for using intra-organisational social media is the making of everyday work easier and faster as well as the media ease of use. For instance, not only is it easy to send instant messages but also easy to produce high quality video and share (using YouTube).

Other ways that development institutions can use social media is for recruitment. Tweets can be used to advertise and LinkedIn can be used for head-hunting.

Conclusion and areas for further investigation
Africa can be regarded as economically poorer than developed parts of the world. However, social media has penetrated there as its technologies (mobile devices and Web 2.0) make economic sense to both individuals and organisations. African development institutions can utilise its power of networking and collaborative knowledge sharing to communicate internally and externally to and from customers and stakeholders. A future study should perform a systematic desk research in order to develop a theoretical model which should explain the application of social media in African development institutions. Such a model should be validated with an empirical study so that conclusions drawn from it can be used to by development institutions to benefit from the potentials social media in their work.

References:

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