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**Influence of Individual Differences on Computer Based Information (CBI)
Usage in Banks in Sudan**

Nawal Abdalla Adam*

ABSTRACT

Although information technology is available in businesses to support managers to make decisions, it is important to know how individual differences among those managers affect the usage of such technology. This paper seeks to investigate the influence of individual differences (age, level of education, and years of working experience) on computer based information (CBI) usage within the framework Technology Acceptance Model (TAM). Survey questionnaire was used to collect the research data from 120 randomly selected managers from banks in Sudan. Linear regression analysis was used to identify association between the individual differences and TAM's basic constructs (perceived ease of use (PEOU) and perceived usefulness (PU)). The research findings indicate that the selected individual differences had a significant influence on CBI usage by managers in banks in Sudan. Regression results, also, revealed that level of education had a significant positive association with both PEOU and PU. While age and working experience had negative non-significant association with both PEOU and PU. These findings have important implications on designing training programs for managers and on recruitment and selection of managers.

Keywords: Individual differences, Technology Acceptance Model (TAM), Computer Based Information (CBI).

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**أثر الاختلافات الفردية علي استخدام المعلومات المجهزة بواسطة الحاسب الآلي في البنوك في السودان
الخلاصة**

على الرغم من توفر تقنية المعلومات في منشآت الأعمال لدعم المديرين في عملية صنع القرارات, من الضروري معرفة مدى تأثير الاختلافات الفردية بين المديرين على استخدام هذه التقنية. تهدف هذه الورقة الى استكشاف تأثير الاختلافات الفردية (العمر, و مستوى التعليم, و سنوات الخبرة العملية) على استخدام المعلومات المجهزة بواسطة الحاسب الآلي في إطار نموذج قبول التقنية (TAM). قد تم استخدام أداة الاستبيان لجمع معلومات البحث من 120 مدير في البنوك في السودان تم اختيارهم عشوائيا. تم استخدام تحليل الانحدار الخطي لإيجاد الارتباط بين الاختلافات الفردية و المكونات الأساسية لنموذج قبول التقنية (السهولة المتوقعة (PEOU) و المنفعة المتوقعة (PU). أشارت نتائج الدراسة ان الاختلافات الفردية المختارة ذات تأثير معنوي على استخدام المعلومات المجهزة بواسطة الحاسب الآلي في البنوك في السودان. كشفت نتائج تحليل الانحدار أيضا أن "مستوى التعليم" له ارتباط ايجابي و معنوي بكل من السهولة المتوقعة و المنفعة المتوقعة . في حين أن "العمر" و "الخبرة العملية" لهما ارتباط سبلي غير معنوي بكل من "السهولة المتوقعة" و "المنفعة المتوقعة". هذه النتائج ذات مضامين مهمة على تصميم البرامج التدريبية للمدراء و على اختيار و تعيين المديرين

الكلمات الدالة: الاختلافات الفردية, نموذج قبول التقنية (TAM), المعلومات المجهزة بواسطة الحاسب

الآلي.

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INTRODUCTION

Computers and its applications are now available in most businesses in Sudan to provide various types of information needed by managers at different levels. But those managers differ in age, sex, and level of education, educational background, and working experience. There are many opinions and anecdotal evidence of the differences in personal technology usage between different demographic groups (Cisco, 2008). According to Agarwal et al. (1999) the notion that individual differences play a crucial role in the implementing of any technological innovation has been a recurrent research theme in a wide variety of disciplines including information systems, production, and marketing (e.g Harrison and Rainer, 1992; Majchrzak and Cotton, 1988; Zinkhan, Joahimsthaler and Kinner, 1987) . It is noted that many studies considered the relationship between demographic factors and attitudes toward information technology (IT) usage. But, little comprehensive research had been conducted to identify the relationship between demographic factors and IT usage. Karahanna and Galvin (2002) remarked that studies of the effect of individual differences on usage of information systems have yielded mixed results. This argument is supported by Cisco (2008) notice that some studies have been done, but a coherent picture of critical demographic factors and their impact on technology use has yet to emerge.

However, individual differences are ignored by most information technology acceptance models even Technology Acceptance Model (TAM). Although some researchers (e.g. Agarwal et al., 1999 and Burton-Jones and Hubona, 2005) attempted to include individual differences in TAM, but they failed to include all types of differences. This paper attempts to incorporate individual differences (age, level of education, and working experience) into TAM in order to examine their influence on computer based information (CBI) usage by managers in the banking sector in Sudan. Therefore, this paper tries to answer the following main questions:

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- How individual differences (age, level of education, work experience) influence with perceived ease of use (PEOU)?
- How individual differences (age, level of education, work experience) influence with perceived usefulness (PU)?

Accordingly, the research hypotheses could be stated as follows:

- H₁: Age of manager associates negatively with both PEOU and PU.
- H₂: Level of Education associates positively with both PEOU and PU.
- H₃: Years of working experience associates negatively with
- both PEOU and PU.

CONCEPTUAL BACKGROUND

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is considered as an information systems theory that models how users come to accept and use a system. The model was initially developed and tested in the 1980's (Davis 1986, 1989; Davis et al. 1989). The model suggests that when users are presented with a new software package, a number of factors influence their decision about how and when they will use it. Two factors have been identified as the most important constructs of the TAM, namely:

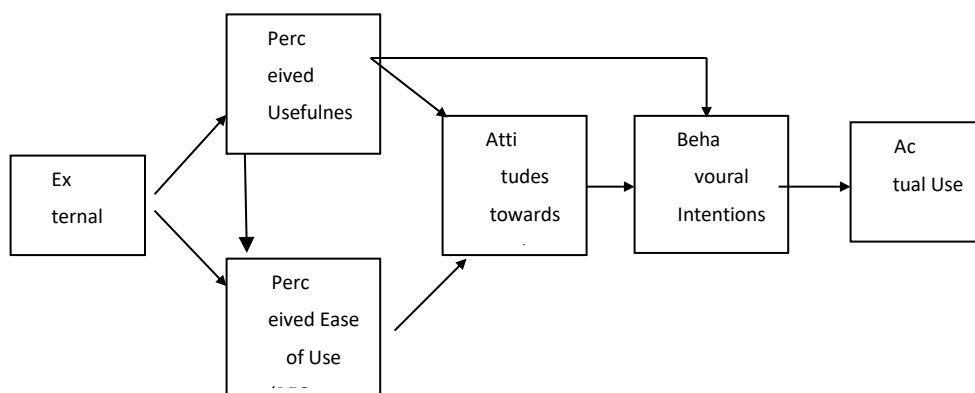
- 1. Perceived ease of use (PEOU):** Davis et al. (1989) defined PEOU as "the degree to which a person believes that using a particular system would be free from effort".
- 2. Perceived usefulness (PU):** PU was defined by Davis et al. (1989) as "the degree to which a person believes that using a particular system would enhance his or her job performance".

According to TAM both perceived ease of use (PEOU) and perceived usefulness (PU) have a significant impact on a user's attitude (A) toward using the system. TAM also posits

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that perceived ease of use (PEOU) and perceived usefulness (PU) determine an individual's intention to use a system (BI) with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use (Furneaux, 2006). The general model of TAM is presented in Figure (1).

Figure (1): Technology Acceptance Model (TAM)



Source: Davis et al. (1989)

Critical assumption of the Technology Acceptance Model (TAM) is that its belief constructs - (PEOU) and (PU) - fully mediate the influence of external variables (individual variables, organizational variables, and technological variables) on IT usage behavior (Burton – Jones and Hubona, 2005). TAM does not incorporate individual factors as a part of external variables that have an influence on information systems usage. Davis (1989) stated even though several theories have been developed to address this phenomenon a consensus about the determinants of IT usage has emerged among researchers in the IS field. Specifically, TAM is considered to be the most parsimonious model in explaining IT use at the individual level (as cited in Zakour, 2004).

Individual Differences

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The term “individual differences” refers to the use factors that include traits such as personality and demographic variables, as well as situational variables that account for differences attributable to circumstances such as experience and training (Agarwal, Ritu, Parsad, Jayesh, 1999, Alavi and Joachimsthaler, 1992; Harrison and Rainer, 1992). Individual differences selected in this study include age, level of education, and working experience. According to Yuandong; Zhan; and Lai (2005) previous studies suggest that individual differences have main effects on technology use and that they also interact with perceptions about technologies to influence technology use

Many researchers attempted to identify the psychological variables that distinguish users who accept or reject technologies. Alavi and Joachimsthaler (1992) suggest that the most relevant user factors determining technology acceptance are cognitive style, personality, demographic, and user situational variables. Among demographic variables that have been studied, age and education have been shown to influence system use in some context; where higher education attainment and lower age both seen to influence use positively but the relationship is weak.

Some researchers attempted to use TAM to examine the relationship between individual differences and CBI systems usage. Burton-Jones and Hubona (2005), for example, conducted a study to determine the effect of staff seniority, age, and education level on usage behavior. They found that these individual user differences have significant direct effects on both the frequency and volume of usage.

Yuandong, Zhan, and Lai (2005) incorporated individual differences into TAM and examined the influence of individual differences on information technology usage. Their research was aimed at exploring whether perceptions fully mediate the impacts of individual differences (age and gender) on technology use; and whether individual differences influence two dimensions of technology use (frequency of use and hours of use) in the same way. Partial Least Squares (PLS) results show that individual difference

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may directly influence technology use and that individual difference variables influence frequency and amount of technology use in same way.

*EDITORIAL***METHODOLOGY****Population and Sample**

The population of this study was the middle level managers in Sudanese banks. The banks considered in this study include 15 banks selected on stratified random sampling basis from amongst 22 commercial banks after they had been classified into Islamic commercial banks, Islamized commercial banks and specialized banks.

This study is confined to middle level managers at headquarters of the selected banks in Khartoum State. To determine the sample size (n), the standard simple formula was adopted:

$$n = \frac{z^2 \pi (1 - \pi)}{d^2}$$

Where:

n: the sample size.

π : the probability (prevalence) of the phenomenon under study.

Z: the standardized variable that corresponds to 95% level of confidence.

d: the desired marginal error.

Since the prevalence of the phenomenon under study, namely the use of CBI among banks' managers, is not known P at 0.5 has been set. Thus, with values of Z and d set at 1.96 and (0.000064), the sample size (n) is given by:

$$n = \frac{(1.96)^2 \times (0.5) \times (0.5)}{(0.000064)^2} \cong 120$$

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The research sample composed of 120 middle level managers selected randomly from the 15 banks (eight managers from each bank).

Instrument

Structured questionnaire was used to collect the research data. The questionnaire used comprised three main sections including questions related to individual characteristics of managers, PEOU, and PU. Questions related to PEOU were derived from Davis et al. (1989), Davis and Venkatesh (1996), Adam et al. (1992), and Doll et al. (1998). Whereas, questions that related to PU were based on Franz and Robey (1998).

First the questionnaire was pre- tested using a sample of 20 managers, selected randomly from different banks, in order to test its reliability and validity. All reliability values are greater than the minimum value of 0.70 required for a construct to be considered reliable, as suggested by Teo , Lim, and Lai (1999).

Total of 200 questionnaires were distributed to managers in headquarters of 15 commercial banks in Sudan in late 2006. Only 120 questionnaires were collected, giving response rate of 60%.

*EDITORIAL***RESULTS AND DICUSSION**

The data collected was coded and analyzed using Statistical Packages for Social Sciences (SPSS). Descriptive statistics and regression analysis were used for analyzing and identifying the correlation between the research variables.

To test the research hypothesizes, linear regression analysis was performed, where PEOU and PU were considered as dependent variables and individual differences (age, level of education, and working experience) were considered as independent.

Participants Profiles

It is clear from the Table (1) that 87.8% of managers included in the sample were males and 12.2% were females. The Table also shows that the majority of respondent managers were of age more than 46 years (37.5%). 52.6% of the respondent managers were bachelor degree holders. Also the majority of the respondents were of working experience ranging from 11 to 16 years (31.2%).

Table (1): Respondents' Profiles

Characteristic	Frequency	Valid percent
Sex		
1. Male	101	87.8
2. Female	14	12.2

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Age		
1. Less than 25 yrs.	3	2.5
2. 26 - 30	3	2.5
3. 31 - 35	9	7.5
4. 36 - 40	32	26.7
5. 41 - 45	28	23.3
6. More than 46	45	37.5

Level of education		
1.Secondary	17	5.8
school or less	10	8.3
2. Intermediate	63	52.6
Diploma	33	27.5
3.Bachelors	7	5.8
4.Masters		
5.Doctorate		

Years of Banking Experience		
3		2.7
1.1- 5 years	8	7.1
2. 6 - 10	36	31.2
3. 11-15	24	21.1
4. 16 - 20	21	18.4
5. 21 - 25	15	13.2
6. 26 - 30	4	3.6
7. 31 - 35	3	2.7
8. 36 - 40		

Source: Author (2005)

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Measures

The dependent variable PEOU was measured by the degree of easiness of the CBI system and understandability of the system. The construct's four indicators were: (1) the easiness of CBI systems, (2) the CBI system usage by manager in order to get what he wants, (3) the clearness of manager's interaction with CBI systems, and (4) whether the CBI usage requires a mental effort. Following Igbaria, et al. (1990, 1996), each indicator in the construct was measured on a six-point scale ranging from "strongly agree" to "strongly disagree".

To measure the dependent variable PU, indicators developed by Franz and Robey (1986) have been modified. The dimensions considered in the measurement of PU include the degree of dependence on the CBI system, benefits of the CBI system, precision and accuracy of CBI system output, and the degree of managers' interaction with the CBI system. The construct's five main indicators were: (1) improvement of quality of decisions, (2) the degree of dependence on CBI in decision making, (3) the quality of the output of the CBI system, (4) the benefits of CBI, (5) the problem with current CBI system's outputs, and (6) the extent of CBI usage in the bank. The scales used in the measurement of PU range from "not at all" to "very much".

The independent variables including age, level of education, and working experience were also measured. A single item measure was used for each of the individual factors.

REGRESSIONS RESULTS

The regression results presented in Table (2) reveal that, at the 1% significance level, individual differences (age, level of education, and working experience) taken together explain 1.8% of the variation in PEOU ($p < .05$). Age had a negative non significant influence on PEOU (Beta = -0.114, $p > .05$). Level of education accounted for 5.4% of variation in PEOU ($p > .05$). Working experience was negatively associated with PEOU (Beta = -.009, $p > .05$).

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Table (2): Regression of PEOU on Individual Differences

Explanator y variable	Estim ated Coefficie nt	Sig. Leve l	R ²	\bar{R}^2	F	S ig. L ev el
Age	-0.114 (t = - 0.908)	0.366				
Level of Education	0.054 (t = 0 .517)	0.607	0. 018	- 0.01	0 .5	5 %
Working experience	-0.009 (t = - 0.073)	0.942				

Source: Author (2005).

Table (3) presents the linear regression results used to examine the influence of individual differences (age, level of education, working experience) on PU. The results show that at 1% individual differences explain 9.7% of the variation in PU ($P < .05$). Age had negative non significant influence on PU (Beta = - 0.223, $P > .05$). Level of education had a

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significant influence on PU was accounted for 24% of the variation in PU ($P < .05$). Working experience has a negative non significant association with PU (Beta = 0.137, $P > .05$).

Table (3): Regression of PU on individual differences

Explanatory Variable	Estimated Coefficient	Sig. Level	R ²	\bar{R}^2	F	Sig.
Age	-0.223 (t = 1.940)	0.055	0.0	0	0.5	
Level of Education	0.240 (t = 2.439)	0.017	0.069	0.06	3.416	%
Working experience	-0.137 (t = -1.187)	0.238				

Source: Author (2005).

These results support the first hypothesis of the research (H_1), implying that age had a negative association with PEOU and PU. These results are, also, consistent with the findings Alavi and Joachimsthaler (1992), Man Lui (2001), Burton-Jones and Hubona (2005)). The second hypothesis (H_2), is confirmed by these results, implying that level of

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education associates positively with PEOU and PU. These goes in line with previous studies (Alavi and Joachimsthaler (1992), Burton-Jones and Hubona (2005), and Yuandong; Zhan; and Lai (2005)). The last hypothesis (H3) is also supported, indicating that working experience has a negative association with PEOU and PU.

CONCLUSION AND IMPLICATIONS

The research findings shows the selected individual differences (age, level of education, and working experience) had a significant influence on PEOU, PU, and therefore, CBI usage in banks. Within TAM constructs, PU was more influenced by the selected individual differences compared to PEOU. Level of education showed the highest significant association with PU, followed by age and working experience. Regression results, also, revealed that age and working experience had negative non significant association with both PEOU and PU.

These findings indicate managers who are older in age and those with long working experience are unlikely to perceive the usefulness of CBI or they perceive such type of information as difficult to understand. While the higher is level of education attained by manager, the more he/she is likely to perceive CBI as useful and easy to understand.

These results have important implications on the design of training programs for managers .It help in determine the level of training required for different group of managers after their classification along these differences. These results, also, have implications on recruitment and selection of managers. Selection of managers with lower ages, higher level of education attainment, and less working experience, is likely to guarantee more CBI usage. Also, these research findings have implications even on potential effectiveness and success of information systems in organizations, as suggested by Agarwal, Ritu, Parsad, Jayesh, (1999) and demonstrated by prior empirical research (e.g. Zmud, 1979, Harrison and Rainer, 1992).

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Limitation of this research should be outlined. It was conducted in Sudan, a country with its specialties; therefore its results cannot be generalized to banks in other countries. Therefore, more research is needed to the research to examine the research findings in other types of organizations and other contexts.

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APPENDIX

QUESTIONNAIRE

Please answer the following questions in reference to your usage of computer based information (CBI) in the bank.

PART I: INDEPENDENT VARIABLES

A- INDIVIDUAL DIFFERENCES (INFORMATION ON THE MANAGER)

1. Age

- | | | | |
|-----------------------|------------|---------------------|------------|
| 1. Less than 25 years | () | 4. From 36-40 years | () |
| 2. From 26-30 | () | 5. From 41-45 | () |
| 3. From 31-35 | () | 6. More than 46 | () |

2. Sex

Male _____
Female _____

3. Level of Schooling:

High School or Less _____

Masters _____

College _____

Doctorate _____

Bachelors _____

4. Present Function: _____

5. Working experience:

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- 1-Number of years in present position: _____
- 2-Number of years with present firm: _____
- 3-Number of years with management experience: _____

PART II: DEPENDENT VARIABLES

1- ACTUAL USAGE

Check from the following statements the ones that apply to your present usage of the system.

- I use printed computer based reports _____
- I use computer graphical outputs. _____
- other (specify)_____

2- PERCEIVED EASE OF USE

(a)[Davis et al. (1989); Davis and Venkatesh (1996); Adams et al. (1992); Doll et al. (1998)]

Statement	Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree
(1) I found CBI easy to use.						
(2) My interaction with CBI systems was clear and understandable.						
(3) Using CBI requires a lot of mental effort.						

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3-PERCEIVED USEFULNESS

(Based on Franz, C. R. and Robey, D., (1986)

Statement	N ot at all	Ver y Little	Litt le	Modera tely	M uch	Ve ry Mu ch
1. To what extent do you actually use CBI compared to your original expectations?						
2. To what extent could you get along without the use of the CBI?						
3. To what extent does CBI assist you in performing your job better?						
4. To what extent do you actually use computer based reports or output.						
5. To what extent do you understand how CBI assisting you with your job does?						

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6. To what extent would you like CBI system to be modified or redesigned all over again from the beginning?						
7. To what extent is CBI actually used compared to the total number of people who potentially could be using it?						