User Characteristics of Information Systems: Do They Really Matter?

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ABSTRACT: *No matter how advanced an information system becomes the users rather than the designers will always be its final "judges". So users' attributes/characteristics form an important consideration when investigating and designing information systems. In an attempt to improve the benefits gained by users from such systems, this study aims to investigate whether user characteristics moderate the effect on user performance in complex information system environments. Understanding the relationship between individual differences and user performance helps design effective information systems that meet user requirements, this in turn improves the effectiveness of systems usage.*

Keywords: User Characteristics, User Evaluation, Enterprise Resource Planning Systems

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1. Introduction

A core stream of information systems research consists of identifying the determinants of individual users' usage and evaluation of information systems [i.e. 2, 3, 11, 26,15]. As organizations continue to increase their investment in information systems, they are becoming aware of the importance of users' evaluation and usage as critical prerequisites for productivity gains. As such, understanding usage patterns and factors that affect users' evaluation of information systems has generated much interest in both the industry and academia. Various theoretical perspectives such as for example, the Technology Acceptance Model (TAM) and the Task Technology Fit (TTF) model have been advanced. However, prior studies have given more attention to examining factors that drive users to "*initially adopt and use a new system, rather than the factors that influence users when utilizing and evaluating information systems and/or moderating the systems*" impacts after they have been adopted [36, 37, 29, 28, 26].

Prior evaluation studies have not articulated the differences in user characteristics and their effects on system evaluation and impacts, they instead focused on the initial adoption and the continued usage assuming implicitly that the processes of adoption, usage and evaluation are similar [2, 28, 15]. Furthermore, even studies that investigated user characteristics at some level, did not give enough attention to the actual impacts that these factors might have on the perceived system impacts by users. In fact, most of these studies dealt with user characteristics as demographic factors explaining only one part of the significant effect of these factors.

This appealed to our interests insofar that user characteristics should be investigated in detail as the foremost factors that might increase or decrease system impacts on user performance, usage, and benefits of information systems. In an attempt to understand which factors affect system impacts on user performance and/or increase the effectiveness of the use of information systems, the focus of this study is to investigate in depth user characteristics and outline the importance of these characteristics when utilizing information systems. This study stems from the research question, "*what are the direct and indirect effects of user characteristics on the evaluation of systems' impacts on user performance*"? To answer this question, this study was carried out in a complex information system, investigating the impacts of ERP systems on user performance. Moreover, the moderating role of individual differences like age, gender, education and computer expertise in the relationship between ERP systems and user performance was analyzed.

User characteristics or what are sometimes called "*individual differences*" such as computer experience gender and age were thought to be important factors in information systems (IS) research [14, 3, 26, 33]. For example, individual differences were found to be significant factors in explaining technology acceptance and user behaviour. However, these factors have not been adequately regarded in IS research. Most studies considered these factors as demographic factors and/or briefly covered them when investigate various types of information systems. Recent studies however found that user characteristics are significant factors in IS models such as TAM and TTF) to help explain IS usage and impact [3, 26].

Consequently, the impact of user characteristics such as, age and gender on user performance has been recently documented in end user computing and human computer interaction literature [8, 3], drawing the increasing attention of IS researchers when investigating various types of information systems. Individual differences refer to factors such as personality and situational demographic variables that affect IS users' beliefs and behaviour and/or affect the relationship between users and system impacts [8].

Although a large number of studies suggest that individual differences affect information systems use [29], to the best of our knowledge no studies have explicitly delineated the relationships between user characteristics and system impacts (especially within an ERP's environment), and whether or not these characteristics moderate the system's evaluation by users. Therefore, in this study the emphasis was placed solely on user characteristics and the significant impacts on user performance and whether or not these characteristics vary the impact of information systems on user performance. The characteristics investigated in this study included gender, work experience, experience with ERP systems, education, usage type and the type of users. All of these characteristics were examined using different analytical techniques to see if they lead to improved performance.

2. Research Methods

A survey methodology was used to gather data and to examine the adopted hypotheses by applying different statistical techniques including regression analysis, ANOVA, one sample test and Sebol test. A questionnaire was constructed based on an extensive review of the IS literature. The questionnaire consisted of three parts covering different factors including demographic questions designed to solicit information about the respondents study factors including TTF, System Quality (IQ), Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and user performance (UP) as shown Figure 1.

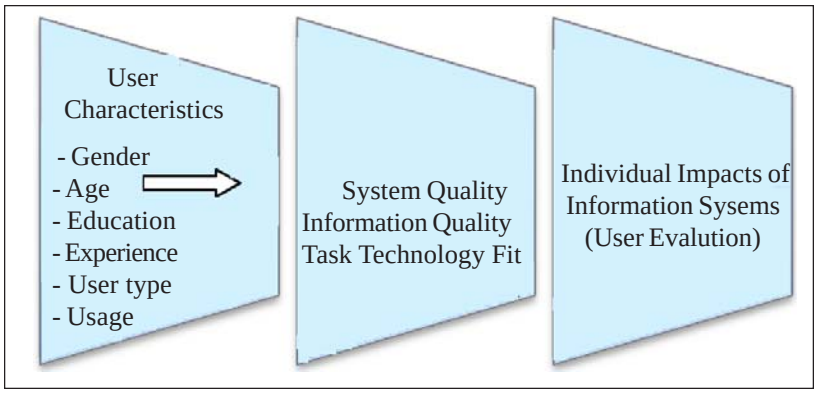

Figure 1. The Study Model

3. Analysis and Findings

3.1 Demographics of the Sample

Participants of this study were various types of ERP systems users including general users and IT professionals. The study participants consisted of various types of ERP system end-users that represented a wide range of positions within organisations, and have used the system for more than one year including general users and IT professionals. Data were collected from 387 users in 10 universities that had implemented ERP packages more than 5 years prior to our study. Participants come from different functional areas in these universities including, human resource, finance, accounting, administrative, information technology and other business departments. This gives the study a unique multiplicity, which might help explain how different individual backgrounds can affect user interaction with information systems as one of the main aims of the study.

There was a relatively high level of education, with 42.1% holding a bachelor's degree. The level of work experience of the study sample reflected their age distribution; with 79.6% having 11 years or more work experience. In relation to the type of users, 79.1% of the participants were general users. Most of the study's participants were regular users, using the systems on a daily basis (77% of the study sample), , while 4.4% of the participants used the systems once a day, 12.1% of the users used the systems several times a week and 6.5% of the users used the systems once a week. In addition, 38.2% of the users had from 1 to 3 years' experience with the systems, 26.9% of the users had from 4 to 6 years' experience with ERP systems, 26.4% of the users had from 7 to 9 years' experience with the systems, while only 8.5% had more than 9 years' experience with ERP systems, as shown in Table 1.

Factor/Classification	Frequency	Percentage	Factor/Classification	Frequency	Percentage
Gender:			**Work experience:**		
Male	105	27.1%	1- 5 years	28	7.2%
Female	282	72.9%	6-10 years	51	13.2%
			11 years or more	308	79.6 %
Age:			**Experience with ERPs:**		
21- 30	26	67.4%	1-3 years	148	38.2%
31- 40	94	24.3%	4-6 years	104	26.9%
41- 50	133	34.6%	7-9 years	102	26.4%
More than 50	134	34.4%	More than 9 years	33	8.5%
Education:			**Usage type:**		
High school or less	162	41.9%	Once a week	25	6.5%
Bachelor or diploma	163	42.1%	Several times a week	47	12.1%
Master	56	14.5%	Once a day	17	4.4%
Doctorate	6	1.6%	Regular use	298	77%
Type of user:					
Professional	81	20.9%			
General user	306	79.1%			

Table 1. Demographics of the sample (N = 387)

4. The Impacts of User Characteristics on User Performance

The benefits obtained from the use of information systems differ from one user to another, thus the impacts will differ from user to user according to their characteristics including education, age and experience. For example, PU as a characteristic depends on the users' belief about the reliability of the information derived from a system. The same is true for the user's level of experience. Experience leads to more knowledge, which might influence computer usage [12], causing influences on utilization and. This in turn affects system impacts. Therefore, users with different characteristics will have different perceptions about an ERP's SQ, system outputs and system impacts on their performance as explained in details below:

4.1 Gender of User

Generally, there is an impression in most disciplines including IS that differences based on gender characteristics exist, "*Although gender differences were almost missing in IS research, they are now widely discussed as an important factor in the user studies*" [3, p. 2908). Researchers recently have begun to show interest in explaining the role that gender plays in affecting or even moderating the relationship between information systems and users aspects including attention to use, frequency of use [28, 17], system usage [13] and user behaviour toward an information system [20].

Previous studies reported contradictory findings regarding the gender moderate effect on the variables that affect information systems' acceptance, usage and impact. For example, a number of studies found that men are more motivated by perceived usefulness [30] while women are more influenced by perceived ease of use of information systems [24]. However, other studies indicated the exact opposite or no differences between the two genders [7]. Other studies also reported mixed results [27, 35]. The extent to which females utilize a system to meet an information need has been explored in a number of studies, and has been found to be one of the various factors that may act as moderators in examining systems' usage [4, 28]. [11] found that women and men differed in their perceptions of a system, but not their use of it, due to differences between genders that lie in their expectations for performance.

In the original information systems models such as TAM no references to the impact of gender are found. Later on, [11] examined gender differences in the perception and utilization of an email-system according to the TAM. Gender effects were confirmed for the TAM factors, however in a differential way. While women reported higher values of perceived usefulness, men were found to report a higher ease of use with computers. Even though women's attitudes towards technology are more negative and their self-confidence significantly lower, gender effects seem to be limited to attitudes and subjective measures, and do not involve lower performance outcomes for female users [3]. This shows once more that the relationship between gender and other aspects of information systems require further examination. The results of the current study demonstrated significant differences among genders. The results for the two groups showed a significant difference regarding the system impacts on user performance. The female group experience more ERP systems' impacts on their performance than the males. However, the effect size of the difference was small as Eta squared **(η^2)** was 0.008. Effect size statistics provide a sufficient indication of the magnitude of the difference between groups [25]. According to Cohen, effect size could be determined by calculating η^2, which ranges from 0.01 small, 0.06 moderate, and 0.14 large [5].

Factors	**Gender**	*N*	**Mean**	**S.D**	**S.E**
User performance	Male	105	4.20	1.33	.129
	Female	282	4.63	1.03	.061
Levene's test for equality of Variances among gender					
User performance	F	Sig	t	df	Mean Difference
Equal variances assumed	12.748	.001	–3.23	385	–.416
Equal variances not assumed			–2.87	152	–.416

*$P < 0.01$ (2-tailed)

Table 2. Independent sample t-test for gender

The study found that females and males differ in terms of using ERP systems and shaping their perceptions about technology. This could be explained in terms of personal user beliefs, which play an important role in affecting users' perceptions in determining system usage [6, 36, 37]. This result confirms what [11] found. That is, significant differences between women and men's perceptions of information systems.

4.2 User Age

Compared with other potential moderating factors such as experience, age received a lesser share of attention in prior studies [26]. Recently however, the influence of age has been investigated in many information system adoption studies [30], indicating that age may influence system use directly and indirectly. That is, through perceptions and/or through moderating the relationships between perceptions and technology use [22]. Researchers stated that user age plays an important role in explaining the variability of system acceptance and performance. PU of a system was found to be lower in older adults, because they weigh the PU against the time to learn how to utilize the system. Other studies congruently showed that older users usually have greater

difficulties in handling a technology or in the acquisition of computer skills. However, the knowledge about the influence of age on the estimation of perceived ease of use and usefulness as well as its relation to performance remains limited [22].

In this study user age was examined to see whether it varies the effect of ERP systems on user performance across different age groups. It has been proposed that older users will have more difficulty with the systems rather than young users. However, the findings demonstrated that whether young or old, users experienced the same systems' impacts. This could be due in part due to similar computer/IT skills and training support offered to all users, in addition to the same system functionality provided by the organizations to all users.

Groupage	**N**	**Mean**	**S.D**	**S. E**
21-30	26	4.96	.827	.162
31-40	94	4.48	1.31	.135
41-50	134	4.42	1.17	.101
More than 50	133	4.46	1.01	.087
Total	387	4.49	1.14	.058
Source of Variance	**Sum of Squares**	**df**	**Mean Square**	
Between Groups	6.47	3	2.15	
Within Groups	497	383	1.29	
Total	503	386		
F	1.665			
Sig	.174			

Table 3. ANOVA test of the users' age

4.3 User Education

Education and its impact on users and system usage has been absent from IS research for a long time. Researchers have recently noticed that education could play an important role in the explanation of computer usage and user performance [3].

As noted by [22], studies have shown that individuals with a higher level of education are generally more aware of technology benefits; suggesting a greater possibility of embracing technology. For example, in the context of intranets, educational level is influential in determining intranet utilization. This is justified based on the fact that individuals who attained tertiary education have a higher degree of exposure to similar systems such as the Internet, while attending university, implying higher possibility of utilization [22]. Previous studies also suggest that users with more formal education tend to use computers more, leading to higher PU among users [23]. In this study therefore, it was assumed that users with higher education levels will utilize ERP systems more and will perceive more impacts on their performance as they perceive the systems more useful and easy to use. Education was measured in terms of the highest qualification attained by the individuals. The findings however are surprising and demonstrate an inverse relationship between education and user performance, indicating that users with higher educational levels experienced less system impacts on their performance, while the impacts was high for those who have less education. In other words, perceived ERP system's impact varies significantly among different users with different qualifications in an indirect way.

Possible plausible reasons for this relationship include the notion that standard ERP systems are geared toward all user types in terms of education, age, computer experience, and gender as stated in [23]. It also could signal that users with more qualifications might expect more customized functionality from the systems rather than the lower qualified users. And/or because more qualified users use the systems for different purposes, they have more skills and knowledge about the information systems so they perceive the systems as less than useful [1]. In other words, the results show that qualifications affect user performance, but in an opposite way, suggesting further investigation for this factor, as shown in the Table 4.

4.4 User Experience

Prior computer experience and its influence on performance have been investigated in previous studies. Generally speaking, it was found that experts show a superior performance with respect to the utilization of technology. As [3, p. 2907] stated, "*this finding is rather trivial as long as the relationship between computer experience, technology acceptance and performance is*

Factor	N	Mean	S.D	Subset (a = .05	
				1	2
1	162	4.72	1.06		4.72
2	163	4.41	1.11		4.41
3	56	4.19	1.27		4.19
4	6	3.05	.89	3.05	
Total	387	4.49	1.14		

$P < 0.05, F = 7.421$

Table 4. Homogeneity and Scheffe's test

not completely clarified, leading consequently to inconsistent results in prior IS research." Experience has been conceptualized in IS research as the number of years of experience with a system. In this study, user experience was measured in terms of experience with ERP systems and broad work experience.

Organizational members with a good knowledge of computers or general IT skills would be useful in ensuring the effectiveness of IS in their contexts [1, 33]. [19] found that lack of computer knowledge can cause deep frustrations with information systems. [7,8] implied that individuals who are proficient with computer systems will be able to use such for their own work and development. Further, business employees' possession of adequate general computer knowledge and skills can be beneficial to their organizations as ERP packages are being adopted [1]. It is also noted that general end user computer skills can increase user involvement and commitment to adopted information systems [15].

An assumption made in this study is related to the belief that more experience with ERP systems would yield greater impacts on performance. Taken from the literature, experience was classified into two types, user experience with the system and user work experience. User work experience is measured by the number of work experience (number of years in the job), while work experience with a system is measured in IS research by the number of years using the system to reflect their breadth of IS experience [12, 16, 17, 19]. Unexpectedly however this does not appear to hold within the ERP system's environment. The findings indicated that neither experience with ERP systems nor work experience influences performance among ERP users

The results indicated that there were no significant differences in the perceived impacts of the ERP systems among users with different work experience. This might be because more work experience does not mean more experience with ERP systems and vice versa, as users might start using the systems at different stages in their work life. In other words, there are no differences between ERP users with long and short experiences in perceiving the same systems' impacts. Similarly, we found that prior experience with ERP systems does not affect user performance. No significant differences were found neither between and nor within groups ($F = 1.15$, $\alpha = 0.32$), as shown in the second part of Table 5.

Source of variance	Sum of Squares	df	Mean Square	F	Sig.
Work experience				.834	.476
Between Groups	3.26	3	1.088		
Within Groups	499.8	383	1.305		
Total	503.1	386			
Experience with ERP				1.157	.321
Between Groups	13.5	9	1.50		
Within Groups	489.6	377	1.29		
Total	503	386			

Table 5. ANOVA for work experience

4.5 Type of User

User type has been investigated as a significant factor with respect to system usage and outcomes, which in turn determines the system impacts on performance. The end user type is classified in previous studies in different ways including programmers and nonprogrammers, system specialist and common users, and/or IT professional and general users [31]. The most commonly used terminology is IT professionals and general users, as used in this study. Professional users refer to those users who have ERP expertise or IT professionals, who have a degree in IT or related majors, while general users are users who use the systems generally and don't have an IT or related degrees.

Different types of users might lead to different results in terms of system usefulness and impacts on user performance. Prior research indicated that the user type could be an effective factor affecting the perception of users and leading to different outcomes yielded by the system such as system usefulness. [18] found that professionals are very different from general users in terms of usefulness and system influence. The same researcher found that "*type of user*" differentiated professionals from general users however, no clear result was provided. Others reported no significant relationship between type of users and system impacts. The findings demonstrated that both types have the same impact on their own performance. This could be due to the standardization of the ERP systems and the similarity of the applications used in different organizational parts, although different users use the system for different purposes and/or for various performance aspects.

DV	Type of User	N	Mean	S.D	S.E
User performance*	Professional	81	4.59	1.57	.175
	General	306	4.49	.994	.056
Levene's Test for Equality of Variances					
User performance	**F**	**Sig.**	**t**	**df**	**Mean Difference**
Equal variances assumed	46.36	.001	.687	385	.098
Equal variances not assumed			.528	96.95	.098

*P < 0.01 level (2-tailed) Table 6. Independent samples t test for type of user

4.6. Usage Type (Frequency of Use)

Frequencies of system use and usage time are the most widely used measures of systems usage [9, 21]. In this study, frequency of use was used to assess the impact of usage volume on user performance and to test whether or not users with more system usage experience more system impacts on their performance.

Previous studies found a positive significant relationship between usage volumes and system benefits or impacts. This factor is also a major contributor to the IS success model as shown in previous studies [1, 31]. However, within the ERP context the implication of these outcomes might be useful for ERP practitioners in terms of directing their attention to usage when evaluating and implementing ERP systems in business organizations, especially in circumstances where the payoff of ERP systems investment is relevant. The findings indicated that regular users perceive more system impacts. The results indicated that system impact varies significantly according to the usage type. The most significant difference refers to the fourth group as it has the highest mean (4.618), as shown in Table 7.

Factor	N	Mean	S.D	Subset (α = .05)	
				1	2
1	25	4.35	.603	3.72	
2	47	4.07	1.13	4.07	
3	17	3.72	1.70		4.35
4	298	4.61	1.10		4.61
Total	387	4.49	1.14		

$P < 0.01$, $F = 6.15$ Table 7. ANOVA analysis of usage type

5. Conclusion

This study extends the user characteristics literature by offering a theory-driven explanation for examining the relationships among individual differences and user performance. To the best of our knowledge, this is the first study to theoretically articulate or empirically test the relationships among user characteristics and their join and individual impacts on performance. We contribute to IS usage research by presenting a theoretical model to explain the influence of user characteristics on system usage, usefulness and impacts on performance.

We explored whether user characteristics have a main effect and an interaction effect on user performance. Based on our findings, we conclude that in general some user characteristics may affect performance directly or indirectly while they may also moderate the relationship between usefulness and ease of use, and system impacts. The study extended previous research by identifying previous research streams to guide future research. We hope it will inspire the research community to deepen the

understanding of relationships among the factors explicitly reviewed, particularly temporal models focusing on measuring fluctuating patterns of information system usage and other related issues.

The most influential factor was usage type (frequency of use). The study found a positive and strong relationship between usage type and system impacts. Users who use the system regularly were found to perceive more positive impacts on their performance. In other words the greater the system usage is, the more the system's impacts on user performance. This has been theoretically accepted, as users get more knowledge about systems as they interact with them more, and with time gain knowledge on how to utilize them more efficiently to perform tasks. Individually, however user characteristics work differently. The study found that some characteristics affect user performance, while some do not. Specifically, age and user type were found to have no affects on user performance, while gender and usage type individually affect user performance significantly and positively.

TAM's factors, PU and PEOU were found to modify the effects of user characteristics on user performance. This confirms that users perceive more impacts when they perceive the systems as useful and easy to use, which in turn leads to greater performance improvements. Moreover, users who use the systems more, experience more impacts on their performance.

This study suggests that research on user characteristics and moderating factors is of great value. This is consistent with suggestions from existing studies that contexts could play an important role in systems usage and user aspects. However, it should be noted that user characteristics are contextual factors, as noted throughout this study some characteristics found to be important factors affecting user performance and system usage in previous studies were not found significant in this study. Therefore, we cannot simply say that user characteristics are always significant predictors of system impact as they work differently in various types of information systems' environments [26]. For example, "*experience*" was thought to be a very important factor affecting and/or moderating the effect of information systems on performance in different information system settings, but not in an ERP system setting, as per the study findings.

This study draws several unique contributions and implications for both researchers and practitioners, especially to ERP vendors and client firms of ERP, in particular those whose business models and revenue streams are based on long-term usage of IS products and services. Understanding the relationships among individual differences also plays a key role in governing effective management of long-term usage and improving benefits derived from ERP systems, assisting in the proactive planning of intervention mechanisms; for instance, user training. Given the important role played by user characteristics, managers should track users' characteristics and technology usage, identifying sources of any negative user characteristics.

An understanding of the effects of user characteristics on system impacts is important in overcoming barriers to the diffusion of technology across business organizations. This also helps better analyze the mechanisms through which user characteristics affect system usage for reducing resistance to technology use and increase the benefits of information systems. Furthermore, because this study focuses on user characteristics and user performance; unlike studies looking at behavioral intention, any improvement in terms of a better understanding of phenomena can translate into higher system usage after implementation; for example, managing user training programs and system utilization.

The findings and propositions can be easily translated into practice. For example, system practitioners and designers should pay particular attention to the inclusion of individual and contextual factors when using previous work on user performance and system usage of information systems. They should realize that existing work is conditional and therefore simply provides a basis for understanding user characteristics of a specific system, individual and contextual factors should be taken into account [26].

For example, training programs directed at men should emphasize usefulness; while those directed at women should emphasize ease of use. Further, trainers should pay attention to the evolution of trainees' perceptions and the influence of ERP systems. Specifically, in the early stage of the system use, ease of use is more important, especially for women. Therefore, trainers can develop specific tactics such as focusing on how to use the system and realizing that once users are no longer newcomers to the system, and are thus focusing on usefulness, the training program should accordingly focus on usefulness, exploring the functional potentials of the ERP system of interest. This tactic can also be applied for users with different levels of prior experience

Interestingly, research on IS success claimed that individual differences are important for success of the implementation of new information systems however, this is not always the case. We argue that it is time for researchers to detract from the question on

whether these differences are relevant to the acceptance and usage of information systems as according to the study findings it seems that individual differences might play different roles in different systems' settings. It is noteworthy that the interactions among these factors make it, however, too early to reach any conclusions about which effects are more robust. More empirical tests are needed to address the interactions among user characteristics with the presence of other moderating factors, such as usefulness and ease of use.

Furthermore, from a methodological perspective, studies of user performance and related issues, especially user characteristics and individual differences may need a methodological shift in order to gain a richer understanding of less studied factors as noticed by [26]. So far, almost most of the prior studies have used a quantitative methodology usually from a positivist perspective. A qualitative methodology, especially from an interpretive perspective, however, is informative and may be another useful alternative that can give researchers new insights.

Though in this study, several user characteristics were investigated and selected according to the literature on information systems and user aspects, there are additional characteristics that have not been included, such as organizational position and nature of the job, which could affect the impacts of ERP systems on user performance. Thus, it would be useful if further research incorporating additional characteristics could be carried out to explore what else can affect user performance in this sense.

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