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The **Journal of Information Systems Applied Research** (JISAR) is a double-blind peer reviewed academic journal published by ISCAP, Information Systems and Computing Academic Professionals. Publishing frequency is three to four issues a year. The first date of publication was December 1, 2008.

JISAR is published online (<https://jisar.org>) in connection with CONISAR, the Conference on Information Systems Applied Research, which is also double-blind peer reviewed. Our sister publication, the Proceedings of CONISAR, features all papers, panels, workshops, and presentations from the conference. (<https://conisar.org>)

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Information Worth: Investigating the Differences in the Importance and Value of Personally Identifiable Information

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Abstract

People are faced with a variety of incentives to divulge personally identifiable information (PII) as online businesses aim to personalize consumer experiences. However, little is known about how people perceive the worth of their PII in relation to the benefits they receive. This brings to question the true worth of information specifically in terms of importance and value. Understanding how people perceive the worth of the PII allows online businesses to establish strategies to enhance the experiences offered to online consumers. In this study, we examine the question “what is the worth of PII?” by employing a survey instrument measuring perceptions across different groups of socioeconomic indicators: education, income, and age. Our findings suggest that the worth of PII is not equally perceived across all groups. More specifically, we find education to be a larger contributor to the perceived differences in information worth. We believe our findings can impact how researchers evaluate PII and how online businesses evaluate PII worth to improve the consumer experience.

Keywords: personally identifiable information (PII), PII importance, PII value, PII worth, privacy paradox.

1. INTRODUCTION

Today’s online businesses aim to provide seamless and personalized customer experiences through digital channels such as social media, web, and mobile apps. To be successful in this endeavor, companies are moving toward making

use of information about individuals on a personal level instead of generic socioeconomic indicators such as age, income, and education. To accomplish this, it requires the collection of personally identifiable information (PII) such as an individual’s name, phone number, address, social media account, and their preference for

various services and affiliations. In contrast, the same PII is also collected by nefarious actors that build doxing databases of individuals, relying mostly on stolen PII available on the dark web for a price. For hackers, a victim with a good credit score can fetch a premium price (Kan, 2017). For instance, a hacked Gmail account sold for \$80 in 2021 (Sen, 2021) while for people with high credit scores, a Social Security number, birth date, and full name can sell for \$60 to \$80 on the digital black market. Some stolen identity information can go for as little as \$1 per person, or even \$0.10 when bought in bulk, according to a 2017 report from security firm Flashpoint. Such baseless and fluctuating valuations can make it difficult for online businesses to offer a suitable incentive to the consumer in exchange for their PII, leading to a negative experience.

Even though consumers have a protective attitude toward their PII, they have been known to reveal their PII in the presence of incentives and personalization, a phenomenon known as privacy paradox (Acquisti et al., 2015; Awad & Krishnan, 2006; Kokolakis, 2017; Martin, 2020; Norberg, Horne et al., 2007). Although a large amount of research exists regarding consumers' attitudes toward the collection of personally identifying data (Kolotylo-Kulkarni et al., 2021), there is little knowledge about the financial *value* that consumers assign to such data (Fehrenbach and Herrando, 2021) and whether the importance they attach to the data matches its monetary value. To our knowledge there are few examples where researchers have looked at the true value of PII as a financial transaction (e.g., Carrascal et al., 2013; Montes et al., 2019), but a gap still remains in the privacy literature from a socioeconomic perspective regarding the differences between information 'importance' versus its 'value', which we refer to as information 'worth'.

Thus, our research mainly aims to understand the nature of the incentives to be provided by 1) having customers assess information by importance and monetary value, 2) checking for consistency in correspondence between what customers consider as important information with its relative monetary value and 3) conducting a drill down to glean insights on how customers in different demographics -- such as education, income, and age -- ranks the worth of their PII. By considering the importance and value of the PII, companies can understand its worth and implement a strategy to provide incentives aligned with customer expectations, resulting in a higher likelihood of disclosure. Additionally, companies can directly incentivize customers in

exchange for PII without having to involve third party providers.

Results of our study illustrate both the perceived importance and value of PII by an individual. We surveyed people asking them to rate the importance of keeping certain PII private, based on an adapted scale. Additionally, we asked the respondents to attach a monetary value to PII based on the relative cost of a meal. In addition, we subdivided the responses by education, income, and age to determine if there were significant differences between each group.

From here, our paper is organized as follows. First, we introduce our methodology of collecting data on people's perception of PII. We follow by summarizing our analysis and results. We then provide a discussion of our findings. Lastly, we conclude with implications and steps forward with this research.

2. METHODOLOGY

Aligned with our research goals, we developed a survey instrument aimed at collecting people's perceptions of importance and value toward personal identifying information (PII). With this goal in mind, we adapted an instrument used by Fehrenbach and Herrando (2021) that identified the types of PII people find vital. Our adaptation asked people how important each type of information was to keep private. Expanding on this scale, we constructed an instrument requesting a person's perceived value of each PII with respect to their average cost of lunch. There is some research that links the cost of lunch to a family's socioeconomic situation (e.g., Domina et al., 2018), thus we felt this offered a normalized monetary reference to people at all income levels. People's budgets for lunch offers a baseline for people to evaluate their perceived value of PII. The measurement items can be found in the Appendix.

To collect the data, we administered the survey to a sample group through Amazon's Mechanical Turk. All participants who fully completed the survey received monetary compensation.

Once the data was collected, incomplete and/or erroneous data was removed from the final dataset. The dataset consisted of 222 valid responses with 33.3 % Females and 66.7 % Males. There were predominantly 3 levels of education: High School (or equivalent) (11.7%), College Degree (undergraduate) (64.0%), and Master's Degree (24.3%). Using information found at Beresford Research, (Brunjes, n.d.) we

transposed each year of birth to their respective generation. Lastly, the participants had a normal distribution of income levels with the mean occurring at \$40 – \$59.9k (33.3%). Table 1 below provides a summary of the sample statistics.

Table 1: Demographic Sample Statistics

Sample Size:	N = 222
<u>Gender</u>	<u>%</u>
Female	33.3
Male	66.7
No response or other	0
<u>Level of Education</u>	<u>%</u>
High School or Equivalent	11.7
College Degree	64.0
Master's Degree	24.3
<u>Generation (based on YOB)</u>	<u>%</u>
Boomer I	3.6
Gen X	23.4
Gen Y	62.2
Gen Z	10.8
<u>Income Level</u>	<u>%</u>
< \$20k	10.4
\$20k – 39.9k	20.3
\$40k – 59.9k	33.3
\$60k – 79.9k	20.7
\$80k – 99.9k	10.4
\$100k +	5.0

3. ANALYSIS & RESULTS

We examined the data for each individual PII and their overall mean scores. Regarding information importance, the highest ranked PII was 'Current Bank Account Balance, followed by 'Social Media Account Access'. The lowest ranked PII was 'Political Preference, closely followed by 'First and Last Name. With regards to information value, the highest value PII was also 'Current Bank Account Balance', followed closely by 'Social Media Account Access'. Like information importance, the least valued was 'Political Preference', and secondarily 'First and Last Name'. All PII and respective values are summarized in Table 2.

Table 2. Descriptive Statistics

Personal Identifying Information	Importance (1 to 5)		Value (-5 to +5)	
	Mean	Std Err	Mean	Std Err
First and Last Name	3.33	1.22	1.75	2.52
Personal Phone Number	3.76	1.04	2.39	2.22
Personal Street Address	3.91	1.04	2.35	2.28
Mother's Maiden Name	3.66	1.24	1.99	2.51
Political Preference	3.23	1.30	1.18	2.71
Current Bank Account Balance	4.14	1.00	2.75	2.09
Browser History	3.92	1.01	2.49	2.20
Social Media Account Access	3.97	1.04	2.62	2.13

Note: N = 222

To evaluate the effect of education, income, and age, as potential socioeconomic indicators, we conducted a multivariate analysis of variance (MANOVA) with the information importance and value as dependent variables as it relates to each respective PII. Using Wilkes Lambda test for significance, the results showed that differences in education was significant on the dependent variables for all PIIs. Overall, this suggests that education level can impact different perceptions on the worth (importance and value) of PII.

With respect to income, there were no significant differences found. This suggests that regardless of income, people have an equal view of the worth of PII.

Lastly, in terms of generational (age) difference, significance was found based on 'First and Last Name' will all other PIIs showing no significance. This suggests there are generational gaps regarding perceptions of the worth of PII that is offered in online contexts. A complete breakdown of significant differences among all groups is offered in Table 3.

We also conducted a post hoc analysis of the results to see which dependent variable (information importance vs. information value) had significance among the different levels of

education, income, and age. Interestingly, apart from the case of 'First and Last Name' where there was a significant difference for information importance with levels of education and information value for generation levels, no other differences were found in the areas of income or generation toward information value or importance. However, we found the majority of differences for the remaining PIIs to be based on education levels.

Table 3. Multivariate Analysis of Variance Wilkes Lambda test for Significance (post hoc summary noted)

Personal Identifying Information	Educ	Income	Gen
First and Last Name	<0.001* ⁱ	0.080	0.033* ^v
Personal Phone Number	0.001* ^v	0.187	0.322
Personal Street Address	<0.001* ^v	0.822	0.361
Mother's Maiden Name	0.019* ⁱ	0.515	0.146
Political Preference	0.004* ^{iv}	0.063	0.266
Current Bank Account Balance	0.006* ^v	0.720	0.478
Browser History	0.002* ^v	0.324	0.665
Social Media Account Access	0.022* ^v	0.925	0.296

note:
All PIIs satisfied assumptions test of normality
Dependent Variables: Information Importance and Information Value
p values shown, * significant $p < .05$, $N=222$
ⁱ post-hoc analysis (Tukey) indicates significance between groups for Information Importance
^v post-hoc analysis (Tukey) indicates significance between groups for Information Value

Specifically, we found that there was significant difference in information importance across levels of education for First and Last Name, Mother's Maiden Name, and Political Preference. In the case of First and Last Name and Mother's Maiden Name, the differences were between Undergraduate college and Master's level college individuals. For Political Preference, differences were found across all education groups. Information value showed significant differences in Personal Phone Number, Personal Street Address, Political Preference, Current Bank Account Balance, Browser History, and Social Media Account Access. These differences were for the most part between High School and those with some college degree (Undergraduate and Masters). A summary of the post hoc analysis is shown in Table 3., with a more detailed breakdown

of education in the Appendix, Table 4.

4. DISCUSSION

The set of data items were chosen to reflect a holistic overview of the various data types that previous research has deemed as personally identifying and important to consumers (Carrascal et al., 2013; Huberman et al., 2005; Tsai et al., 2011). Table 2 shows that overall, consumers rank 'Current Bank Account Balance' and 'Social Media Account Access' as the most important and the most valuable PII. Also, our analysis shows that 'First and Last Name' and 'Political Preference' rank the least in terms of both information importance and value. We believe this suggests that consumers do have some consistency in the worth of PII. This finding suggests that individuals are aware that their financial wellbeing, as shown in their current bank account balances is important to maintain as private over other PIIs. Furthermore, we can see that there is high worth placed on a person's social media information, which can also indicate that people seek to maintain a degree of privacy as it pertains to their social lives when asked to divulge related information. This can lead to future research in these areas to determine as to the reasons people find high value in such types of PIIs.

There are significant differences in the worth perceptions of PII with respect to their degree of importance and value based on the education level of the individual. Our findings show that differences exist in all PII variables as it relates to education. In the areas of education, we were able to see some differences in the importance of keeping PII private, however, the findings also start to identify where people may find some difference between what information is important to keep private (information importance) and what information can be used as means of trade (information value). More specifically, our findings suggest that differences in education appear to illuminate the true value of information and the benefits people expect to receive if divulged. Furthermore, education levels reveal the need for further research to understand incentive adjustments for PII requests, since a majority of the PII are significant for information value along those groups.

Examining differences in income on PII, we find that there was almost no difference in information importance or value. Overall, our findings suggest that regardless of income, the view of PII are equal between groups as identified in the MANOVA analysis in Table 3. This finding is

important as it indicates that the same incentives can be given as income has minimal influence on PII worth.

Investigating generational (age) differences, the data suggests differences as it relates to the importance and value of PII. More specifically, some PII shows a significant difference based on its value but not importance as it comes to requests for 'First and Last Name'. However no other PII was found to show significance. When reviewing our sample demographics, there were fewer later generation participants (e.g., 3.6% of Boomer Generation), who had adapted using information technology later in life. Whereas the majority of other generations were born at time with information technology introduced earlier in their lifetime (e.g., Digital Natives). Although our findings may show minimal impact in this area, there is a need to explore this further to include a larger sampling of later generations.

Overall, our analysis shows that there is consistency in the ranking of PII in terms of information importance and value. The highest ranked PII was a person's 'Bank Account Balance' and 'Social Media Account Access'. However, upon deeper inspection, we find that differences of education have a larger impact on the worth of information with a greater degree of significance found in terms of information value.

5. IMPLICATIONS

Our analysis shows that consumers bestow different worth for the PII considered in this study. This may be a critical component for researchers that study the privacy paradox, the idea people believe it important to maintain information private yet offer it for a benefit. The findings in the paper suggest that people are willing to offer their PII for a price that is consistent with its perceived worth.

Our study also reveals that there is a consistency in information worth across income and generation since the valuation and importance of PII across income and generation do not have significant changes. However, from an education viewpoint, information worth is perceived differently since information value and importance are perceived differently as seen in how importance remains the same for most PII, but value differs significantly between education levels.

Additionally, our study offers a unique measurement of information value providing a standardized monetary basis to evaluate PII. This

is directly usable for researchers that seek to explore not just the importance of PII, but what value people place on PII.

We believe this research offers companies a perspective that some PII's are worth more than others and that the worth of PII's differ across socioeconomic variables, especially when considering the education level of the consumer. Thus, companies should pay attention to each PII and carefully design their monetary incentive for each PII to increase the likelihood of its disclosure.

6. LIMITATIONS

As with all research, limitations are present, and we recognize that there are gaps in this study that may limit the suggested findings. For example, we recognize there is a smaller distribution of Boomer generations, which when applied to our analysis, may cause some concern due to its imbalance across the dataset. This can be easily remedied by collecting data targeting this age group to increase the sample size in this dimension.

Also, we recognize that a survey instrument alone has its limitation and can introduce some inconsistencies of people's true perceptions. To improve upon this, other studies may be able to add some qualitative analysis (e.g., via open ended questions) by targeting people's perceptions.

7. FUTURE WORK

With this study we can see there a need to look deeper into the educational and generational difference in the perceptions of the worth of PII. For example, our study illustrates there are some differences based on education, however, the question as to the degree of difference and cause of differences needs further investigation. This is also the same with differences found based on the different generations. Furthermore, it would be valuable to see what PII each individual group finds of highest worth. For example, what PII is of highest worth to Gen Z, or those with a High School level of education. There is need for future studies to understand these differences and create a ranking of PII worth between groups based on education and/or generation (age).

Future studies could consider other non-socioeconomic variables such as ethnicity and gender to understand the variation if any in the worth of different PII. Furthermore, since our study analyzed only a subset of consumer's PII,

future studies can consider the worth of additional PII relative to modern consumers such as their health-related information.

Additionally, we can see the need for a information worth construct from a privacy paradox perspective since our results show that though importance and value are consistent over most of the PII's considered, there are perceived differently in the case of education levels possibly across demographic variables that can be considered in future research. This may require the construction and validation of a formative construct with indicators given that will provide a single construct of information worth.

8. CONCLUSION

With the aim of smoothening the consumer experience, we investigated the perception of PII worth and whether the incentives offered can remain consistent across the demographic groups considered in this study. To this end, we conducted a survey of individuals asking questions regarding different types of PII and their importance and relative value. Our findings show that there are significant differences on the perceptions of PII worth based on an individual's education level and age. Also, we show that perceptions of PII worth are consistent across gender. This study opens new perspectives to both the research community examining the privacy paradox and businesses seeking to collect PII to benefit the consumer experience.

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APPENDIX A

Survey Instrument

Information Importance (adapted from Fehrenbach and Herrando, 2021)

Question 1: For the following personal information, what **degree of importance** do you feel it is to maintain as private? *5-point likert scale: Not important to keep private, Slightly important to keep private, Moderately important to keep private, Important to keep private, Very important to keep private.*

1. First and Last Name
2. Personal Phone Number
3. Personal Street Address
4. Mother's Maiden Name
5. Nationality
6. Political Preference
7. Current Bank Account Balance
8. Browser History
9. Social Media Account Access
10. Preferred Brand of Underwear

Information Value (new)

Question 2: For the following personal information, what **amount of value** would you expect to receive if shared? *11-point polar scale: -5 Less than the cost of lunch, 0 Average cost of lunch, +5 More than the cost of lunch*

1. First and Last Name
2. Personal Phone Number
3. Personal Street Address
4. Mother's Maiden Name
5. Nationality
6. Political Preference
7. Current Bank Account Balance
8. Browser History
9. Social Media Account Access
10. Preferred Brand of Underwear

Table 4: Post Hoc Analysis - Multiple Comparisons in Education - Tukey HSD

Dependent Variable	Education (I)	Education (J)	Importance		Value	
			Mean Diff (I-J)	Sig.	Mean Diff (I-J)	Sig.
First and Last Name	H.S. or equal	U.G. College	0.06	0.968	0.07	0.991
		Masters	-0.57	0.115	0.38	0.784
	U.G. College	H.S. or equal	-0.06	0.968	-0.07	0.991
		Masters	-0.63	0.003*	0.32	0.693
	Masters	H.S. or equal	0.57	0.115	-0.38	0.784
		U.G. College	0.63	0.003*	-0.32	0.693
Personal Phone Number	H.S. or equal	U.G. College	0.16	0.741	1.01	0.074
		Masters	-0.08	0.944	1.59	0.007*
	U.G. College	H.S. or equal	-0.16	0.741	-1.01	0.074
		Masters	-0.24	0.309	0.58	0.223
	Masters	H.S. or equal	0.08	0.944	-1.59	0.007*
		U.G. College	0.24	0.309	-0.58	0.223
Personal Street Address	H.S. or equal	U.G. College	0.22	0.575	1.76	0.001**
		Masters	-0.07	0.953	2	0.001**
	U.G. College	H.S. or equal	-0.22	0.575	-1.76	0.001**
		Masters	-0.29	0.18	0.23	0.789
	Masters	H.S. or equal	0.07	0.953	-2	0.001**
		U.G. College	0.29	0.18	-0.23	0.789
Mother's Maiden Name	H.S. or equal	U.G. College	-0.05	0.981	0.54	0.579
		Masters	-0.54	0.161	0.7	0.471
	U.G. College	H.S. or equal	0.05	0.981	-0.54	0.579
		Masters	-0.49	0.036*	0.17	0.908
	Masters	H.S. or equal	0.54	0.161	-0.7	0.471
		U.G. College	0.49	0.036*	-0.17	0.908
Political Preference	H.S. or equal	U.G. College	-0.8	0.008*	-1.94	0.002*
		Masters	-1.37	0.000**	-1.98	0.004*
	U.G. College	H.S. or equal	0.8	0.008*	1.94	0.002*
		Masters	-0.58	0.011*	-0.04	0.994
	Masters	H.S. or equal	1.37	0.000**	1.98	0.004*
		U.G. College	0.58	0.011*	0.04	0.994
Current Bank Account Balance	H.S. or equal	U.G. College	0.44	0.102	1.03	0.052
		Masters	0.33	0.342	1.66	0.002*
	U.G. College	H.S. or equal	-0.44	0.102	-1.03	0.052
		Masters	-0.1	0.793	0.63	0.133
	Masters	H.S. or equal	-0.33	0.342	-1.66	0.002*
		U.G. College	0.1	0.793	-0.63	0.133
Browser History	H.S. or equal	U.G. College	-0.02	0.995	1.11	0.042*
		Masters	-0.25	0.571	1.71	0.003*
	U.G. College	H.S. or equal	0.02	0.995	-1.11	0.042*
		Masters	-0.23	0.35	0.6	0.187
	Masters	H.S. or equal	0.25	0.571	-1.71	0.003*
		U.G. College	0.23	0.35	-0.6	0.187
Social Media Account Access	H.S. or equal	U.G. College	0.16	0.749	1.21	0.020*
		Masters	0.02	0.996	1.7	0.002*
	U.G. College	H.S. or equal	-0.16	0.749	-1.21	0.020*
		Masters	-0.14	0.679	0.49	0.313
	Masters	H.S. or equal	-0.02	0.996	-1.7	0.002*
		U.G. College	0.14	0.679	-0.49	0.313

Based on observed means.