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Essay title: Investigating the degree to which demographic and attitudinal factors predict people's attitudes towards technology developments.
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1. Introduction

The aim of this research was to investigate the degree to which demographic and attitudinal factors predict people's attitudes towards technology developments. An analysis of literature published in recent years, suggested that demographic factors of influence include: (1) income, (2) age, (3) sex, and (4) education. Attitudinal factors include: (5) concerns with data privacy, and (6) support for the welfare state.

The findings from literature review were then used to create six hypothesis, and data from the World Value Survey Wave 6 (2010-2014) was used to test them. To begin with, a correlation analysis was performed to evaluate the strength of relationship between variables. In addition, a multivariate regression model was built to analyse the correlation between the dependent variable (a scale created to measure people's attitudes towards technology developments) and multiple independent variables.

2. Literature review

Many studies have been published in recent years regarding people's attitudes towards technology, and in particular, the factors that influence its adoption. A literature review of some of those studies, indicates that there are multiple variables that influence people's attitudes towards technology. Moreover, it suggests that these factors can be grouped in two categories: demographic factors and attitudinal factors (Rojas-Méndez et al., 2016; Csuka at al., 2019).

Demographic factors

In "A framework of attitudes towards technology in theory and practice", Rojas-Méndez et al. (2016) explored how demographics and attitudinal variables may help to explain adoption and use of technology-based products and services (Rojas-Méndez et al., 2016, p. 18). The authors included the three most commonly used demographic variables in e-readiness research—gender, age and education—and concluded that "men, younger people, and higher-educated individuals tend to have more positive attitudes toward adopting technology (Rojas-Méndez et al., 2016, p. 32). Moreover, the authors point out that educational level outperforms age and gender (Rojas-Méndez et al., 2016, p. 18).
Cai et al.'s (2017) analysis is consistent with the above findings regarding gender. The authors meta-analysed 50 research studies published between 1997 and 2014 on the gender difference in the attitude toward technology, and concluded that "males still hold more

favourable attitudes toward technology use than females" (Cai et al. 2017, p. 1). Inconsistent with these findings, a study carried 11 years before by Yol et al. (2006), investigated the moderating roles of gender in forming perceptions and behavioural outcomes with regards to mobile phone services (Yol et al. 2006, p. 20) and concluded that "gender has a very limited effect on the examined relationships in the mobile services context" (Yol et al. 2006, p. 30).

Beyond gender, age and education, economic variables such as income might also have an influence on the attitudes towards technology (Yol et al. 2006; Csuka at al., 2019). Although technology adoption is globally increasing, these developments are still not accessible for everyone. An example of this is the digital divide. In fact, according to data released by the UN's International Telecommunication Union (ITU), as of December 2018, half of the world's population did not have access to, or was not able to use the internet (ITU, 2018). That is approximately 3.9 billion people without the possibility of benefiting from web-based technologies.

Attitudinal factors

In "A framework of attitudes towards technology in theory and practice", Kershner and Ehlers (2016) point out that "A trend analysis of Eurobarometer data shows that attitudes towards science and technology are diversifying in the EU" (Kershner and Ehlers, 2016, p. 139). According to the authors, if in the past the skepticism towards technology developments was attributed to the public's ignorance, nowadays it is a sign of an increasingly informed public. In fact, recent research suggests that many people nowadays are concerned about the negative consequences of technology: the impact of artificial intelligence and automation on the job market, cyber crime, online abuse, extremist groups using digital platforms and fake news online (Bartlett and Gaston, 2017).

The second attitudinal factor resultant from literature review was support for the welfare state. In "Embedding technological transformation: the welfare state and citizen attitudes toward technology", Lim (2020) explored how welfare state institutions shape and are shaped by citizens' perceptions of technological transformation (Lim, 2020, p. 1). The author's analysis found that "citizens embracing technological transformation are more supportive of the welfare state than techno-skeptics are" (Lim, 2020, p. 1).

2 – Research question, hypothesis and dataset

Research question: To what extent are people's attitudes towards technology developments determined by demographic and attitudinal factors?

As mentioned previously, the literature review suggests that factors that determine people's attitudes towards technology developments can be grouped in two categories: demographic factors (income, age, sex and education) and attitudinal factors (concerns with data privacy and support for the welfare state). The following hypothesis were derived from the findings of literature review:

Research Question: What are some of the factors that determine people's attitudes towards technology developments?	**Hypothesis 1:**	Those who have a higher income are more optimistic towards technological developments.
	Hypothesis 2:	Those who are younger are more optimistic towards technological developments.
	Hypothesis 3:	Men are more optimistic towards technological developments than women.
	Hypothesis 4:	Those who have a higher level of education are more optimistic towards technological developments.
	Hypothesis 5:	Those who are more concerned about personal data privacy are more skeptical towards technological developments.
	Hypothesis 6:	Those who are more supportive of the welfare state are more optimistic towards technological developments.

The present study uses the most recent available World Value Survey (Wave 6: 2010-2014). Data was weighted by *V258: Weight*, as recommended on the survey's *Release notes*.

4. Correlation analysis to test hypothesis 1, 2, 4, 5, and 6

The table below shows the results of the Spearman's rho tests that were produced to test the hypothesis 1, 2, 4, 5, and 6.

Output 1 – Spearman's rho

	V197: The world is better off, or worse off, because of science and technology (ordinal variable)		
	Correlation coefficient	Sig. (2-tailed)	Hypothesis testing
V239: Scale of incomes (interval variable)	.101	.000	1
V242: Age (interval variable)	-.038	.000	2
V248: Highest educational level attained (ordinal variable)	.082	.000	4
V186: Worries: Government wire-tapping or reading my mail or email (ordinal variable)	.000	.938	5
V134: Democracy: People receive state aid for unemployment (interval variable)	.131	.000	6

Interpretation (Output 1):

- Spearman's correlation coefficient indicates little, if any association between *V197: The world is better off, or worse off, because of science and technology* (ordinal variable) and all the other variables tested.
- Comparing the statistically significant Spearman's correlation coefficients (all are significant with exception to *V186* which presents a P-value higher 0.05), we can conclude that is *V197: The world is better off, or worse off, because of science and technology* has the strongest association with variable *V134: Democracy: People receive state aid for unemployment* (.131), followed by *V239: Scale of incomes* (.101), V248: *Highest educational level attained* (.082) and *V242: Age* (-.038).

5 – Creating a reliable scale to measure attitudes towards technology developments

A scale was created to measure *attitudes towards technology developments*. Missing values were set for the selected variables. It was not necessary to recode direction because all variables run in the same direction. The new scale will aggregate the following variables:

- *V192: Science and technology are making our lives healthier, easier, and more comfortable*
- *V193: Because of science and technology, there will be more opportunities for the next generation*
- *V197: The world is better off, or worse off, because of science and technology*

5.1. Factor analysis to check evidence for the underlying factor

Factor analysis was carried to check if any evidence could be found for the underlying factor.

Output 2: Correlation Matrix

		Science and technology are making our lives healthier, easier, and more comfortable	Because of science and technology, there will be more opportunities for the next generation	The world is better off, or worse off, because of science and technology
Correlation	Science and technology are making our lives healthier, easier, and more comfortable	1.000	.669	.389
	Because of science and technology, there will be more opportunities for the next generation	.669	1.000	.367
	The world is better off or worse off, because of science and technology	.389	.367	1.000
Sig. (1_tailed)	Science and technology are making our lives healthier, easier, and more comfortable		.000	.000
	Because of science and technology, there will be more opportunities for the next generation	.000		.000
	The world is better off, or worse off, because of science and technology	.000	.000	

Output 3: Total Variance Explained

		Initial Eigenvalues		**Extraction Sums if Square Loadings**		
Component	Total	& of Variance	Cumulative %	Total	& of Variance	Cumulative %
1	1.964	65.481	65.481	1.964	65.481	65.481
3	.705	23.489	88.969			
3	.331	11.031	100.000			

Interpretation (Output 3):

- one of the components' Eigenvalue is higher than 1 (1.964). According to Kaiser's criterion rule (Kaiser, 1960), this means that the three variables are likely to represent one real underlying factor.

Output 4: Component Matrix[a]

	Component 1
Science and technology are making our lives healthier, easier, and more comfortable	.871
Because of science and technology, there will be more opportunities for the next generation	.862
The world is better off, or worse off, because of science and technology	.679

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Interpretation (Output 4):

- Factor loading for variable V192 is 0.871: this value demonstrates an Excellent degree of association with the underlying factor;
- Factor loading for variable V193 is 0.862: this value demonstrates an Excellent degree of association with the underlying factor;
- Factor loading for variable V197 is 0.678: this value demonstrates an Good degree of association with the underlying factor;

Output 5: Frequency distribution

		Total	& of Variance	Cumulative %	Total
Valid	Negative attitudes towards technology developments	1.964	65.481	65.481	1.964
	4.00	1.964	65.481	65.481	1.964
	5.00	.705	23.489	88.969	88.969
	6.00	.331	11.031	100.000	100.000
	7.00	1.964	65.481	65.481	1.964
	8.00	.705	23.489	88.969	88.969
	9.00	.331	11.031	100.000	100.000
	10.00	1.964	65.481	65.481	1.964
	11.00	.705	23.489	88.969	88.969
	12.00	.331	11.031	100.000	100.000
	13.00	1.964	65.481	65.481	1.964
	14.00	.705	23.489	88.969	88.969
	15.00	.331	11.031	100.000	100.000
	16.00	1.964	65.481	65.481	1.964
	17.00	.705	23.489	88.969	88.969
	18.00	.331	11.031	100.000	100.000
	19.00	1.964	65.481	65.481	1.964
	20.00	.705	23.489	88.969	88.969
	21.00	.331	11.031	100.000	100.000
	22.00	1.964	65.481	65.481	1.964
	23.00	.705	23.489	88.969	88.969
	24.00	.331	11.031	100.000	100.000
	25.00	1.964	65.481	65.481	1.964
	26.00	.705	23.489	88.969	88.969
	27.00	.331	11.031	100.000	100.000
	28.00	.705	23.489	88.969	88.969
	29.00	.331	11.031	100.000	100.000
	Positive attitudes towards technology developments	1.964	65.481	65.481	1.964
	Total	1.964	65.481	65.481	1.964
Missing	System	.705	23.489	88.969	88.969
Total	27.00	.331	11.031	100.000	100.000

5.2 – Scale reliability

Crownbah's alpha was measured to check if the scale is internally reliable.

Output 6: Reliability statistics

Cronbach's Alpha	N of Items
.728	3

Interpretation (output 6):

- Following the guidelines developed by Gliem & Gliem (2003, p. 87), scale reliability is acceptable (Cronbach's Alpha is 0.728).

Output 7: Item-total statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Science and technology are making our lives healthier, easier, and more comfortable	15.00	14.251	.635	.536
Because of science and technology, there will be more opportunities for the next generation	14.89	14.717	.618	.560
The world is better off or worse off, because of science and technology	15.36	16.790	.414	.801

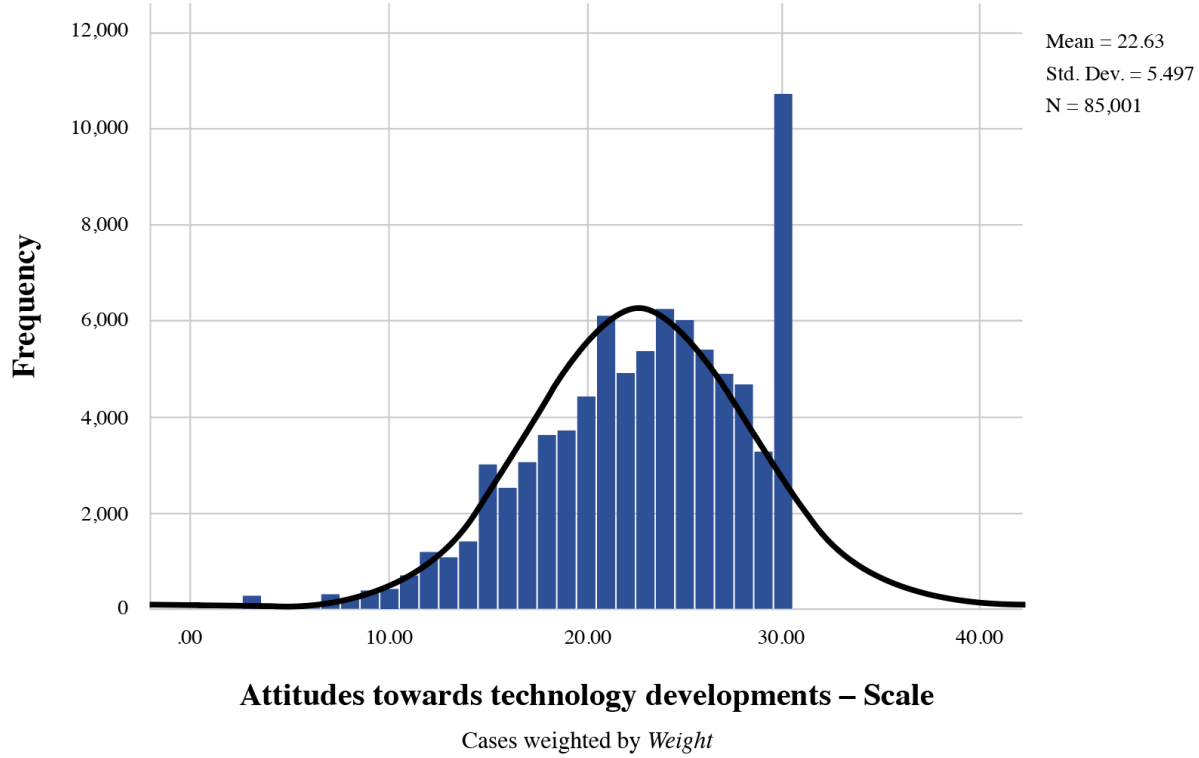
Interpretation (output 7):

- Removing the variable *the world is better off or worse off, because of science and technology* would increase reliability (Cronbach's Alpha would be 0.801). However, variation would be substantially reduced in the new scale variable, so therefore this item was kept in the scale.

5.3. Assess the distribution of the scale

Histogram and tests of normality were generated to assess the distribution of the scale.

Output 8: Histogram



Interpretation (Output 8):

- The most frequent scores cluster on the right of the histogram, meaning that data concentrate among positive attitudes towards technology developments.
- Distribution is bimodal (two peaks) with one observation that deviates markedly from other observations in the sample. This means that a big percentage of survey participants have very positive views towards technology developments.

Output 9: Statistics

N	Valid	85001
	Missing	4564
Mean		22.6296
Median		23.0000
Mode		30.00
Std. Deviation		5.49651
Skewness		-.658
Std. Error of Skewness		.008
Kurtosis		.129
Std. Error of Kurtosis		.017

Interpretation (Output 9):

- Mean, median and mode have different values (mean: 22.6; median: 23; mode: 30);
- Skewness and kurtosis measures are not 0 (skewness: -0.658; kurtosis: 0.129);
- The scales are approximately normally distributed but not perfectly normally distributed. In order to be perfectly normally distributed, the mean, median and mode of each scale should be the same; and skewness and kurtosis measures would need to be 0, which is not the case.

Output 10: Tests of Normality

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Attitudes towards technology developments – Scale	0.090	85001	.000

a. Lilliefors Significance Correction

Interpretation (Output 10):

- The significant value on the K-S test < 0.05, which indicates a deviation from normality;

6. Build a multivariate regression model to test hypothesis

A multivariate regression model was created in order to analyse the correlation between the dependent variable (*attitudes towards technology developments*) and the independent variables shown on Table 2.

Table 2 – Independent variables

Variables	Variable label	Hypothesis testing
V239	*Scale of incomes* (interval variable);	1
V242	*Age* (interval variable)	2
V240	*Sex* (nominal variable), included as dummy variable *V442: Sex Female*	3
V248	*Highest educational level attained* (ordinal variable), set *LevelEducation1_NoFormalEducation* as the reference category	4
V186	*Worries: Government wire-tapping or reading my mail or email* (ordinal variable[1]), set *Not at all* as the reference category	5
V134	*Democracy: People receive state aid for unemployment* (ordinal variable[1]), set *Not an essential characteristic of democracy* as the reference category	6

6.1. Analyse the relationships between the dependent variable and the independent variables

Output 11: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.265[a]	.070	.070	5.26205

Interpretation (Output 11):

- R-square indicates that 7% of the variance in attitudes towards technology developments can be predicted from the multivariate regression model created.

Output 12: Coefficients

Model		Unstand. B	Coefficients Std. Error	Stand. coefficients Beta	t	Sig.
1	(Constant)	21.432	.142		150.646	.000
	Scale of incomes	.277	.010	.106	28.801	.000
	Age	-.008	.001	-.025	-6.690	.000
	Sex Female	-.386	.039	-.035	-9.939	.000
	Level of education 2 – Incomplete primary school	-.232	.122	-.010	-1.911	.056
	Level of education 3 – Complete primary school	-.141	.108	-.008	-1.305	.192
	Level of education 4 – Incomplete secondary school: technical / vocational type	.014	.114	.001	.125	.900
	Level of education 5 – Complete secondary school: technical / vocational type	.639	.102	.046	6.289	.000
	Level of education 6 – Incomplete secondary school: university–preparatory type	-.064	.115	-.003	-.560	.575
	Level of education 7 – Complete secondary school: university–preparatory type	.574	.103	.040	5.588	.000
	Level of education 8 – Some university–level education, without degree	.454	.115	.023	3.950	.000
	Level of education 9 – University–level education, with degree	1.225	.104	.085	11.821	.000
	Data privacy 2 – Not much	-.318	.054	-.025	-5.934	.000
	Data privacy 3 – A great deal	-.486	.057	-.035	-8.576	.000
	Data privacy 4 – Very much	.096	.052	.008	1.863	.063
	Support for welfare level 2	-1.245	.138	-.038	-9.026	.000
	Support for welfare level 3	-1.415	.122	-.052	-11.614	.000
	Support for welfare level 4	-1.807	.116	-.072	-15.574	.000
	Support for welfare level 5	-1.318	.096	-.077	-13.780	.000
	Support for welfare level 6	-.877	.100	-.046	-8.753	.000
	Support for welfare level 7	-.407	.097	-.023	-4.213	.000
	Support for welfare level 8	.211	.093	.013	2.267	.023
	Support for welfare level 9	.692	.097	.039	7.118	.000
	Support for welfare level 10 – An essential characteristic of democracy	1.716	.086	.137	20.013	.000

a. Dependent Variable: Attitudes towards technology developments – Scale

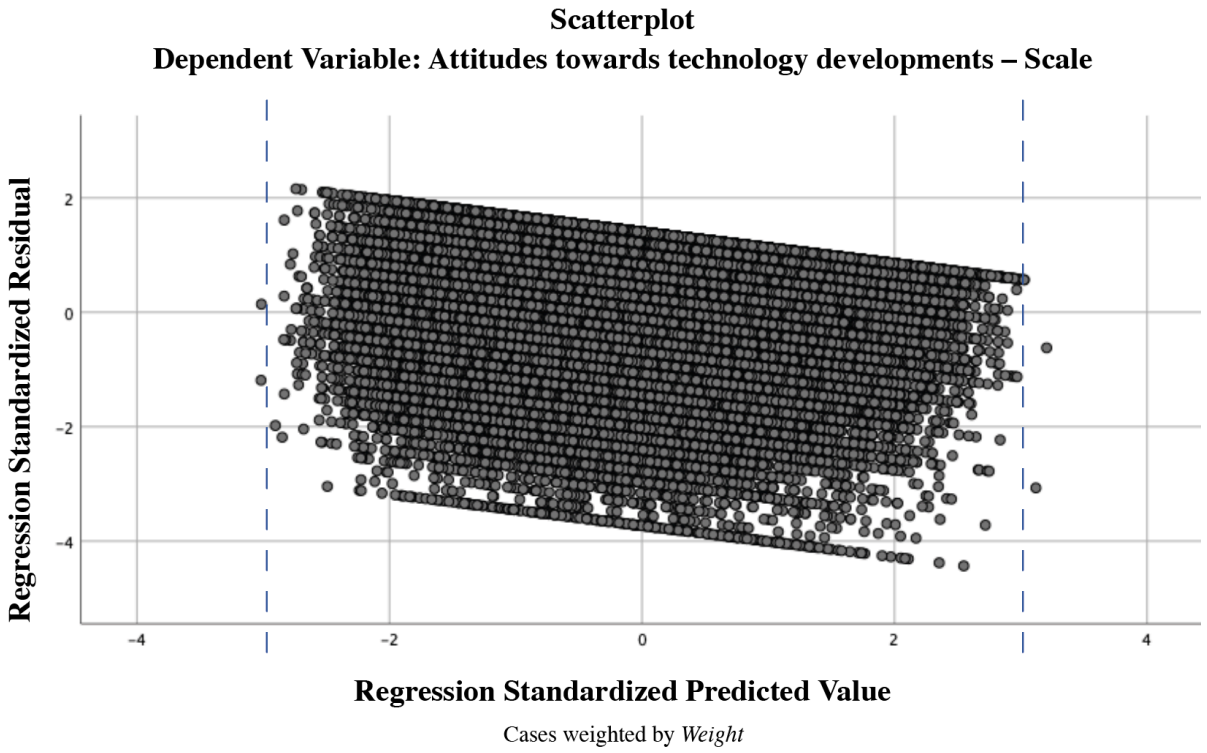
Interpretation (Output 11):

- An analysis of the standardized coefficients of the independent variables included in the regression model, reveal that *Support for the welfare state – an essential characteristic of democracy* has the strongest effect on people's attitudes towards technology (0.137), outperforming *Scale of incomes* (0.106), *University level education* (0.085), *data privacy 4–worry a great dea*l (-0.035), *Sex female* (-0.035), and *Age* (-0.025).
- **Hypothesis 1 is correct:** unstandardized coefficient B for *Scale of incomes* is 0.277, so attitudes towards technology developments are more positive as income increases. For every unit increase in *Scale of incomes*, there is a 0.277 unit increase in the *Attitudes towards technology developments* score. This relationship is statistically significant given that P-value is lower than 0.05 (P-value is 0.000).
- **Hypothesis 2 is correct:** unstandardized coefficient B for *Age* is -0.008, so attitudes towards technology developments are less positive as age increases. For every unit increase in *Age*, there is a -0.008 unit decrease in the *Attitudes towards technology developments* score. This relationship is statistically significant given that P-value is lower than 0.05 (P-value is 0.000).
- **Hypothesis 3 is correct:** unstandardized coefficient B for *Sex Female* is -0.386, so attitudes towards technology developments are more negative for women than for men. This relationship is statistically significant given that P-value is lower than 0.05 (P-value is 0.000).
- **Hypothesis 4 is correct:** unstandardized coefficient B for *Level of education 9 - university level education with degree* is 1.225. This means that attitudes towards technology developments are more positive for people with a university level education than for people with no formal education (the reference category). This relationship is statistically significant given that P-value is lower than 0.05 (P-value is 0.000).
- **Hypothesis 5 is not correct:** unstandardized coefficient B for *data privacy 4–worry a great deal* is 0.486. This means that attitudes towards technology developments are more positive for people concerned about data privacy than for people not at all concerned about data privacy (the reference category). This relationship is statistically significant given that P-value is lower than 0.05 (P-value is 0.000).
- **Hypothesis 6 is correct:** unstandardised coefficient B for *Support for welfare level 10 – An essential characteristic of democracy* is 1.716. This means that attitudes towards technology developments are more positive for people that support the welfare state than for people who do not. This relationship is statistically significant given that P-value is lower than 0.05 (P-value is 0.000).

6.2. OLS Violation Tests

In order to check if the relationship between independent variable (*attitudes towards technology developments*) and dependent variable (*Age*) is non-linear, a squared term for *Age* was created and included in the regression model. Linear coefficient age is negative and *Age2* coefficient is .000. This suggests that attitudes towards technology developments do not change much as age increases. R-square indicates a small increase from 7% in the previous model, to 7.1% in this model (with *Age2*). By including the squared term *Age2*, the predictive power of the model was slightly increased.

Output 13: Checking for heteroskedasticity



Cases weighted by *Weight*

Interpretation (Output 13):

- The scatter plot looks like a rough rectangle with few points <-3 and >+3. This shape reveals some suspicion of heteroskedasticity.

Output 14: Checking for multicollinearity

There was no cause for concern regarding multicollinearity: all variables (except Age and Age2) have an indicator for Tolerance >0.1, and a VIF < 5.

7. Conclusion

The aim of this research was to investigate the degree to which demographic and attitudinal

factors predict people's attitudes towards technology developments. The results suggest that, with the exception of hypothesis 5, all the other hypothesis formulated are correct. In fact, younger men, who support the welfare state, and have a higher level of formal education and income, tend to be more optimistic towards technology developments.

Both correlation and regression analysis have indicated that, among the variables tested, support for the welfare state is the factor with the strongest effect on people's attitudes towards technology, followed by income, and level of formal education. The results have also indicated that concerns about data privacy, age, and sex, have a relatively low impact on people's attitudes towards technological developments.

As previously mentioned, the present research used data from the World Value Survey Wave 6 (2010-2014). As possible next steps, it would be interesting to carry this research with the World Values Survey Wave 7 (2015-2020) that will be released in July 2020, and see how results have changed.

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