

Survey on the US National Security Agency (NSA): Opinions, Concern and Information Security Awareness

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Abstract. *Revelations about the United States National Security Agency (NSA) data collection sources and methods alerted global public to issues of data collection, surveillance and privacy.*

This article explores opinions of US and non-US residents about the NSA, their familiarity with Edward Snowden's revelations, related concerns and resulting rise in information security awareness. Relationships between IT proficiency and familiarity with Snowden's revelations and between concern with Snowden's revelations and increase in information security awareness are examined. Finally, differences in opinion about the NSA in several regions of the world are examined.

Keywords. NSA, Snowden, survey, opinion, information security awareness

1 Introduction

Note: The views expressed in this article are those of the author and do not necessarily reflect the views of the Croatian National Bank.

At the beginning of June 2013, world media outlets were abuzz with leaks and revelations about United States (US) National Security Agency's (NSA) and its methods for wide-ranging data collection. It was revealed that its data sources are numerous and diverse and include US internet companies, telecom providers, undersea cables, non-US intelligence agencies, etc. [3] [5]

Furthermore, the leaks showed that data is collected *in bulk*, meaning that it was collected indiscriminately. The data of ordinary private citizens, who were not suspected of any wrongdoing – both US and non-US residents – was collected, stored and probably analyzed.

The source of the leaks was soon identified as Edward Snowden, an employee of the defense contractor Booz Allen Hamilton who worked at the NSA and who collected, took and revealed to

journalists troves of US government's classified secrets and documents [6].

Traditional media outlets and internet media were soon ablaze with comments, opinions and views on what these revelations mean for foreign policy, information security of companies and ordinary citizens, future of privacy, etc.

There were several foci of public opinion and they could have been classified into several categories, depending on the prevailing concern of a particular group:

- personal privacy (worldwide concern),
- national security (concern of mostly US-residents),
- relationship between their country and the US (concern of non-US residents).

After the initial shock, public focus dwindled and shifted to other topics, although journalists such as Glenn Greenwald continued with methodical and deliberate publication of documents collected and leaked by Edward Snowden. However, it is not certain whether Snowden's revelations will have a lasting effect on public opinion and if they will initiate or influence policy changes. Furthermore, it is uncertain whether these revelations will change information security awareness of internet users, especially taking into account ever greater proliferation of social networks and their leveraging of their users' personal information.

In line with that, this article will explore the opinions of both US and non-US residents about the NSA and about their familiarity with Edward Snowden's revelations (at the time of writing of this article, the time lapse from the initial revelations is 22 months). Furthermore, the article will examine related concerns and resulting rise in information security awareness.

2 Review of surveys and literature

Numerous surveys that assessed public opinion on the NSA, data privacy issues and Edward Snowden were conducted since June 2013.

Pew Center's research from beginning of 2014 showed that US public is split in approval and disapproval of the NSA surveillance program [12] [14], although the general opinion is moving towards condemnation (change from mid-2013). Globally, Pew Research Center's 2014 Global attitudes survey [14] showed (based on surveys in 43 countries) that 81% of non-US citizens finds US government's monitoring of communications unacceptable. The same survey found that 62% of US citizens share that opinion.

In March 2015 Pew Research Center published a report on changes in the use of technology by US-citizens, following the Snowden's revelations [17]. Almost 90% of respondents stated that they heard about (US) government surveillance programs and one-third of them took steps to "hide or shield their information from the government". Expectedly, younger adults were more likely to alter their behavior. The same research found that 52% of respondents are very or somewhat concerned with "surveillance of Americans' data and electronic communications". Respondents viewed differently acceptability of surveillance of US citizens (40% acceptable, 57% unacceptable) and non-US citizens (54% acceptable, 44% unacceptable).

European sentiment towards the NSA surveillance programs is rather negative. 2014 survey by John Stuart Mill Institute [18] found that two-thirds of Germans think that foreign internet surveillance is the greatest danger to freedom in Germany [18, 24].

CIGI-Ipsos Global Survey on Internet Security and Trust [2] from November 2014 encompassed 24 countries around the world. Overall, almost two-thirds of respondents stated that they are more concerned about online privacy than in the previous year. However, that concern varied across regions. In North America it included 59% of respondents, in Europe 51% and in BRIC countries (Brazil, Russia, India, China) 76% of respondents. Globally, 60% of respondents heard about Edward Snowden and 39% of those "have taken steps to protect their online privacy and security as a result of his revelations". The percentage of people who took steps for self-protection varies greatly among regions - from 58% in BRIC countries to 33% in North America and 29% in Europe.

Snowden's revelations influenced businesses as well. NTT's survey of companies in France, Germany, Hong Kong, UK and USA from 2014 [13] shows that companies have a "real concern for the sanctity of corporate data in the cloud".

Academic research related to opinions and awareness arising from Snowden's revelations about

the activities and methods of the NSA is plentiful and focuses on various aspects such as:

- Public opinion on the NSA and Snowden in the US and other countries [11]
- Political and legal context of the revelations [8]
- Public opinion on *whistleblower or traitor* dilemma surrounding Snowden [15] [20]
- Implications of the revelations on privacy and relationship between individual and *surveillance state* [19].

Although academic articles often refer to results of externally conducted polls, some researchers conducted their own surveys. E.g. Mason and Dupois conducted a survey [11] which found that Indian and US respondents agree on their opinions of Snowden, but differ on judgment of his revelations' impact. This finding is in line with CIGI-Ipsos survey [2] which found that of those aware of Snowden's revelations, 69% of Indian respondents took steps to protect their online privacy and security, compared to 36% of US respondents.

3 Research goals and hypotheses

Taking into account previously conducted surveys and research, this article will explore what people around the world think about the NSA, are they aware of Edward Snowden's revelations and how did those revelations change their opinion of the NSA.

Furthermore, differences in opinion about the NSA across different parts of the world will be examined, taking into account the idea that all non-US residents are a *fair game* for the NSA surveillance [5]. The focus will be on 3 global areas/groups: US, EU and BRIC countries.

The assumption that users with self-image of higher IT proficiency would be more likely to be aware of Edward Snowden's revelations will be tested.

Finally, this article will test the assumption that people who are more concerned with Snowden's revelations would be more likely to increase their information security awareness.

Therefore, posed hypotheses are as follows:

- H1: There is a significant positive correlation between respondents' opinion about their IT proficiency and familiarity with Snowden's revelations.
- H2: There is a significant positive correlation between the level of concern with Snowden's revelations and increase in information security awareness.
- H3: There is a significant difference in opinion about the NSA between US, EU and BRIC countries.

4 Survey design

A simple survey with 8 questions was constructed to collect the data. To stimulate higher response rate, the survey design was minimalistic and filling out of the questionnaire required only 2-3 minutes. Furthermore, to simplify the collection process and to reduce ethical concerns, taking into account global reach of the survey (and related different ethical standards), the survey was designed as anonymous.

Out of 8 posed questions, 7 were questions with itemized rating scales of Likert-type answers with odd number of possible choices (5, 7 or 9). All possible answers were labeled. Where possible, balanced scales were used (2 questions). Parallel wording was also used where possible, and words in response alternatives were chosen in line with samples of response alternatives in Air University Sampling and Surveying Handbook [16]. One posed question was categorical.

Survey questions and possible answers are as follows (the order of response alternatives in the questionnaire was as presented):

1. How would you judge your level of proficiency in using information technology?

Answers (5 levels): Not proficient at all, Slightly proficient, Somewhat proficient, Reasonably proficient, Very proficient.

2. Where do you live?

Answers (4 categories): US, EU, BRIC countries (Brazil, Russia, India, China), Other.

3. How familiar are you with function of the NSA (United States National Security Agency)?

Answers (5 levels): Not familiar at all, Slightly familiar, Somewhat familiar, Reasonably familiar, Very familiar.

4. What is your general opinion on the NSA?

Answers (9 levels): Extremely negative, Decidedly negative, Somewhat negative, Slightly negative, Neutral, Slightly positive, Somewhat positive, Decidedly positive, Extremely positive.

5. How familiar are you with actions of Edward Snowden in relation to the NSA activities?

Answers (5 levels): Not familiar at all, Slightly familiar, Somewhat familiar, Reasonably familiar, Very familiar.

6. Did the NSA revelations (information disseminated by Edward Snowden) change your opinion of the NSA?

Answers (7 levels): Greatly diminished, Somewhat diminished, Slightly diminished, Did not influence, Slightly improved, Somewhat improved, Greatly improved.

7. Do you find NSA revelations concerning?

Answers (5 levels): Not concerning at all, Slightly concerning, Somewhat concerning, Decidedly concerning, Very concerning.

8. Did the NSA revelations increase your information security awareness?

Answers (5 levels): Not at all, Slightly increased, Somewhat increased, Decidedly increased, Greatly increased.

The survey was constructed as online survey and posted to the r/SampleSize community of reddit website¹, which is dedicated specifically to posting and responding to surveys and has almost 30,000 participants/subscribers (April 2015). Reddit was chosen because of its popularity and global reach – Pew Research Center's report from mid-2013 claims that 6% of online adults are reddit users [4]. It can be assumed that the survey sample is skewed in line with the general reddit demographics (e.g. mostly young males) [4]. The survey is, by design, limited only to internet users, since significant majority of Edward Snowden's revelations are related to internet usage.

The ethical considerations of the study are negligible. No personally identifiable information was collected. Furthermore, the survey was specifically designed without possibility for free-form data input which might contain such information – only selection of pre-defined ordinal/categorical choices is possible. The survey was conducted via Google Forms environment, it was publicly available and author of the survey was, by design, unable to collect technical personally identifiable information such as IP addresses. Furthermore, submission process was also handled automatically via Google Forms. Collected information is not sensitive. No reward or incentive was given for participation in the survey. The context and goal of the survey (academic survey of the opinion about the NSA) were clearly presented.

Taking all this into account, respondents were not only anonymous but unidentifiable and were not asked for a written consent form.

The anonymity/unidentifiability of the survey is also its greatest weakness. It provided opportunity for a single person to submit multiple entries and sincerity of answers might be questionable. On the other hand, anonymity allows respondents not to enter their personal information, which should alleviate potential privacy concerns and entice higher response rates. Furthermore, some empirical research shows that anonymity brings more honesty [9]. Summarily, I believe that benefits of anonymity in this survey outweigh weaknesses.

¹ <http://www.reddit.com/r/samplesize>

5 Data analysis methods

Bulk of collected data is of ordinal type, with only one categorical variable. The data will be described through descriptive methods such as frequency tables with indication of median and mode. Median will be explicitly stated, while mode will be obvious from the frequency tables. Methods for visual presentation of data applicable to ordinal and categorical data will be used (e.g. bar charts and mosaic plots).

The first and second hypothesis will be tested via Spearman's rank correlation coefficient (Spearman ρ (rho)) measure of statistical dependence. Spearman ρ was chosen, instead of more often used Pearson r , since it is capable of detecting non-linear correlations and because it is applicable to ordinal (ranked) data [7, 261-282].

The third hypothesis will be tested via Mann–Whitney–Wilcoxon (also known as Mann–Whitney U) test since it allows comparison of samples with ordinal variables and of samples with unequal sizes [10].

Statistical analysis will be performed via Microsoft Excel (descriptive statistics and bar charts) and in R environment (inferential statistics and mosaic plots).

6 Results and discussion

The survey was active 14-22 January 2014 and collected 444 answers. Complete collected dataset is available at: <to be defined afterwards>.

Collected data was of high quality with only one prevalingly blank response which was removed from analysis. Hence, 443 answers were analyzed.

Descriptive statistics for all questions is presented in tables 1-10.

Respondents of the survey obviously have a high opinion of their IT literacy, as almost 90% of respondents placed themselves into top 2 categories out of 5 available (Table 1).

Self-reported location is prevalingly the USA, which was to be expected, considering the general reddit demographics [1]. Only 8 responses came from BRIC countries, which is too few to allow statistical comparison of opinions between BRIC countries and US and EU. However, comparison between US and EU will be performed.

Self-reported degree of familiarity with the function of the NSA (Table 3.) is high – over 60% of respondents stated that they are very or reasonably familiar with it. This statistics might have been expected since the majority of respondents are from the USA, and taking into account cited CIGI-Ipsos Global Survey on Internet Security and Trust [2].

Table 1. Descriptive statistics for question nr. 1

How would you judge your level of proficiency in using information technology?		
Answer	Frequency	% of answers
Not proficient at all	3	0.7%
Slightly proficient	10	2.3%
Somewhat proficient	44	9.9%
Reasonably proficient	167	37.7%
Very proficient	219	49.4%
median	Reasonably proficient	

Table 2. Descriptive statistics for question nr. 2

Where do you live?		
Answer	Frequency	% of answers
USA	275	62.1%
EU	106	23.9%
BRIC countries	8	1.8%
Other	51	11.5%
(no answer)	3	0.7%

Table 3. Descriptive statistics for question nr. 3

How familiar are you with function of the NSA?		
Answer	Frequency	% of answers
Not familiar at all	7	1.6%
Slightly familiar	40	9.0%
Somewhat familiar	119	26.9%
Reasonably familiar	186	42.0%
Very familiar	89	20.1%
(no answer)	2	0.5%
median	Reasonably familiar	

Table 4. Descriptive statistics for question nr. 4

What is your general opinion on the NSA?		
Answer	Frequency	% of answers
Extremely negative	106	23.9%
Decidedly negative	146	33.0%
Somewhat negative	72	16.3%
Slightly negative	34	7.7%
Neutral	33	7.4%
Slightly positive	17	3.8%
Somewhat positive	19	4.3%
Decidedly positive	11	2.5%
Extremely positive	3	0.7%
(no answer)	2	0.5%
median	Decidedly negative	

Table 5. Opinion on NSA: USA vs. EU

What is your general opinion on the NSA?				
Answer	USA		EU	
	Freq.	%	Freq.	%
Extremely negative	66	24.0%	22	20.8%
Decidedly negative	76	27.6%	45	42.5%
Somewhat negative	48	17.5%	17	16.0%
Slightly negative	19	6.9%	8	7.5%
Neutral	23	8.4%	6	5.7%
Slightly positive	14	5.1%	3	2.8%
Somewhat positive	15	5.5%	3	2.8%
Decidedly positive	9	3.3%	2	1.9%
Extremely positive	3	1.1%	0	0.0%
(no answer)	2	0.7%	0	0.0%
median	Decidedly negative		Decidedly negative	

However, analysis of answers by non-US respondents shows that over 50% of them believe that they are very or reasonably familiar with the function of the NSA.

The opinion about the NSA is strongly negative (Table 4). Only 11.3% have positive opinion on the NSA, 7.4% are neutral and over 80% have a negative opinion. Furthermore, over 50% of all respondents have extremely or decidedly negative opinion on the NSA. This result is in line with cited survey by Pew Research Center's 2014 Global attitudes survey [14] (which polled acceptability of NSA's surveillance programs) and shows a lasting, negative opinion about the NSA. However although the cited research showed a certain difference in opinion between US and non-US citizens, comparison of answers from EU and US respondents of this survey (Table 5) shows greater similarity. Although EU respondents do have a more negative opinion (over 86% negative, only 7% positive) compared to the US (76% negative and 15% positive), distributions of answers look rather similar. Furthermore, EU and US responses had the same median (Decidedly negative) and mode (Decidedly negative). Although the opinion of EU citizens could have been expected, it is somewhat surprising that US respondents have such a negative opinion on the NSA since is a US agency. This result might indicate that US respondents are not reassured with NSA's and US government's response to the revelations and have doubts whether the NSA operates in their best interest.

Table 6. shows high level of familiarity with Edward Snowden's revelations, with three-quarters of respondents declaring themselves as reasonably or very familiar. Similarly to the question of familiarity with the function of the NSA, it might be assumed that this represents high percentage of US respondents in the sample. However, summary of responses of non-US respondents also shows that almost three-quarters of respondents (73%) believe to be reasonably or very familiar with Snowden's revelations. Hence, it is obvious that knowledge of Snowden's revelations is not limited to the USA.

Table 7. shows that Snowden's revelations had a decidedly negative influence on the opinion about the NSA.

Furthermore, almost half of respondents find NSA revelations very concerning (highest allowed category), with only 8% of respondents who do not find those revelations concerning (table 8).

Finally, Table 9. shows that NSA revelations increased security awareness of respondents, and this increase is evenly distributed around the central values (median = Somewhat increased). Comparison of answers of US and non-US respondents shows very similar results (Table 10.).

Table 6. Descriptive statistics for question nr. 5

How familiar are you with actions of Edward Snowden in relation to the NSA activities?		
Answer	Frequency	% of answers
Not familiar at all	8	1.8%
Slightly familiar	24	5.4%
Somewhat familiar	67	15.1%
Reasonably familiar	205	46.3%
Very familiar	137	30.9%
(no answer)	2	0.5%
median	Reasonably familiar	

Table 7. Descriptive statistics for question nr. 6

Did the NSA revelations (information disseminated by Edward Snowden) change your opinion of the NSA?		
Answer	Frequency	% of answers
Greatly diminished	190	42.9%
Somewhat diminished	102	23.0%
Slightly diminished	56	12.6%
Did not influence	86	19.4%
Slightly improved	1	0.2%
Somewhat improved	4	0.9%
Greatly improved	2	0.5%
(no answer)	2	0.5%
median	Somewhat diminished	

Table 8. Descriptive statistics for question nr. 7

Do you find NSA revelations concerning?		
Answer	Frequency	% of answers
Not concerning at all	35	7.9%
Slightly concerning	57	12.9%
Somewhat concerning	41	9.3%
Decidedly concerning	102	23.0%
Very concerning	205	46.3%
(no answer)	3	0.7%
median	Decidedly concerning	

Table 9. Descriptive statistics for question nr. 8

Did the NSA revelations increase your information security awareness?		
Answer	Frequency	% of answers
Not at all	73	16.5%
Slightly increased	84	19.0%
Somewhat increased	122	27.5%
Decidedly increased	102	23.0%
Greatly increased	61	13.8%
(no answer)	1	0.2%
median	Somewhat increased	

Table 10. Increase in awareness: US vs. non-US

Did the NSA revelations increase your information security awareness?				
Answer	US		non-US	
	Freq.	%	Freq.	%
Greatly increased	40	14.5%	21	12.5%
Decidedly increased	68	24.7%	32	19.0%
Somewhat increased	77	28.0%	45	26.8%
Slightly increased	46	16.7%	37	22.0%
Not at all	43	15.6%	30	17.9%
(no answer)	1	0.4%	3	1.8%
median	Somewhat increased		Somewhat increased	

The first hypothesis (H1) claims that there is a significant positive correlation between respondents' opinion about their IT proficiency and familiarity with Snowden's revelations. To facilitate better understanding of relationship between those variables, a mosaic plot of their relationship was created and is displayed in Fig. 1. Mosaic plots are used to display relationship between two or more ordinal or categorical variables and the area of each *tile* in the graph is proportional to the number of observations within that category.

The displayed graph shows a certain relationship between higher IT proficiency and higher familiarity with Snowden's revelations. Quantification of this relationship via Spearman's correlation coefficient ($\rho = 0.325, p \ll 0.001$) shows a statistically significant moderate level of positive correlation between observed variables and proves H1.

Therefore, as expected respondents with self-proclaimed higher level of IT-proficiency also believe to be more familiar with Snowden's revelations.

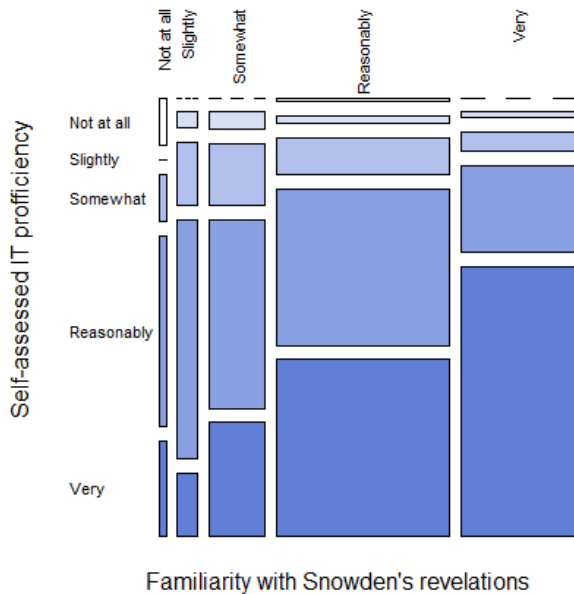


Figure 1. Relationship between level of (self-assessed) IT proficiency and familiarity with revelations of Edward Snowden

To analyze and test the second hypothesis (H2) whether there is a significant positive correlation between the level of concern with Snowden's revelations and increase in information security awareness, a mosaic plot was constructed (Fig. 2). The plot shows that there clearly is a relationship between analyzed variables.

Calculation of Spearman's correlation coefficient ($\rho = 0.465, p \ll 0.001$) verifies that a statistically significant moderate towards substantial positive correlation exists.

This proves H2 and shows that higher level of concern with the NSA revelations is related to higher information security awareness.

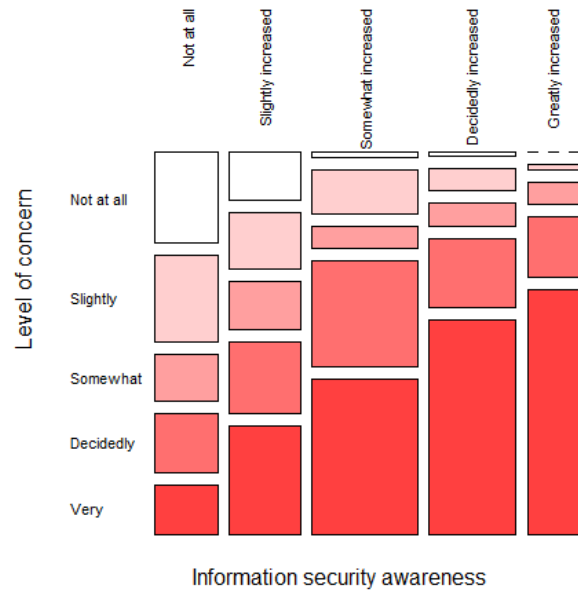


Figure 2. Relationship between level of concern with NSA revelations and increase in information security awareness

The last hypothesis (H3) states that there is a significant difference in opinion on the NSA between US, EU and BRIC countries. As explained previously, comparison between BRIC countries and other regions cannot be performed because of insufficient number of responses from BRIC countries. On the other hand descriptive statistics displayed in the Table 5 and Fig. 3 casts a doubt that there really is a significant difference in opinion about the NSA between the USA and the EU respondents.

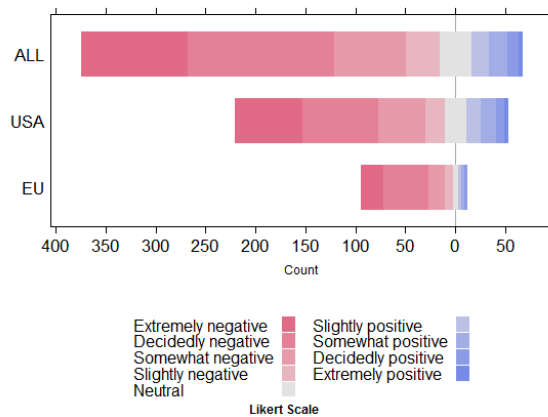


Figure 3. Opinion on the NSA – comparison between all answers, EU-only and US-only.

This doubt is corroborated by Mann-Whitney U test ($n_1=275, n_2=106, p = 0.1591, \text{two-sided}$) which does not show a statistically significant difference between US and EU responses. Hence, H3 has to be discarded.

7 Conclusion

This article examined public sentiment about the NSA through an anonymous survey which was conducted a year and a half after the initial revelations by Edward Snowden about the NSA's data collection programs. 444 respondents from US, EU and other countries completed the survey.

The results show a high degree of self-proclaimed familiarity with function of the NSA and Edward Snowden's revelations. Public opinion about the NSA is strongly negative and that sentiment is shared among respondents from US, EU and other countries. Interestingly, there is no significant difference in opinion between US and EU respondents. Edward Snowden's revelations were judged as very concerning by almost half of the respondents, and the respondents think that those findings somewhat increased their information security awareness.

The study showed a statistically significant moderate level of positive correlation between respondents' IT proficiency self-assessment and familiarity with Snowden's revelations. Furthermore, a statistically significant moderate towards substantial positive correlation between the level of concern with Snowden's revelations and increase in information security awareness was found.

The results of the survey indicate that Edward Snowden's revelations had a lasting effect on public opinion. However, it is uncertain how this change in opinion translates into action. As mentioned in chapter 2, CIGI-Ipsos Global Survey on Internet Security and Trust [2] indicates that significant percentage of people have taken steps to protect their online privacy and security as a result of Snowden's revelations. However, it would be interesting to examine what technologies are used, how well they protect from indiscriminate data collection, how they influence business models of companies that rely on data collection, and so on. Furthermore, it is unclear whether the public will, through electoral process or otherwise, push for policy changes. Both areas might be interesting for further research.

Additionally, shortcomings of this survey such as skewness of the sample (relative preponderance of respondents from the USA and shortage of respondents from BRIC countries), absence of stratification by age and sex, self-assessment of competence, restrictions of anonymous surveys, etc. somewhat limit reliability of the conclusions. Therefore, additional survey(s) with wider scope might be needed to fully confirm the conclusions.

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