

Generational Gaps in AI Adoption: Exploring the Correlation Between Age and AI usage in small and medium enterprises (SME's)

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Abstract

From Generation Z to Generation X, the humanity experienced many events which shaped the world that we see today. Technology is the main root of generational changes according to Twenge, 2023. The growing interest in AI applications like Gemini and Chat GPT could accelerate generational differences and cause changes to happen more quickly. The goal of this research paper is to analyse the views of different generations in order to answer the question: "Is there a correlation between generations and usage of AI?"

The study focuses on small and medium sized companies where AI implementations would optimise workflows and decision-making processes (Sandra Maria Correia Loureiro, 2020). In order to answer the research question, data was collected from 190 SME employees about their opinion on the usage of AI throughout a survey distributed via "Prolific.com". We anticipate a significant difference in AI adoption between Gen Z, Millennials and Gen X. Our hypotheses are that Gen Z is more enthusiastic about using AI applications in the workplace and that people under the age of 35 are using more AI than the ones over the age of 35.

Keywords: Artificial Intelligence, Generation Z, Millennial, generational differences, willingness to learn, SME

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1. Introduction

For 2000 years the older generations are criticizing the younger generation for being lazy, self-absorbed and arrogant (Worklife, 2017). It is a cycle that repeats itself since Aristotle until now. The youth will always try to find creative ways to do tasks differently than the older cohort. The older generation is not always open to the ideas of the youth, preferring to look at these with a certain level of scepticism. The rapid developments of artificial intelligence have changed the decision making process of companies all around the world. These technologies are changing how employees interact at work, creating opportunities for everyone to learn from each other. According to Nguyen and Malik, 2022, small and medium-sized enterprises (SMEs) often have issues to keep up with these innovations, due to a lack of knowledge or financial reasons. In order to see growth in their business, the owners have to think about the danger of implementing AI regarding the psychological responses to these technological advancements.

Large companies are investing significantly more than SMEs in AI technologies (Statista, 2024) as shown in Figure 1. Smaller and medium enterprises are struggling with implementing AI technologies and also with training the employees. As SMEs increasingly recognize the importance of integrating AI into their operations, they must also adapt with the varied learning styles and current knowledge levels across different generational groups. Generation Z grew in an era of technological advancements at every corner and Millennials are not so far away from their younger co-workers in adapting to technological innovations. On the other hand, Generation X, who often have leadership roles within companies, may show a more scepticism toward adopting new technologies like artificial intelligence. This is due to the fact that their experience may be a result of previous technological failures, adopting a more conservative approach to how things should be done.

1.1. Problem Statement

Previous studies only explored the different attitudes people possessed regarding the topic of AI. This research will take the work of these articles and will build on top of them in order to bring more insights to small and medium enterprises. This will help these companies

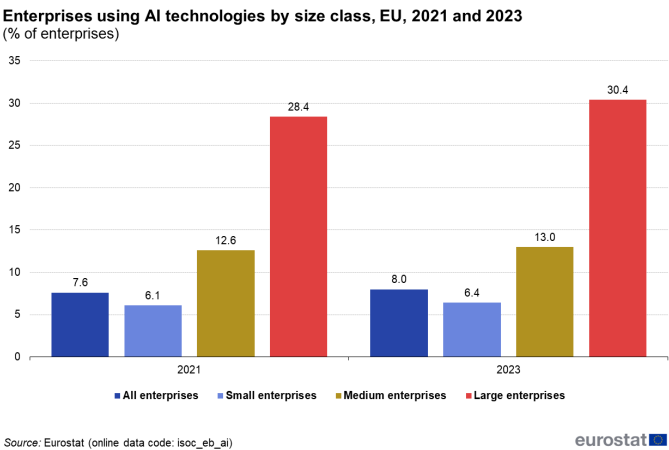


Figure 1. Investments in AI technologies EU (Eurostat, 2023)

in providing a better training regarding artificial intelligence. The unexplored field is seeing if the generational differences are affecting people's opinion on the advancements of AI.

1.2. Hypotheses

As a result, two hypotheses are built using their respective pairs:

H_{01} : AI usage does not differ across different generations.
 H_{A1} : Generation Z is the most common user of AI technologies, followed by Millennials and Gen X.

H_{02} : Utilisation of AI does not differ across the age of the consumer.
 H_{A2} : People under the age of 35 are using more AI in their day to day lives, than people older than 35.

Firstly, the hypothesis H_{A1} assumes there is a generational difference in the adoption of AI among the 3 generations. The intention of AI usage is to encompass all forms of utilization, whether it be during work or at home. The null hypothesis H_{01} presuppose the opposite: there is no difference in AI usage between generations. In this manner, H_{01} shows a shift in the cycle of generational criticism.

Secondly, the hypothesis H_{A2} brings a more holistic view on the issue, focusing on age as a broader factor than forcing to bin respondents into generations. This approach will compare individuals born prior to 1989 with those born after 1990. On the other hand, the null hypothesis H_{02} asserts that AI usage does not differ across the age of the employee in a small and medium sized company.

2. Literature Review

In the research world, there is a controversy over whether there is an actual difference between generations. According to Rudolph et al. (2021) the majority of research papers lack evidence and are built primarily as a form of modern ageism. This study argues that the current articles present online are written from a generational point of view and they are lacking a nuanced perspective. However, Karina Gabrielova (2021) provides strong evidence to the hypothesis that generations are indeed different. The latter paper is using theoretical frameworks like the General Cohort Theory (McKercher, 2023) and Leader-Member Exchange (LMX) as well as analytical approaches such as qualitative analysis from various studies and a extensive literature review in order to identify differences between generations.

2.1. Bayesian Brain

Bayesian statistics is a sub-field of statistics that recalculates the probability of an event by making use of priors and new information. According to Chieives (2024), the human brain is a near perfect Bayesian model, since our priors are built as our beliefs. In some cases, the priors are so deeply believed, that no matter the amount of evidence it is shown to the individual they will find alternative hypothesis for the outcome of the event. For an individual who does not trust the developments of artificial intelligence, for instance, it is more feasible to believe the premise that scientific papers are a conspiracy theory than it is for them to believe in the benefits and regulations of AI. Since the older cohort has more life experience, it is reasonable to assume that they have stronger beliefs about some topics. However, the question of changing their beliefs is outside the scope of this research. If they experienced the failures of other technologies in the past, they will be less prone to trust the developments of artificial intelligence. In the event that the hypotheses are validated, Bayesian statistics could offer a potential explanation.

2.2. General Cohort Theory

The present research paper uses the General Cohort Theory as a foundation stone of the study. This framework states that similar generations are sharing similar experiences due to significant historical events. These significant historical events are a consequence of the technological advancements that humanity does. For example, Generation Z may be defined by COVID 19, which is a consequence of the advancements in transportation which made possible affordable traveling more than ever. The shared experiences of each generation, shaped by significant historical events and technological advancements, influence how individuals adapt to new innovations.

2.3. Technological Advancements & Artificial Intelligence

The term "technological advancement" is defined as the combination of science and knowledge put into practical use in order to solve problems or invent tools (Twenge, 2023). One of the most important technology advancements in our day and age is artificial intelligence and it is prone to continue in the upcoming decade according to Shaoa et al., 2022. The major problem that companies are facing is that employees do not have time to digest all the information about the rapid development of artificial intelligence and its benefits to their workspace. In the next section, the psychological profile of the employees will be explained based on the Cognitive Appraisal Theory and a study on the emotional and rational response of employees regarding AI usage in their workspace.

2.4. Cognitive Appraisal Model

The cognitive appraisal model developed by Lazarus and Folkman, 1984 is an influential theory that explains the coping mechanism of people when dealing with stressful situations and how do they evaluate them. When facing the risk of AI taking over their jobs, employees consider leaving the company, being a consequence of the this model (Zhu et al., 2021a). In the previously mentioned paper, the supported hypothesis show that there is a correlation between the perceived importance of AI and the affective (emotional response) and cognitive (or how willing are they to learn) attitude of employees towards the developments of artificial intelligence. In another study by the same authors (Zhu et al., 2021b), four different typologies of people were observed based on their cognitive and affective responses. The majority of people who participated in that study were AI Dissenters (people who do not perceive the benefits of AI and have a negative emotional response) representing 46% of the respondents. However, this number may vary across age group, thus the goal of this research paper is to see if the number of AI Dissenters vary between Generation Z, Millennials and Generation X.

3. Methodology

3.1. Research Design

In the current research paper, an observational study is being conducted with the purpose of investigating the possible connections that exist between various generations and the use of artificial intelligence. As a result, the research is categorised as an exploratory paper, and its purpose is to serve as a foundation stone for subsequent experimental papers that would investigate the causal correlations between variables. For the purpose of determining whether or not the alternative hypothesis is more plausible than the null hypothesis, quantitative data was gathered. During this preliminary phase of the investigation, observational research is particularly well-suited since it enables the study of natural behaviour in situations that are based in the actual world. Furthermore, the current design offers a solid basis for the studies that will be written in the future that will investigate the causality relationships.

3.2. Data Collection Methods

Quantitative data was used for the purpose of this paper, through a survey. The survey was distributed through "Prolific.com" to the desired population (SME employees). Thus, we can be sure that each data point is independent from another, ensuring the accuracy of the statistical analysis and that the dataset does not show any convenience bias. People from 27 countries responded, avoiding a geographic bias. Moreover, Prolific uses a random sampling technique based on some requirements used to best represent the target population of the study through the sample. In the study by Zhu et al., 2021a, a significant portion of the participants, specifically 46%, were identified as AI Dissenters. These individuals not only failed to recognize the benefits of AI but also exhibited negative emotional responses toward it. This suggests that nearly 46% of the people in that study are likely not utilizing AI technologies due to their skepticism and emotional aversion. Due to the fact that the study was conducted in 2021, the general view of people may have changed in the mean time. These people are reasonably represented by the ones in Table 1 who answered with "Rarely" and "Never", that meaning 37.3%. This threshold is similar to the one in the study by Zhu et al., 2021a, so we can deduct that these people have very strong beliefs about uselessness of AI.

3.3. Data Analysis

Originally, the dataset contained 59 variables, however only three questions were used for the purpose of this paper. The first one was about the age of the respondent in order to group them into generations. The other questions helped with measuring the frequency of AI usage in day to day life and work life. The end feature named

Table 1. Summary of Data

Variable	Category	Number	Percentage Participants*
Age	18-24	53	27.2%
	25-34	88	45.1%
	35-44	29	14.9%
	45-54	17	8.7%
	55-64	3	1.5%
AI Usage	Regularly	39	20.5%
	Occasionally	80	42.1%
	Rarely	51	26.8%
	Never	20	10.5%

* The percentage relative to the total sample.

"AI Usage," was produced by scoring the responses to the questions about the frequency of using AI, combining the results to produce a final score, and then returning the scores to their original categories: "Regularly", "Occasionally", "Rarely", and "Never". In Figure 2, the age distribution of respondents is shown and Table 1 shows the number and percentages of the column "AI Usage". The Figure 3 illustrates the distribution of responses to the question about the use of AI in the workplace and during leisure time. This graph indicates that respondents are generally utilizing AI at home more frequently. Nonetheless, the plot emphasizes that, regardless of the setting, a greater number of individuals use AI technologies than either rarely or never.

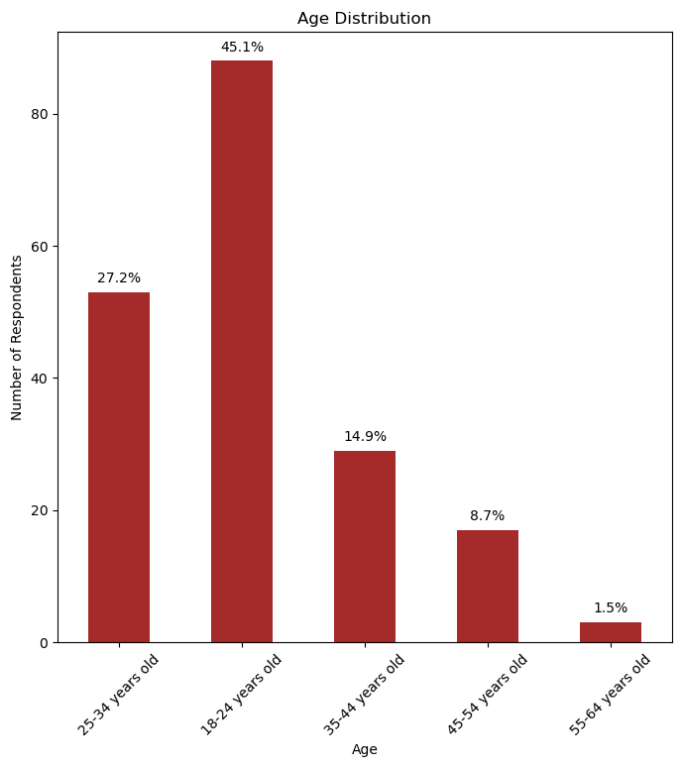


Figure 2. Age Distribution in the Survey

An initial exploratory data analysis file was done in Python in order to create the table and plots for understanding the contents of the dataset. After analysing the descriptive statistics of the dataset, I tested the hypothesis. Due to the small number of people who are

Generation X, the success-failure condition was not met, so Fisher's Exact Test was the most appropriate method. Fisher's Exact Test is a statistical test that checks nonrandom associations between 2 categorical variables in a contingency table. This test is particularly good when working with small samples and it's an alternative to the Chi Squared test, which involves the success-failure condition. However, the independence condition still needs to be evaluated in this kind of statistical method.

During the hypothesis testing, the expected outcome was seeing a clear difference between the generations in AI usage. Generation Z would use the most these technologies at work, but also in their day to day life, then Millennials and afterwards Generation X. The point estimates would confirm these expectation in the early phase of hypothesis testing, showing a real difference between the 3 generations. The second hypothesis was formulated in a broader view point, in order to see any differences in people under the age of 35 and above the age of 35. This way of categorizing the data basically divided the Millennials in 2 groups: the ones who have more in common with Generation Z and the ones who are more similar to Generation X. The first expectation was made from a generational point of view that Generation Z is using more artificial intelligence technologies than the other ones due to personal experience. The common misconception of the younger generation's decreased attention span (Subramanian, 2018) addresses the issue. Even though the shrinking attention span myth (which is usually connected to Generation Z and the upcoming Generation Alpha) is not based on real world data, the impact of technologies and use of smartphones that are encouraging multitasking and disrupting the focus is true, ultimately implying that younger generations use more technology than older generations.

The second hypothesis, is based on the implication of the General Cohort Theory that states that generation flow into each other. For example, are people born in 1996 are considered Millennials and the ones born in 1997 Gen Z, but research (Twenge, 2023) showed that generations do not end abruptly, but are flowing into each other. This implication, enabled me to further divide the people in the second hypothesis. The first half of Millennials share more characteristics with Generation Z and the latter half with Gen X.

3.4. Ethical Considerations

Moreover, during the research, a data management plan was constructed in order to ensure that the research paper is in accordance to the legal framework and check every ethical consideration. The files are saved in GitHub in a folder named "DMP" (Data Management Plan) and it contains the following files: the official data management plan, Breda University of Applied Sciences Ethics Review Letter, an information letter, an informed consent letter, the protocol of saving the data, a FAIR checklist, a code-book describing the variables and a ReadMe file. The official data management plan outlines how the data is going to be stored, shared, and preserved, in line with funder and institutional requirements. The BUas Ethics Review Letter is meant to be reviewed by the mentors of Breda University of Applied Sciences and ensures that the research complies with ethical standards. The information letter provides essential information about the research project to the participants in interviews and surveys. The goal of this file is to inform the participants about the research and to obtain their consent to participate. The informed consent paper is presented after the Research Information Letter and it is meant to be signed by the participants to confirm their consent to participate in the research, acknowledging that they understand their rights and the study's purposes. The Data Storage Protocol establishes the methods for data storage, access, and protection throughout the study process, in accordance with the General Data Protection Regulation (GDPR). Ultimately, the FAIR Checklist guarantees that the data generated in this project is Findable, Accessible, Interoperable, and Reusable. This document outlines the procedures implemented to ensure the

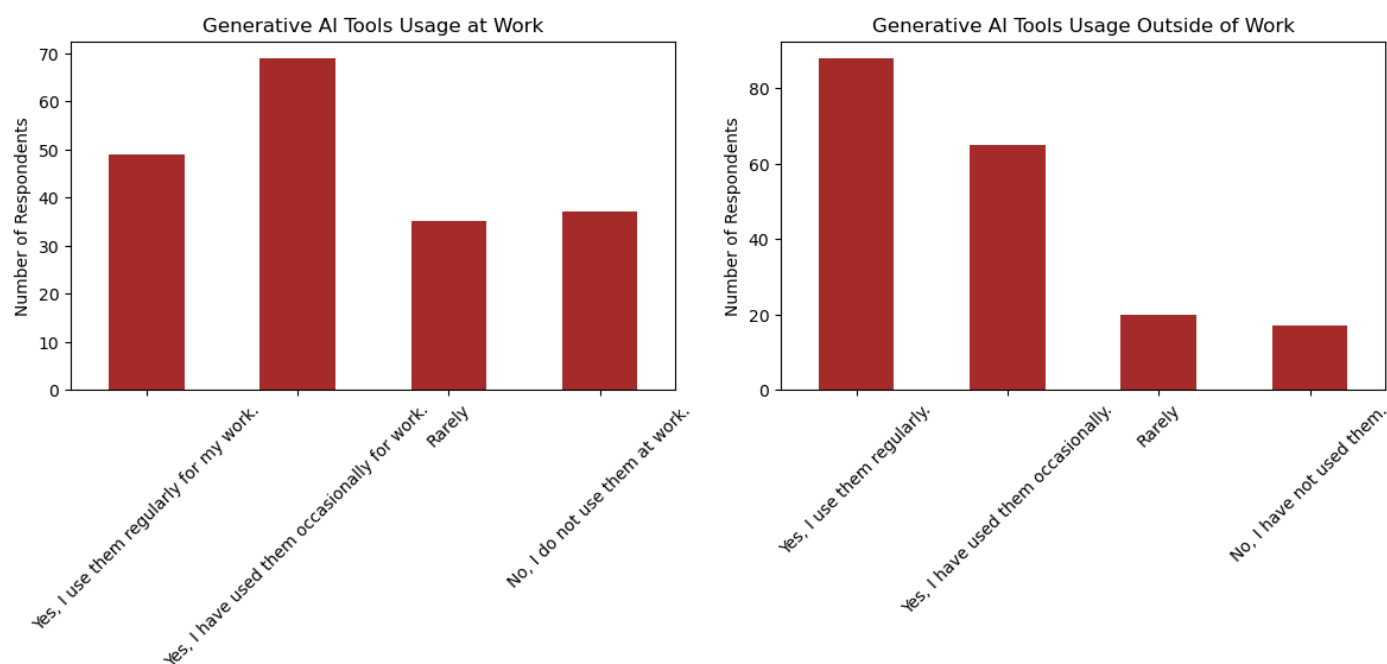


Figure 3. Distribution of answers of AI usage at home and at work in the Survey

data is FAIR, whereas the ReadMe file breaks down the contents of the data management plan folder.

3.5. Limitations

The limitation of this study is characterized by the data collection methods employed. Although "Prolific.com" guarantees the independence of responses and their quality, it suggests a bias favoring Millennials. The dataset has almost 60% of their participants between the ages of 25 and 44. Generation Z has 30% of the data points, but the problem comes to Generation X, which represents roughly 10% of the dataset. Ideally, the dataset would have a similar number of responses from each generation. It is possible that this may make it more difficult to make fair comparisons between different generations, which will in turn reduce the internal validity of the findings. It is for this reason that the second hypothesis is being proposed in order to make an effort to battle this problem and at the very least to have a more comprehensive perspective on the situation at hand.

Another limitation present in the current dataset is being the fact that the majority of participants in the survey are being located in a single country. 52% of participants are currently living in the respective country, representing a concern for the generalization of the findings. "Prolific.com" did not take into account the bias behind some of the demographics of the respondents, thus, the outcome of the study may be influenced by these biases.

4. Results

The aim of this research paper is to examine the way generational gaps are influencing the AI usage of employees in small and medium size companies. The first hypothesis is aiming to see the impact of these generational gaps regarding how much they use artificial intelligence, however the second hypothesis takes a holistic view on the issue and uses the age as a parameter instead of generations. Thus, the Millennials are being divided so that the individuals who share more with Generation Z are being merged and the ones who are more similar with the older cohort are being combined. This way, the bins are transformed into people who are aged under 35 and those who are above 35. As explained in section 3.3, the General Cohort Theory states that individuals who share similar experiences can be

considered to be part of a generation. However, these generations flow into each other, and they overlap. Thus, there are young Millennials who share the same experiences also with older people from Generation Z, for example. This theory made possible the division of the Millennials and analysing the people aged under and over 35 years old.

Both hypotheses were tested with Fisher's Exact Test, which checks for nonrandom associations in small samples of a population. Due to the small number of people from Generation X, this statistical method is better than the others. In order to provide enough evidence to reject a null hypothesis, the p-value of Fisher's Exact Test needs to be lower than 0.05. The p-value of the *first hypothesis* (H_{A1}) is 0.27, which is does not provide enough evidence to reject the null hypothesis H_{01} . The *second hypothesis* (H_{A2}) scored a p-value of 0.09, also to failing to reject the null hypothesis (H_{02}).

The Cramer V score is a statistical method to value how strong 2 categorical variables are associated. Usually this score is a number between 0 and 1. A score between 0 and 0.1 means no association, 0.1 to 0.3 is considered to show a moderate association, 0.3 to 0.5 shows a strong association and a score above 0.5 means a very strong association. Hypothesis 2 scored 0.18 showing a moderate association in the social sciences, while hypothesis 1 did not have the condition of having only 2 categorical variables. A brief summary of the status of the hypothesis and the p-values can be found in Table 2 below.

Table 2. Hypothesis Status

Hypothesis	P-value	Cramer V	Status
H_{A1}	0.27	-	<i>Failed to Reject Null</i>
H_{A2}	0.09	0.18	<i>Failed to Reject Null</i>

5. Discussion

In the following part of the research paper, the results presented in the previous section will be interpreted for both hypotheses.

5.1. Hypothesis one

Since the p-value of the first hypothesis is 0.27, we fail reject the null hypothesis. This value signifies that there is a probability of 27% seeing results as extreme as the ones present or more extreme under the null hypothesis H_{01} . Therefore, we do not have enough evidence to confidently say that Generation Z uses more AI than Millennials or Generation X. One important factor to consider is the imbalance in the survey responses. A significant portion of the survey responses were from Millennials, which skewed the results and influenced the p-value. This imbalance could reduce the power of the test, making it more difficult to detect a true difference if one exists. It would be advantageous to accumulate additional data with balanced classes in order to obtain a more precise p-value for future research, as well as trying to add more depth to the problem like the psychological profile of the respondent (Zhu et al., 2021a). This way we can be sure of the verisimilitude of the outcome of this hypothesis. Section 3.5 provided a comprehensive outlook on the limitations of this study.

5.2. Hypothesis two

The second hypothesis explores the question if there is a difference between age and AI usage. A p-value of 0.09 means that there is a 9% chance of seeing results as extreme or more extreme as this sample. More easily said, if I were to conduct this experiment over again, I would see this result once in 11 times, considering the null hypothesis H_{02} true. This sample provides stronger evidence to reject the null hypothesis H_{02} , however not strong enough since the value is not lower than 0.5. Thus, we still are unable to say that people under the age of 35 are using more AI than the people above 35. However, the Cramer V score indicates a moderate association between these two variables. This implies that there might be a connection between the variables, but there might be other factors that are influencing the usage of AI in SME employees.

6. Conclusion

Until further research, the null hypotheses are staying relevant for this study. Consequently, it may imply a shift in the generational gaps between humans, where the older generation is accepting the fresh ideas of the youth and even try to use them. The possibilities of artificial intelligence may have been enough for the older cohort to become less sceptic about AI. Older people have a tendency for scepticism since the brain is essentially a near perfect Bayesian model with very strong priors that are hard to change (Chieves, 2024). That implies that it needs stronger evidence for the older cohort to change their opinions on topics like artificial intelligence. It may be a possibility that with the developments of this technology and the legal and ethical frameworks developments, they provided enough evidence for Generation X to reconsider their scepticism. As a result, the criticism cycle that has been present in humanity since Aristotle (Worklife, 2017) may not apply to the use of artificial intelligence across different generations and ages.

In this way, the generational gap in AI adoption in SME's may be narrower than expected. However the Cramer V score may show that there is a more complex association, where AI usage is not only influenced by the age or the respective generation of the employee. The results of this research paper is suggesting for the stakeholders, that there is no need for any major differences in the training or informing campaigns about AI across different generations or ages. Failing to reject the null hypotheses, might be beneficial for companies since they do not have to invest in tailored AI learning programs for their employees based on their age since they have overall a similar level of knowledge about how to use this technology.

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