

DEMOGRAPHIC AND EDUCATIONAL FACTORS IN THE USE OF ARTIFICIAL INTELLIGENCE IN INDUSTRY

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Abstract: *The swift advancement of artificial intelligence (AI) is increasingly influencing the world of work, particularly in industrial environments. This study analyses the influence of age and education on the use and integration of AI in the industrial sector, based on a survey of 211 participants. Demographic factors such as age and educational attainment were examined in relation to the practical application of AI technologies, especially within production and operational processes. Contrary to common assumptions, the results refute the hypothesis that the age of employees significantly affects the adoption or operation of AI systems. While it is often assumed that older employees may encounter more difficulties when working with new technologies, our data does not support this notion. Similarly, no statistically significant correlation was found between the level of education and the extent to which AI is used or successfully implemented. These findings suggest that other variables, such as organisational culture, the quality of change management processes, employee involvement in digital transformation, and leadership support, may play a more decisive role in the successful deployment of AI. The study underscores the importance of focusing on these organisational and procedural aspects rather than on demographic characteristics alone when designing strategies for AI implementation in industrial contexts.*

Keywords: *Artificial Intelligence; Industry 4.0; Age; Education; Digitisation*

INTRODUCTION

In the last few years, the fast development of artificial intelligence (AI) has led to an intense debate about its impact on the world of work. On the one hand, forecasts predicting the far-reaching replacement of human labour by AI systems are being discussed. On the other hand, the potential of AI to support and supplement human skills is also being emphasised (Heinen, Heuer, Schautschick 2017). In order to find out whether the age of the employees or education plays a role in the application, a survey was conducted with $n=211$. This survey analysed the level of education and age concerning AI. It was initially assumed that, as with many new technologies, age plays a role in the use of AI (Aubert, Caroli, Roger 2023). To confirm or refute this, the survey was conducted in three sections. As mentioned in the introduction, demographic data and AI use were surveyed (Hunt, Howell, Chonko, Wood 2023). These data were combined into variables, and the correlation was calculated and analysed. Older people often struggle with new technologies (Knowles, Hanson 2018). Therefore, it is reasonable to assume that introducing and using AI in industry also leads to difficulties that reduce commitment and thus impact productivity. Mowday, Steers and Porter (1979) mentioned a connection between organisational commitment and employee performance (Mowday, Steers, Porter

1979). Although the results of various studies cited in the article show a positive trend, the correlations are weak. However, the authors point out that many factors influence performance, and commitment is only one. Indeed, as with most process changes or introductions, the possibility of rejecting new technologies can be reduced with well-organised change management and training. Like Tolstoi (1828 - 1910), “Everyone wants to change the world, but no one wants to change themselves” Most people find change difficult. Since there are no significant differences in commitment between the age groups themselves (Kluge 2006), it can be assumed that if age itself has no effect, a change in commitment during the introduction of AI is directly attributable to the technology itself or the change process. The survey results with n=211 showed no correlation between the use of AI, age and education.

RESEARCH METHODOLOGY

Educational factors in the use of artificial intelligence in industry

Unlike age, employees’ education level appears to play a more significant role in the use and introduction of AI. The empirical study shows that employees with a higher level of education can present quickly and recognise the technology’s benefits more often (Pfeiffer 2020). However, the study by Pfeiffer (2020) also shows that in areas considered “knowledge- and/or consulting-intensive”, employees have the potential to use AI. This is also reflected in some of the interviews conducted in this context with leading employees of car manufacturers and industrial companies. However, the focus here is not on knowledge-intensive tasks such as setting up and training AI systems but on their use in industry. Here, AI systems are to be used to support employees or for quality assurance. Using such a solution or even a simple language model such as ChatGPT certainly requires training, but a simple front end such as ChatGPT with, e.g. text or voice input can make it much easier to use the system. This does not necessarily mean that the employee’s education influences the use of AI. This was also queried in the survey with n=211, and the correlation between the level of education and AI was tested using a validated questionnaire. To ensure the reliability and accuracy of the survey, a validated questionnaire Niedersee et al. (2021) developed a questionnaire which was used to create the following three variables:

Use of AI:

16. Exciting, but no time/opportunity yet: “I find the topic exciting but have not yet had the time/opportunity to look into it more closely.”

20. Already involved in AI solutions: “I am already involved in AI-based solutions in our company.”

Benefits of AI:

17. The clear benefit for products/services: “or our company, AI brings a clear benefit for our products or services.”

19. Is overrated, no expectations: “I think the topic of AI is overrated. I don’t expect significant improvements.” [R]

22. Benefit is unclear: “The potential benefit of AI for our company or my area is not clear to me”.[R]

23. New business models: “AI enables new business models for our company”.

Characteristics of AI:

18. Comprehensible decisions: “Decisions made by AI systems must be comprehensible to users”.[R]

21. AI = ML: “For me, AI and machine learning are the same thing.” [R]

24. Support not a substitute for humans: “AI systems should be used as support, not as a substitute for human intelligence.” [R] (Niederee et al. 2021)

These questions were coded and combined into three variables: Use, Benefits and Characteristics of AI. The meaning of the variables is as follows. The variable ‘use of AI’ explores whether the respondent is interested in the technology and is already involved in an AI-supported process. The variable ‘benefits of’ questions if the respondents see benefits in using AI or if it is an overrated technology. The ‘characteristics of AI’ mirror the respondents’ opinions on how much such an AI can decide for itself or how transparent the operation should be. In the following tables 1 – 3, the coding of the questions mentioned above, age and education according to the Likert Scale will be shown (Robinson 2014).

Table 1. Coding of AI questions

Answer	Coding	Coding of [R] questions
fully applies	5	1
mostly applies	4	2
I cannot judge	3	3
no answer	3	3
mostly not true	2	4
not at all true	1	5

Table 2. Coding of Age

Age	Coding
under 18	1
18 - 24	2
25 - 34	3
35 - 44	4
45 - 54	5
55 - 64	6
65+	7

Table 3. Coding of Education

Education	Coding
No academic degree	1
Bachelor	2
Diploma	3
Master	3
Doctor	4

Education and age are converted into variables and will be compared with the three AI variables

using a spearman rho analysis. Correlations between $r = 0.1$ and $r = 0.3$ can be categorised as low to moderate, correlations between $r = 0.3$ and $r = 0.5$ as moderate to high, and from $r = 0.5$ as high (Cohen 1988).

The survey was conducted over six months using an online platform to publish it. To reach a wide range of people it was spread via private channels such as messaging services. But to reach the right persons and a wide spread of people, cultures and countries, a professional networking platform where individuals can connect, share career achievements, and explore job opportunities was used.

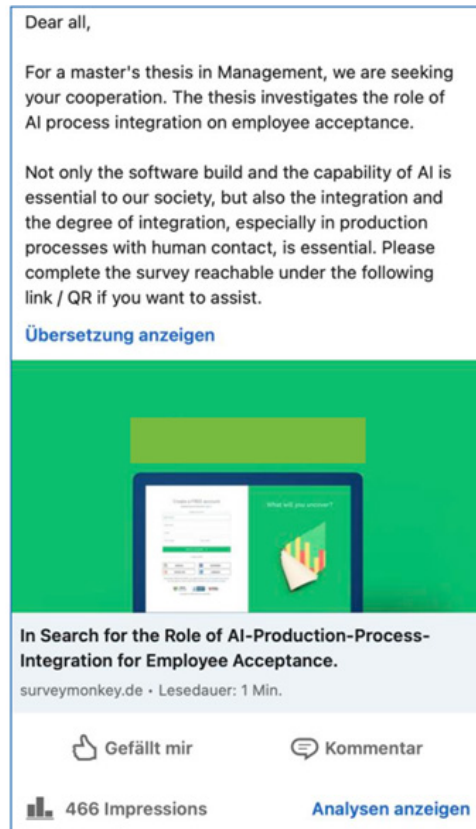


Fig. 1. Impressions on Social Media

The number of impressions is impressive, even if not everyone who saw the post attended. A sample size of $n=211$ is still a good result.

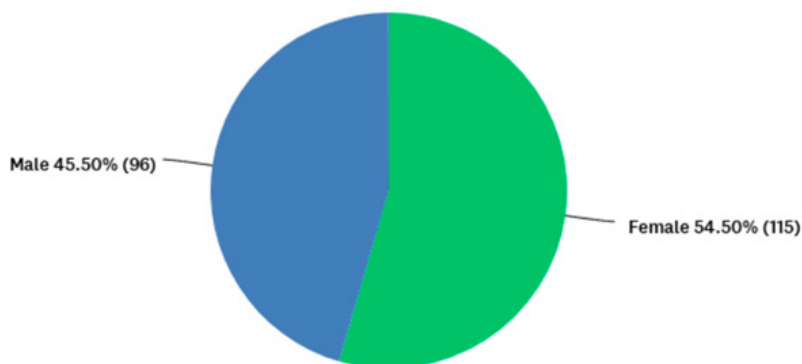


Fig. 2. Gender split

Also, the gender split is very exciting as it is almost 50/50. However, this might also be a downside, as it does not reflect the reality in the industry today.

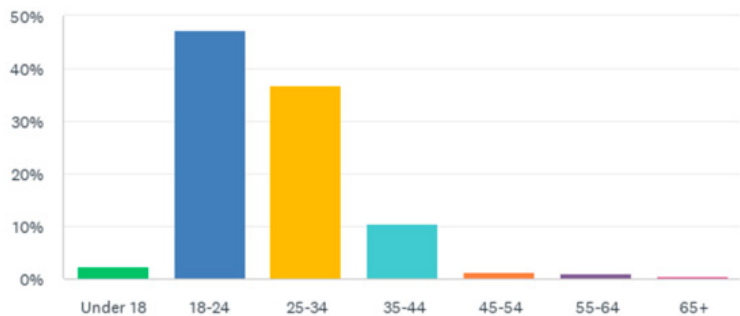


Fig. 3. Age

The age distribution shows a focus on the 18-34 age group, which can mean a glimpse into the future depending on the results of the survey.

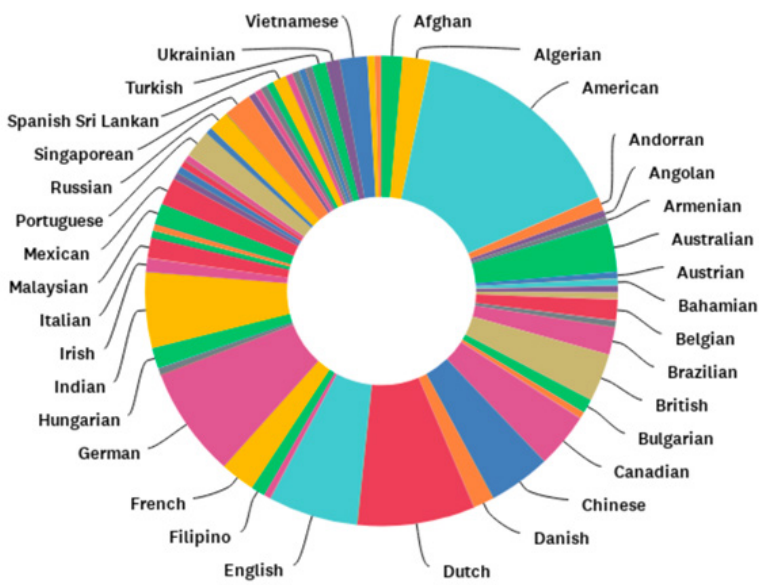


Fig. 4. Nationality

The breakdown by nationality reflects the high degree of dissemination of the socail media and thus provides a good global view of the current reality.

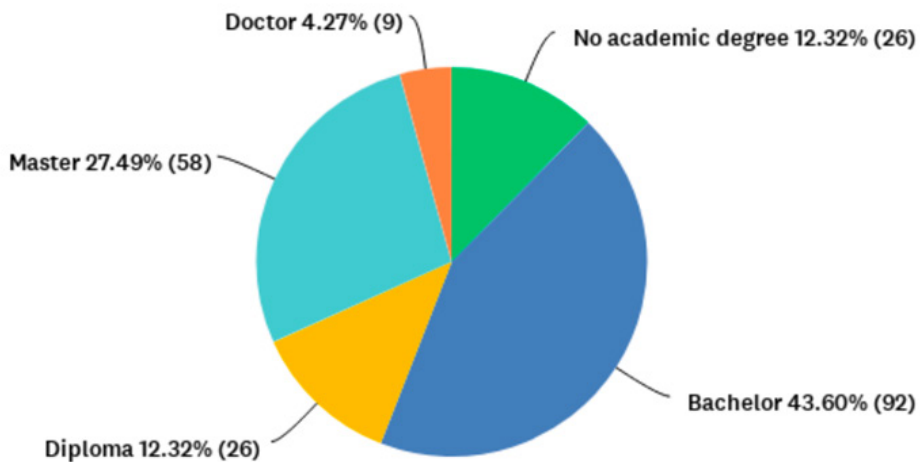


Fig. 5. Education

Fig. 5 illustrates the breakdown of the survey participants' educational backgrounds.

RESULTS

The survey results with $n = 211$ showed no correlation between the AI variables, level of education and the age of the attendees. The results are shown in the following table.

Table 4. Correlation

	Age]	Education	AI Use	AI Benefits	AI Char
Age		0,399 ($p=0,0000$) N=211	0,006 ($p=0,4641$) N=211	0,114 ($p=0,0493$) N=211	-0,154 ($p=0,0125$) N=211
Education	0,399 ($p=0,0000$) N=211		-0,110 ($p=0,0558$) N=211	-0,028 ($p=0,3410$) N=211	0,033 ($p=0,3176$) N=211

The first significant correlation can be seen between education and age. The correlation coefficient of 0.399 means a moderate correlation, which is not surprising as the level of education is time-consuming, and it is more likely that older human beings have a higher education and level of university degree. Looking at the scattered field matrix, it is evident that there is a relationship between these variables.

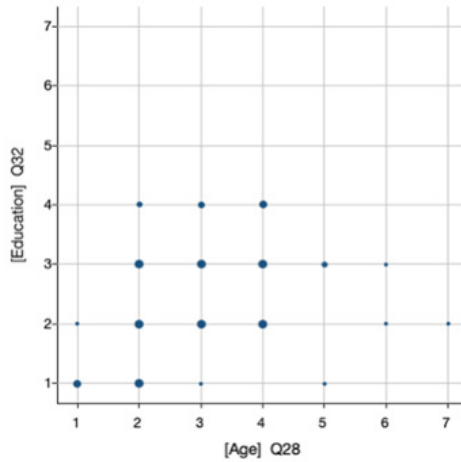


Fig. 6. Scattered field matrix

The correlation coefficients of the age and the three AI variables show a low to very low correlation. Age to the use of AI does not influence with a coefficient of 0.006. The Benefits of AI are at 0.114, and the Characteristics of AI, at -0.154, are also low. This means that the age of the respondents has only a non-to-low influence on the usage of AI in organisations (Cohen 1988). Comparing the same three AI variables with the level of education, we are getting results like -0.11, -0.028 and 0.033, which is also considered a low correlation, meaning that the level of education does not influence the three variables.

CONCLUSION

The study showed that neither the age nor the level of education of employees significantly impacts the use of AI in the industry. In particular, age, often seen as an inhibiting factor in introducing new technologies, does not play a role, according to the results. Similarly, the level of education shows no significant correlation with the use or acceptance of AI. This suggests that the successful integration of AI depends less on the individual demographic characteristics of employees and more on strategic change management measures and suitable training. Therefore, companies should focus more on designing processes and supporting structures to promote the acceptance and use of AI systems.

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ДЕМОГРАФСКИ И ОБРАЗОВАТЕЛНИ ФАКТОРИ ПРИ ИЗПОЛЗВАНЕТО НА ИЗКУСТВЕН ИНТЕЛЕКТ В ПРОМИШЛЕННОСТТА

Резюме: Бързото развитие на изкуствения интелект (ИИ) оказва все по-голямо влияние върху света на труда, особено в индустриална среда. В настоящото изследване се анализира влиянието на възрастта и образованието върху използването и интегрирането на ИИ в индустриалния сектор въз основа на проучване, проведено сред 211 участници. Демографските фактори, като възраст и образователен ценз, бяха разгледани във връзка с практическото приложение на технологиите на ИИ, особено в рамките на производствените и оперативните процеси. Противно на общоприетите предположения, резултатите опровергават хипотезата, че възрастта на служителите оказва значително влияние върху приемането или функционирането на системите с ИИ. Въпреки че често се предполага, че по-възрастните служители могат да срещнат повече трудности при работа с нови технологии, нашите данни не подкрепят това схващане. По същия начин не беше установена статистически значима връзка между нивото на образование и степенята на използване или успешно внедряване на ИИ. Тези констатации предполагат, че други променливи, като например организационната култура, качеството на процесите за управление на промените, участието на служителите в цифровата трансформация и подкрепата на ръководството, могат да играят по-решаваща роля за успешното внедряване на ИИ. Проучването подчертава значението на фокусирането върху тези организационни и процедурни аспекти, а не само върху демографските характеристики, когато се разработват стратегии за внедряване на ИИ в индустриален контекст.

Ключови думи: изкуствен интелект; индустрия 4.0; възраст; образование; дигитализация

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