# Információs Társadalom

## [Information Society]

A SOCIAL SCIENCE JOURNAL

Founded in 2001

**English Issue** Vol. XXIV, No. 4 (2024)



Published by INFONIA Foundation

Principal sponsor: Budapest University of Technology and Economics, Faculty of Economic and Social Sciences

Technical partner: SZTAKI



ISSN 1587-8694 (Print)
ISSN 2063-4552 (Online)
ISSN-L 1587-8694

Produced by Server Line Print & Design, Budapest

The journal Information Society (In Hungarian: Információs Társadalom, abbreviated as InfTars) aims to provide a platform for research and discussion of the theories and applications of Information Society Studies. Currently every second issue is published in English, the rest are in Hungarian.

The journal is fully Open Access and freely available at https://inftars.infonia.hu/

InfTars is indexed in both the *Web of Science Social Sciences Citation Index and Scopus*, and all titles are automatically submitted to *Crossref*.

Since Vol. VIII, No. 1 (2008) the journal has been included in the Thomson Reuters index (Social Sciences Citation Index, Social SciSearch, Journal Citation Reports/Social/Sciences Edition)

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# LECTORI SALUTEM

In our first article, Kancné Nagy and Tóth report on extensive research conducted among 320 engineering students. As part of their exploration into university students' attitudes toward robotization, their primary objective was to understand how students perceive their own labor market competencies.

Shalkarbek et al. examine the cognitive mechanisms underpinning the construction of language paradigms by analyzing hyperbolized phraseological units as tools of emotive evaluation in media texts. Their theoretical approach to media literacy in contemporary society involves constructing linguistic templates for perceiving reality and its cognitive representation, using examples from two national language codes.

Chen et al. report on how blockchain-based social networks differ from traditional ones in terms of information diffusion. Their study introduces an evolutionary game model to explore how blockchain features affect users' information-sharing behaviors, aiming to enhance efficiency in social networks.

Yaroshenko et al. analyze the current state of legal regulation concerning the use of digital technologies to monitor and manage working time in the EU and individual Member States. The scientific novelty of their article lies in its comprehensive legal analysis and recommendations designed to clarify regulatory policy in labor relations.

Finally, Kazakov presents the second part of his two-part paper on AGI. This installment systematically explores the key implications of the concept of AGI-correlationism, as introduced in the first part—from the assumption that AGI must replicate human intelligence to the often-unquestioned reliance on human-centric benchmarks like the Turing Test.

The editorial board wishes you a pleasant and thought-provoking reading experience.

# A study of labor market competencies among Hungarian engineering students

## *Skills required to use industrial robots*

The study presents partial results of extensive research conducted among 320 engineering students. As part of the exploration of university students' attitudes towards robotization, our primary objective was to learn about their opinions regarding their own labor market competencies. The exploration of the labor-displacing effect of technological changes has long been the subject of research (Pol et al. 2017). The introduction of innovations is presented as a workplace threat to young people, as technical development represents a significant factor of uncertainty for future generations (Radinsky 2015). Investigators (Turja et al. 2022; Dornelles et al. 2023) have emphasized that the advance of robotics and artificial intelligence may further intensify this uncertainty. The results of our research show that students perceive themselves as having serious deficiencies in their self-confidence, judgment and decision-making skills, as well as their problem-solving skills.

**Keywords:** *robotization, labor market, competences, young workers*

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**How to cite this article:**

Katalin Kanczné Nagy, Péter Tóth. "A study of labor market competencies among Hungarian engineering students".
*Információs Társadalom* XXIV, no. 4 (2024): 9–28.
*https://dx.doi.org/10.22503/inftars.XXIV.2024.4.1*

## 1. Introduction

In 2022, related to Section 9.2.4 of the Competitiveness Programme of the National Bank of Hungary (MNB), we conducted a research project among 320 engineering students at the Budapest University of Technology and Economics on students' expectations regarding robotization: Do they have any fears; if so, why? What new skills do they think they need to learn to succeed in the labor market? What do they think about the effects of robotization on their career path?

As part of the research, students' opinions about their own labor market competencies were explored. In this study, we report on the findings of these studies. Our research questions were as follows:

- Q1: What do students think about the level of their own preparedness in terms of current labor market expectations?
- Q2: Is there a correlation between the assessment of competencies and knowledge and work experience related to robotization?
- Q3: How do they see the development of their own labor market key competencies?
- Q4: What do they think labor market expectations will be in five?

The development of students' labor market competencies and, in their opinion, employers' expectations were assessed with a self-developed, self-assessment questionnaire. The online questionnaire was sent to all students at the university through the administration system (Neptun). After data cleaning, the scores were evaluated using the IBM SPSS Statistics 28 program.

The age distribution of the students participating in the research project (M= 24.41 years; SD= 6.133 years) is as follows: 75% are aged 25 or under, with most aged 21 (15.3%) and 23 (13.8%). The proportion of those over 27 is 12.8%. 67.2% are men, and 32.8% are women. 59.1% are studying in a bachelor's degree program, 33.1% in a master's degree program and 7.8% in a doctoral program. Of the undergraduate students, 23.8% are majoring in computer science engineering, 13.23% in electrical engineering, 10.05% in mechanical engineering, 8.99% in chemical or mechatronics engineering, and 7.94% in business administration and management. The distribution of students in master's programs by major: IT engineering 13.21%, mechanical engineering 11.32%, and mechatronics engineering 8.49%. Of the doctoral students, 20% are studying at the Doctoral School of Computer Sciences, 20% at the Kandó Kálmán Doctoral School, and 16% at the Vásárhelyi Pál Doctoral School of Civil Engineering and Earth Sciences. 90.6% of the respondents are full-time students, while 9.4% are in the part-time correspondence program. 85.6% have received a state scholarship, whereas 14.4% are self-funding their education.

## 2. Literature review

Technology and globalization have led to profound transformations in the labor market. The number of unskilled jobs is decreasing, while the demand for qualified

professionals working on the design, construction, and operation of systems is increasing (Hussain et al. 2020). Therefore, it is not that fewer people are needed in the labor market, but rather professionals who can cope with the challenges of higher value-added jobs. In other words, competency expectations are changing, and there is an ever-increasing emphasis on creativity and human cooperation. According to the World Economic Forum (2020), the following 10 key competencies are the most important in the labor market:

- complex thinking;
- teamwork;
- interpersonal competency;
- critical thinking;
- negotiating;
- quality control;
- service orientation;
- judgment and decision making;
- active listening;
- creativity.

Technical development and robotization have appeared in the literature not only as a driver of economic and social change, but also as a factor of significant concern to cause unemployment (Khogali et al. 2023; Fehér et al. 2023; Bessen 2019; Campa 2014). Pol and Reveley (2017) focused their research on workplace threats to young people while investigating the workforce replacement effects of technological change. The impact on future generations is a major uncertainty factor with regards to the introduction of innovations, and this unpredictability can cause anxiety for employees. Citing Radinsky (2015), the advancement of robotics and artificial intelligence may generate fears of unemployment caused by technological progress. He quoted Stiegler, who believed that there is a "huge transition" in the making (Stiegler 2015, 126) as automation replaces jobs. He also supported his argument with the ideas published by Brynjolfsson and McAfee (2011) and Ford (2015), who advised young people to acquire more education, training, and skills in order to be protected from the threat of job loss. Pol and Reveley (2017) argued for the inevitability of technological unemployment and the need for coping strategies, the latter of which helps members of the younger generation deal with previous life situations.

Today, the exploration of the effects of technological change is increasingly focusing not only on economic values, but also on human factors. An important factor is the well-being and satisfaction of employees in a robotization environment. Turja et al. (2022) have stressed that recognizing and supporting employees' needs during and after technological change is essential for successful and socially responsible robotization. In their opinion, the most important question is the dilemma of "What does it mean to me?" This question concerns the extent to which new technology and robots both serve and are disconnected from human needs.

In their study, Dornelles et al. (2023) examined how the use of the collaborative robot, the "cobot," shapes workers' skills. Cobot is a type of Industry 4.0 technology designed to support manufacturing workers and create smart working

environments. Their results indicated that human-cobot interactions affect workers' skills in different production activities. However, based on their observations, most companies are in the early stages of deployment and are most focused on replacing workers when employing cobots.

Webber et al. (2015) found that employees' positive and negative work habits are directly related to workplace productivity. However, these habits are based on intangible behaviors and attitudes that, while not easy to quantify, are known to experienced managers. Based on the opinions of managers, certain positive factors increase productivity in the workplace:

- ethics;
- initiative;
- interpersonal skills;
- personal development.

Factors that negatively affect productivity in the workplace include:

- lack of interpersonal skills;
- inability to control one's own time;
- lack of focus.

Pirohov-Tóth (2022) drew attention to the importance of work experience gained during university studies. Referring to previous research by Kiss (2014) and Kiss-Máté (2016), the study claimed that prior professional experience can greatly contribute to one's success on the labor market. Students who work during their higher education studies develop certain work-related attitudes (e.g., cooperation skills, independence and teamwork, flexibility, precision) that will be indispensable in later employment.

In their research, Tóthné and Kelemen-Erdős (2020) attempted to identify employers' expectations of employee competencies. They identified the following 10 groups of competency variables formed by hierarchical cluster analysis:

- managerial competencies;
- multicultural competencies;
- high-level professional know-how;
- complex problem-solving competencies;
- creative problem-solving competencies;
- core problem-solving competencies;
- core task-solving competencies;
- openness;
- adaptation competencies;
- service approach.

Pirohov-Tóth (2022) found that very different opinions are present in the literature on key workplace competencies. According to Vincze (2013) and Kópházi (2017), although higher education institutions focus on the transfer of special knowledge, employers prefer transferable skills from their employees. At the same time, there is a great need for young people entering the labor market to acquire competencies during their higher education studies to be successful in later work. In our changing world, flexibility and continuous redesign are also essential for companies. Their application may be badly needed even during the job analysis, as external

environmental changes can have a great impact on determining the competencies most suitable for the job. Furthermore, it is important that all organizational components are aligned with the chosen organizational solution and the mindset and attitudes of its employees.

## 3. Results

### *3.1. Assessment of engineering students' own competencies*

In the questionnaire (Cronbach's alpha=0.796), respondents had to score on a 10-point scale how they considered their own preparedness, competencies, and overall quality in terms of current labor market expectations (N=320; M=6.02; SD=2.116).

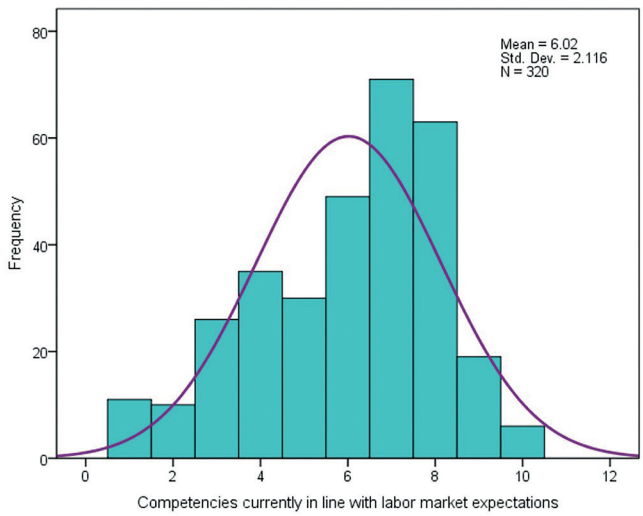


*Figure 1:* Students' perception of their preparedness for labor market expectations (self-editing)

A higher proportion of them feel more prepared (Figure 1).

49.2% of undergraduate students, 16.0% of graduate students, and 8% of doctoral students feel unprepared, meaning that this assessment decreases significantly as students progress in their studies (Figure 2).

In terms of funding for degree programs, 35.8% of state-sponsored respondents and 30.4% of self-funded students feel unprepared for labor market expectations.

Significant differences were observed in terms of robotization skills (c2= 8.202; p=0.017). 39.7% of those who did not study a related domain, 33.0% of those who had one related course, and 15.8% of those who had more than one related course felt that they were rather unprepared for labor market expectations. Therefore, learning robotization skills positively affects students' perception of their preparedness for

the labor market. 86.54% of those who had some robotization work experience (52 people) felt that they would not have any issues with labor market expectations. We found a significant relationship between the two variables, with moderate strength (c2=14.340; p=0.002; f=0.212).

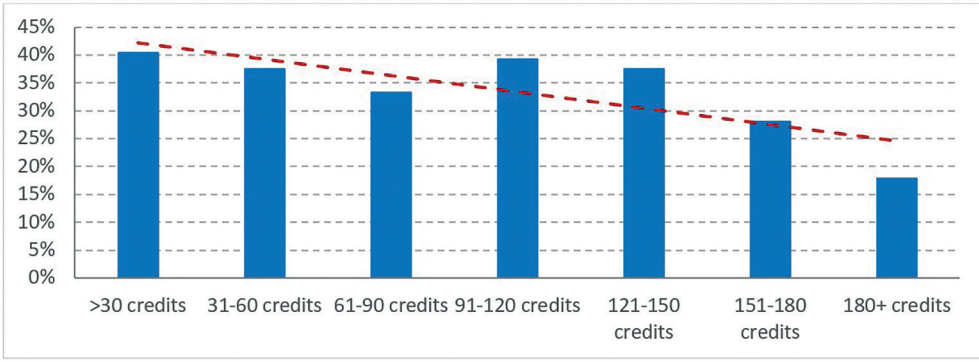


*Figure 2:* Feeling of students' unpreparedness for the labor market as they progress in their studies (self-editing)

### *3.2. Self-rated predictions of labor market key competencies and labor market expectations in five years*

Next, we compared how students estimated how their own labor market key competencies and labor market expectations may look in five years. Both questionnaires are considered reliable (Cronbach's alpha=0.782 and 0.811). During the measurement, a 6-point scale was used to assess key competencies. The results of the opinions on their own present labor market competencies are shown in Figure 3, while the results of their predictions of possible labor market competency needs in five years are found in Figure 4.

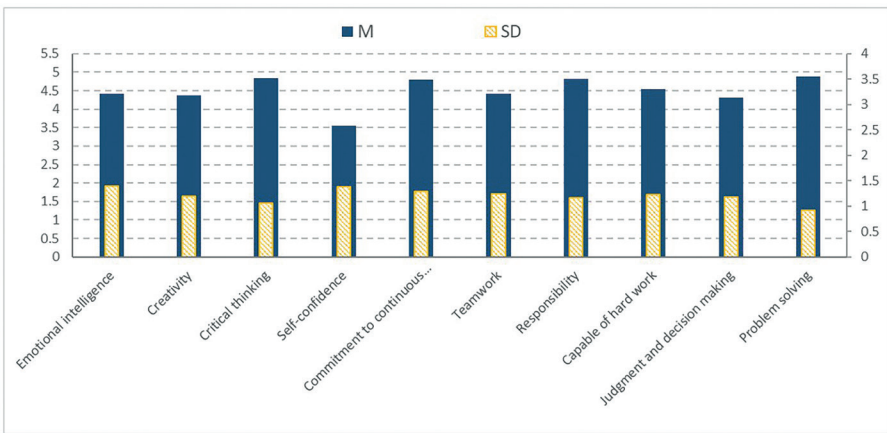


*Figure 3:* Self-rated existing labor market competencies (self-editing)

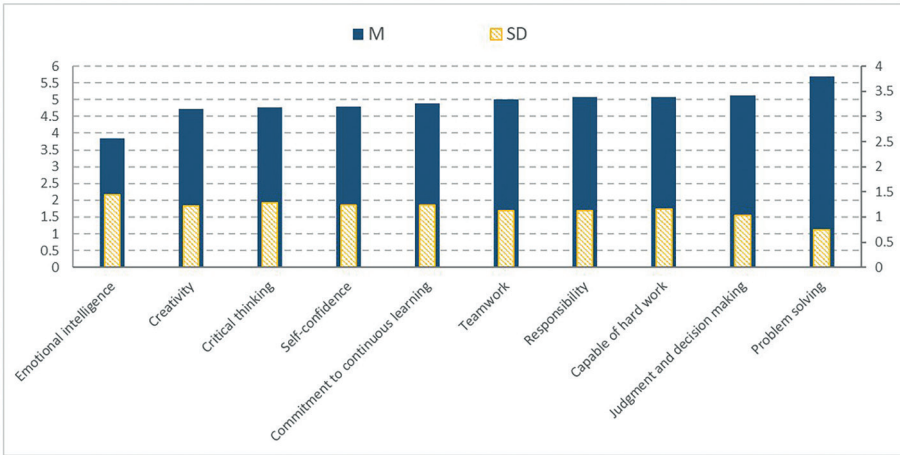


*Figure 4:* Predicted labor market competency needs in five years (self-editing)

With regard to labor market key competencies, students believe that advanced problem solving will be the most necessary in five years (M=5.68), while emotional intelligence will be the least important competency (M=3.82). The former has the lowest standard deviation (SD=0.762), while the latter has the highest standard deviation (SD=1.395) (Figure 18). Regarding their own level of competencies, respondents also found problem-solving skills to be the most developed here (M=4.87; SD= 0.921), but the least developed appeared to be self-confidence (M=3.48; SD=1.345). The indicators of emotional intelligence here were as follows: M=4.37; SD=1.354.

### *3.2.1. Comparison of opinions about labor market expectations in five years based on background variables*

Male and female students assessed the competencies required in five years in a significantly different way in the following cases:

- critical thinking (c2=4.712; p=0.030),
- self-confidence (c2=8.359; p=0.004),
- emotional intelligence (c2=8.107; p=0.004),
- judgment and decision making (c2=4.091; p=0.043),
- capable of hard work (c2=6.258; p=0.012).

The mean and standard deviation of the above five competencies are listed in Table 1. For all five competencies, women were significantly more likely to predict their role would be important in five years than men.

| Competency | Gender | N | M | SD |
|---|---|---|---|---|
| Critical thinking | female | 104 | 4.98 | 1.134 |
| | male | 214 | 4.66 | 1.328 |
| Self-confidence | female | 104 | 5.03 | 1.076 |
| | male | 212 | 4.63 | 1.263 |
| Emotional intelligence | female | 104 | 4.12 | 1.345 |
| | male | 211 | 3.67 | 1.398 |
| Judgment and decision making | female | 104 | 5.25 | 0.969 |
| | male | 213 | 5.02 | 1.057 |
| Capable of hard work | female | 103 | 5.29 | 0.940 |
| | male | 212 | 4.92 | 1.213 |

*Table 1:* Prediction of the importance of soft skills in five years (self-editing)

By the level of education, we found a significant difference only in terms of commitment to continuous learning (c2= 7.827; p=0.020):

- Undergraduate degree program: N=178; M=4.72; SD=1.211,
- Graduate degree program: N=103; M=5.02; SD=1.171,
- Doctoral program: N=25; M=5.20; SD=1.190.

As they progress in their studies, students were significantly more likely to predict that commitment to continuous learning would be important in five years.

In terms of course load, we found a significant difference in three competency areas (Table 2).

| Competency | Course load | N | M | SD | c2 | p |
|---|---|---|---|---|---|---|
| Creativity | full-time | 289 | 4.65 | 1.230 | 12.980 | 0.000 |
| | part-time | 30 | 5.38 | 1.015 | | |
| Emotional intelligence | full-time | 285 | 3.75 | 1.402 | 9.360 | 0.002 |
| | part-time | 30 | 4.52 | 1.122 | | |
| Commitment to continuous learning | full-time | 285 | 4.82 | 1.225 | 3.444 | 0.063 |
| | part-time | 30 | 5.24 | 0.912 | | |

*Table 2:* Assessment of the importance of soft skills in five years based on course load (self-editing)

Students in part-time programs were significantly more likely to predict that these competency areas would be important in five years compared to their full-time counterparts. Obviously, their professional experience offers a good basis for such an assessment. This argument is supported by the comparison of labor market key competencies with robotization work experience. First, we used a scale for robotization work experience with four values:

- has no related work experience;
- has related experience but robotization played a limited role in their work;
- has related experience and robotization played a moderate role in their work;
- has related experience and robotization played a primary role.

This variable shows a significant or close to significant difference for the competencies shown in Table 3. In the case of problem solving and creativity, the means show an upward trend, while they tend to indicate a downward trend for critical thinking and workload capacity.

| Competency | Work experience in robotization | N | M | SD | c2 | p |
|---|---|---|---|---|---|---|
| Problem solving | None | 267 | 5.64 | 0.804 | 5.400 | 0.145 |
| | Limited | 37 | 5.86 | 0.487 | | |
| | Moderate | 10 | 5.67 | 0.500 | | |
| | Primary | 5 | 5.82 | 0.523 | | |
| Creativity | None | 267 | 4.63 | 1.249 | 10.080 | 0.018 |
| | Limited | 37 | 5.14 | 0.961 | | |
| | Moderate | 10 | 4.89 | 1.364 | | |
| | Primary | 5 | 5.80 | 0.447 | | |
| Critical thinking | None | 266 | 4.72 | 1.307 | 8.907 | 0.031 |
| | Limited | 37 | 5.00 | 1.069 | | |
| | Moderate | 10 | 4.44 | 1.014 | | |
| | Primary | 5 | 4.87 | 0.902 | | |
| Capable of hard work | None | 263 | 5.09 | 1.120 | 5.089 | 0.165 |
| | Limited | 37 | 4.94 | 1.264 | | |
| | Moderate | 10 | 4.44 | 1.333 | | |
| | Primary | 5 | 4.80 | 0.837 | | |

*Table 3:* Assessment of the importance of soft skills in five years based on level of robotization work experience (self-editing)

If we narrow down the robotization work experience scale to two points (yes/no), the differences are even more significant, except for critical thinking (c2= 1.209; p=0.271). The aforementioned upward and downward trends in means are even more visible (Table 4).

| Competency | Work experience in robotization | N | M | SD | c2 | p |
|---|---|---|---|---|---|---|
| Problem solving | No | 267 | 5.64 | 0.804 | 3.188 | 0.074 |
| | Yes | 52 | 5.84 | 0.468 | | |
| Creativity | No | 267 | 4.63 | 1.249 | 7.684 | 0.006 |
| | Yes | 52 | 5.16 | 1.017 | | |
| Capable of hard work | No | 263 | 5.09 | 1.120 | 2.322 | 0.128 |
| | Yes | 52 | 4.84 | 1.235 | | |

*Table 4:* Assessment of the importance of competencies in five years based on robotization work experience (self-editing)

Examining the correlations between the key competencies required in five years, a moderately strong relationship can be detected in certain cases:

- problem solving – creativity: r=0.388; p=0.01;
- creativity – critical thinking: r=0.478; p=0.01;
- critical thinking – self-confidence: r=0.302; p=0.01;
- critical thinking – judgment and decision making: r=0.371; p=0.01;
- self-confidence – teamwork: r=0.337; p=0.01;
- self-confidence – emotional intelligence: r=0.335; p=0.01;
- self-confidence – judgment and decision making: r=0.301; p=0.01;
- teamwork – emotional intelligence: r=0.342; p=0.01;
- emotional intelligence – judgment and decision making: r=0.349; p=0.01;
- judgment and decision making – commitment to continuous learning: r=0.334; p=0.01;
- judgment and decision making – responsibility: r=0.496; p=0.01;
- commitment to continuous learning – responsibility: r=0.341; p=0.01;
- responsibility – capable of hard work: r=0.334; p=0.01.

Analyzing the relationships, judgment and decision making (five relationships) and self-confidence (four relationships) are the key competencies that are closely related with several other competencies, revealing their prominence in the analysis.

The key competencies were also subjected to factor analysis: KMO=0.828; c2=859.808 and p=0.000.

Factor analysis distinguished three factors (Table 5):

F1: cognitive key competencies
F2: emotional and social key competencies
F3: capable of hard work

| Competency needs in 5 years | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Problem solving | .773 | .126 | .071 |
| Creativity | .718 | .258 | -.280 |
| Commitment to continuous learning | .685 | .097 | .211 |
| Responsibility | .603 | .203 | .511 |
| Critical thinking | .563 | .467 | -.311 |
| Judgment and decision making | .559 | .399 | .292 |
| Emotional intelligence | .127 | .779 | .028 |
| Self-confidence | .120 | .773 | .127 |
| Teamwork | .315 | .623 | .174 |
| Capable of hard work | .033 | .142 | .846 |

Extraction Method: principal Component Analysis.
Rotation method: Varimax with Kaiser Normalization. [a]
a. Rotation converged in 5 iterations.

Rotated Component Matrixa

*Table 5:* Factors of key competencies predicted in five years (self-editing)

### *3.2.2. Comparison of self-rated labor market key competencies based on background variables*

Regarding the existing competencies, we observed significant or close to significant differences in several cases by gender (Table 6).

| Competency | Gender | N | M | SD | c2 | p |
|---|---|---|---|---|---|---|
| Problem solving | female | 105 | 4.78 | 0.951 | 1.893 | 0.169 |
| | male | 214 | 4.92 | 0.905 | | |
| Creativity | female | 105 | 4.52 | 1.097 | 3.269 | 0.071 |
| | male | 212 | 4.26 | 1.196 | | |
| Critical thinking | female | 104 | 4.63 | 1.116 | 3.305 | 0.069 |
| | male | 211 | 4.88 | 0.978 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Self-confidence | female | 104 | 3.22 | 1.287 | 5.362 | 0.021 |
| | male | 212 | 3.61 | 1.358 | | |
| Emotional intelligence | female | 104 | 4.80 | 1.267 | 17.598 | 0.000 |
| | male | 211 | 4.16 | 1.348 | | |
| Judgment and decision making | female | 105 | 4.08 | 1.240 | 3.908 | 0.048 |
| | male | 211 | 4.37 | 1.084 | | |

*Table 6:* Assessment of the importance of one's own competencies by gender (self-editing)

In terms of creativity and emotional intelligence, women are more likely to view their competencies as more advanced, while in the other cases, men judged themselves as being significantly more competent.

Regarding the level of education, we found significant or close to significant differences in almost all competencies. In almost all cases, the means increase as studies progress, which is possible due to the increase in academic and professional experience (Table 7).

| **Competency** | **Level of education** | **N** | **M** | **SD** | **c2** | **p** |
|---|---|---|---|---|---|---|
| Problem solving | Undergraduate | 189 | 4.66 | 0.959 | 21.912 | 0.000 |
| | Graduate | 105 | 5.15 | 0.772 | | |
| | Doctoral | 25 | 5.28 | 0.792 | | |
| Creativity | Undergraduate | 187 | 4.22 | 1.253 | 4.653 | 0.098 |
| | Graduate | 105 | 4.51 | 1.008 | | |
| | Doctoral | 25 | 4.56 | 1.083 | | |
| Critical thinking | Undergraduate | 185 | 4.68 | 1.109 | 5.433 | 0.066 |
| | Graduate | 105 | 4.92 | 0.882 | | |
| | Doctoral | 25 | 5.12 | 0.927 | | |
| Self-confidence | Undergraduate | 187 | 3.31 | 1.409 | 5.336 | 0.069 |
| | Graduate | 104 | 3.68 | 1.148 | | |
| | Doctoral | 25 | 3.84 | 1.491 | | |
| Judgment and decision making | Undergraduate | 186 | 4.12 | 1.198 | 5.880 | 0.053 |
| | Graduate | 105 | 4.51 | 1.056 | | |
| | Doctoral | 25 | 4.40 | 0.957 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Commitment to continuous learning | Undergraduate | 187 | 4.49 | 1.349 | 23.524 | 0.000 |
| | Graduate | 105 | 5.10 | 0.995 | | |
| | Doctoral | 25 | 5.60 | 0.577 | | |
| Capable of hard work | Undergraduate | 188 | 4.38 | 1.196 | 8.831 | 0.012 |
| | Graduate | 105 | 4.83 | 1.097 | | |
| | Doctoral | 25 | 4.60 | 1.291 | | |

*Table 7:* Assessment of the importance of own soft skills by level of education (self-editing)

Regarding course load, we found a significant or close to significant difference in the following competencies:

- problem solving (c2=4.936; p=0.026);
- self-confidence (c2=3.537; p=0.060);
- teamwork (c2=5.068; p=0.024);
- emotional intelligence (c2=2.944; p=0.086);
- judgment and decision making (c2=11.177; p=0.001);
- commitment to continuous learning (c2=4.271; p=0.039);
- capable of hard work (c2=4.572; p=0.033).

In all cases, the means of part-time students are significantly higher, which may be due to their more significant life and work experience.

In terms of funding, significant differences were found in the assessment of teamwork (c2= 4.657; p = 0.031) and judgment and decision making (c2= 6.101; p=0.014), while close to significant differences were found in emotional intelligence (c2= 2.888; p=0.089). In all cases, the means of the participants in the self-financed programs are higher, as most of these studies must work while studying, which greatly helps the assessment of their competencies.

The presence of a robotization course results in significant differences primarily in cognitive competencies:

- problem solving (c2=8.779; p=0.012);
- creativity (c2=6.994; p=0.030);
- critical thinking (c2=10.124; p=0.006).

Enrolling in a robotization course greatly increases the means of these competencies, which can be traced back to the knowledge of modern technologies. The impact of work experience in robotization is highly similar, the difference being that there are significant differences even in terms of commitment to continuous learning and workload capacity.

### *3.2.3. Competency balance by background variables*

We compared competency needs with existing competencies and found weak medium correlations. The two strongest correlations were found in terms of emotional

intelligence (r=0.292; p=0.01) and teamwork (r=0.241; p=0.01), while the lowest was in critical thinking (r=0.084; p=0.139).

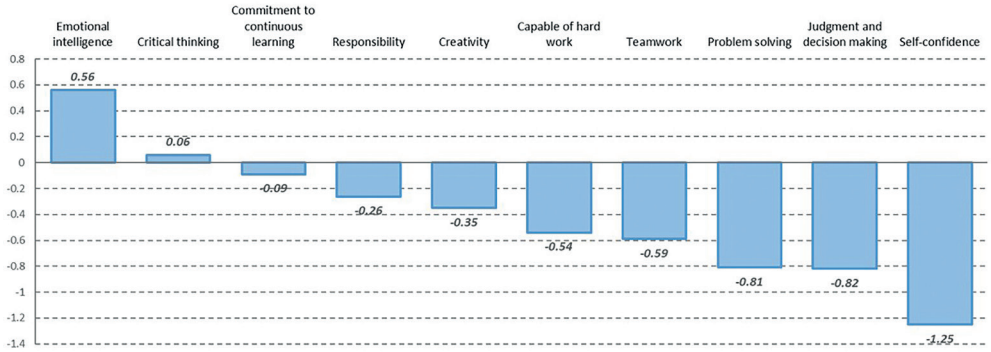


*Figure 5:* Competency balance (self-editing)

We also compared the means of competency needs and existing competencies. In most cases, we identified a competency deficit. With the exception of emotional intelligence and critical thinking, students reported that they fell short of labor market expectations in most competency areas. The gap is especially significant in the areas of self-confidence; judgment and decision making; and problem solving. The lack of self-confidence is likely to "sum up" the perceived competency deficit in other areas, as the students feel that key competences are not sufficiently developed at the university. Another question is whether this fear is real or only perceived due to a lack of experience. The results highlight the need to develop labor market competencies in higher education (Figure 5).

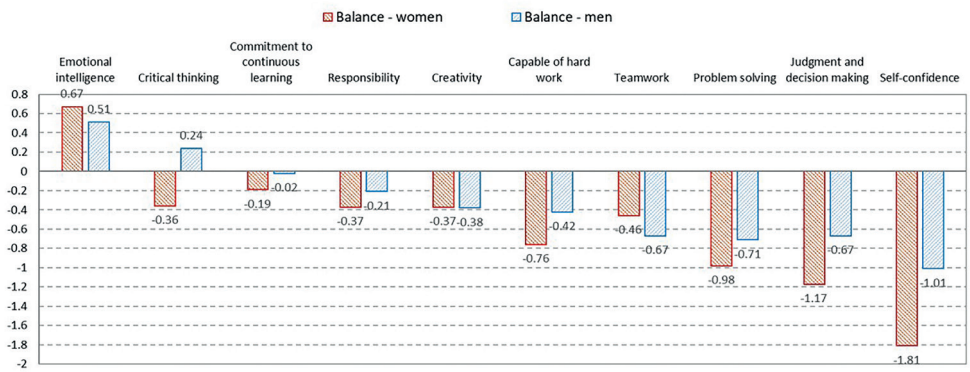


*Figure 6:* Competency balance by gender (self-editing)

The competency balance was also compared by gender. Women reported a more significant competency deficit than male students. This may be due to the fact that women are more likely to underestimate themselves while overestimating labor market expectations in areas such as technical careers, where they feel

less comfortable. Technical careers are stereotypically viewed as being primarily linked to men. Women's fears in this regard, e.g., inability to meet expectations, are reflected in the results. Only in the areas of emotional intelligence and teamwork do women show more positive expectations than men (Figure 6).

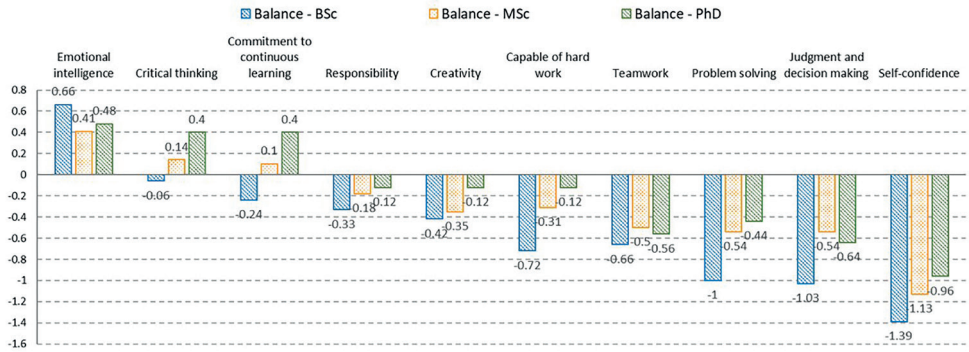


*Figure 7:* Competency balance by level of education (self-editing)

When comparing the competency balance by education level, only small differences could be detected in terms of future labor market expectations, whereas significant differences emerged in their assessment of their own competencies. As studies progress, competency deficits decrease. The biggest competency gaps in undergraduate education were in problem solving and judgment and decision making. In terms of graduate and doctoral programs, competency gaps differed only slightly (Figure 7).

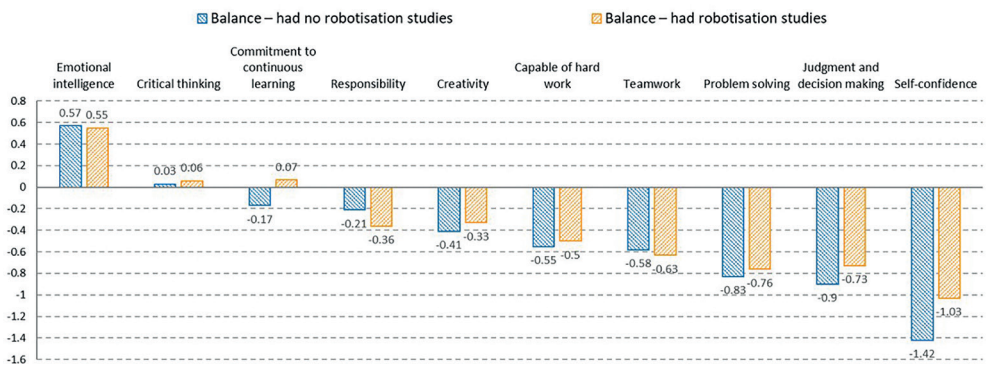


*Figure 8:* Competency balance by robotization studies (self-editing)

We also studied the competency balance in regard to robotization studies. It can be concluded that robotization studies slightly reduce the competency deficit, except for judgment and decision making, as well as self-confidence (Figure 8).

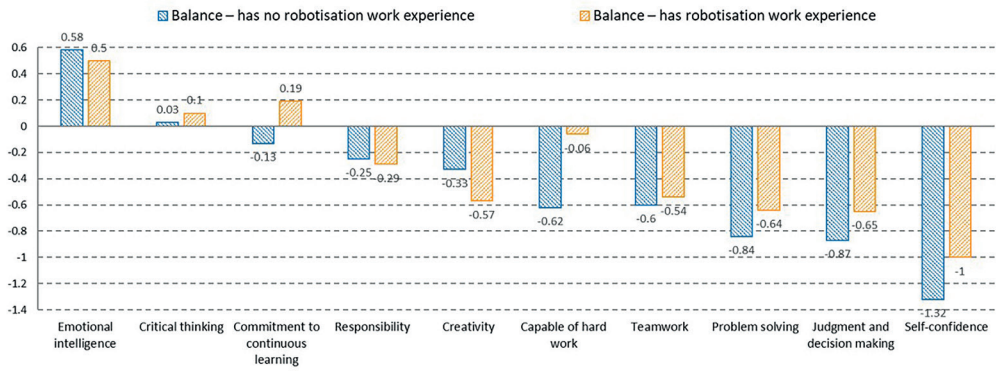


*Figure 9:* Competency balance by robotization work experience (self-editing)

Robotization work experience indicates a higher competency deficit. Students' existing competency was almost the same among those with or without robotization work experience, but the presumed competency in five years was predicted to be much higher by those with robotization work experience. However, an opposite trend can be observed in terms of workload capacity (Figure 9).

## 4. Summary and discussion

Our study presented the partial findings of a broad research project. The study uncovered the assessment of engineering students about labor market competencies.

We summarize our results by answering our research questions:

Q1: What do students think about the level of their own preparedness in terms of current labor market expectations?

- A high proportion of them feel unprepared, but this feeling decreases significantly as they progress in their studies. Nearly half of undergraduate students feel unprepared for labor market expectations. This figure drops to only 16% for those in graduate programs.
- With the exception of emotional intelligence and critical thinking, students reported that they fell short of labor market expectations in most competency areas. The gap is especially significant in the areas of self-confidence; judgment and decision making; and problem solving.

Q2: Is there a correlation between the assessment of competencies and knowledge and work experience related to robotization?

- Learning robotization skills and gaining robotization work experience positively affects their perception of preparedness for labor market expectations.
- Completing a robotization course results in significant differences primarily in cognitive competencies
- Among those with robotization work experience, the importance of problem solving, creativity and workload capacity competencies in the labor market is perceived as significantly higher.

Q3: How do they see the development of their own labor market key competencies?

- In terms of their own competencies, problem-solving skills were considered the most developed, and self-confidence was viewed as the least developed.
- In all cases, the means of part-time students were significantly higher, which may be due to their more significant life and work experience.
- Among the participants in the self-financed programs, teamwork, judgment and decision-making skills are significantly higher, as these students are more likely to be working while studying, which greatly helps the assessment of their competencies.

Regarding existing competencies, we observed significant or close to significant differences in several cases by gender. Women rated their creativity and emotional intelligence as more competent than their male counterparts, while in the other cases, men judged their own competencies to be significantly more advanced. We concluded that women reported a more significant competency deficit than male students. This may be because women are more likely to underestimate their abilities while overestimating labor market expectations in technical careers, where they feel less comfortable.

Q4: What do they think labor market expectations will be in five years?

- With regard to labor market key competencies, students believe that advanced problem solving will be the most necessary in five years, while emotional intelligence will be the least important competency. The role of critical thinking, self-confidence, emotional intelligence, judgment and decision making, and workload capacity competencies was predicted as being significantly more important in five years' time by women than by men.
- It can be concluded that the more students have progressed in their studies, the more important they think commitment to continuous learning will be in five years.
- Regarding future labor market expectations, only small differences could be detected between part-time and full-time students.

The literature review confirmed that technological development has led to profound transformations in the labor market, as evolving circumstances in the job market demand new employee competencies. Among the most important 10 key competencies outlined by the World Economic Forum (2020), creativity, critical

thinking, teamwork, and judgment and decision-making also appeared in our study. In the case of creativity and critical thinking, our results show students are divided in their beliefs that these skills will be as important in five years as they are now. On the other hand, students are likely to believe judgment and decision-making will be more important in the labor market in five years.

The results of studies investigating the correlation between technological changes and the fear of job loss (Khogali et al. 2023; Bessen 2019; Pol and Reveley 2017; Campa 2014) are further colored by our research results. We have shown that students' views about self-confidence are significantly related to teamwork, emotional intelligence, and judgment and decision-making, which confirms the importance of personal and interpersonal competencies. The importance of the transferability of special skills in the labor market has also been emphasized in the research (Vincze 2013; Kópházi 2017).

Our research supported the findings of Pirohov-Tóth (2022), Kiss (2014), and Kiss-Máté (2016), according to which professional experience gained during university studies improves work-related attitudes, thereby contributing to success in the labor market. In our studies, we revealed that students with robotization work experience have more confidence in strengthening their competencies.

## 5. Conclusion

In terms of soft skills, students indicated serious deficiencies in self-confidence; judgment and decision making; and problem solving. The development of these areas should be prioritized during their education. The need for methodological training for instructors is stressed. In terms of emotional intelligence, students indicated a significant surplus, which should be analyzed by further studies. The factors that play a role in the change in working conditions are viewed as more significant by female and full-time students. This is also true for students who have already learned about the social impacts of robotization during their studies. All this points to the need to emphasize the knowledge of the social effects of robotization in university courses.

It is necessary for university professors to renew the methods of processing curricula, because transversal competencies can be developed in this way. Educators must be prepared to introduce methodological innovations. Universities can achieve this goal by launching Training of Trainers programs. It is also important to make the relationship between employers and the university more dynamic (guest lectures about the labor market, dual education, plant visits, job fairs) and involve student organizations in the planning, implantation, and execution.

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# Hyperbolic phraseology in media literacy

The purpose of this research-in-progress paper is to examine the primary mechanisms underpinning the construction of a language paradigm in cognitive terms by analysing hyperbolised phraseological units as tools of emotive-evaluation in media texts. The main method employed is a theoretical approach to the study of media literacy in contemporary society, which involved constructing linguistic templates for the perception of reality and its cognitive representation, using the examples of two national language codes. This investigation reveals the basic mechanisms of recognising communicative strategies in the media sphere by means of employing a wide array of linguistic resources, with a focus on the functioning of phraseological units built on hyperbole.

**Keywords:** *phraseological units, communication, information space, media, phraseme*

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**How to cite this article:**
Shalkarbek, Aigerim, Elmira Ibrayeva, Anel Shalkarbek, Rinat Kertayev, Menlikul Shindaliyeva. “Hyperbolic phraseology in media literacy”.
*Információs Társadalom* XXIV, no. 4 (2024): 29–42.
*https://dx.doi.org/10.22503/inftars.XXIV.2024.4.2*

## 1. Introduction

The relevance of this study is driven by a broad public interest in the use of stylistic and lexical-semantic means in the context of media communication, as well as the lack of research on the introduction of phraseological units, with regard to media literacy strategies and tactics emerging in the modern information field. This study focuses on the specific role of hyperbolised phraseological units and their cognitive impact in the context of media literacy. Hyperbole is employed as a rhetorical device to intensify the emotional and cognitive impact of a message; such devices prompt audiences to conduct a critical assessment of the media content presented in an exaggerated form and to engage with the underlying persuasive intent. This study examines hyperbolic expressions in English and Kazakh to elucidate the impact of exaggerated language on the perception and the comprehension of media messages. It contributes to advancing media literacy through a greater understanding of cognitive processes.

Only consistent, comprehensive research with exhaustive detail and depth in semantic and conceptual processes can identify the underlying factors and criteria for building correct and competent communication with a readership. Modern scientific resources can be used to trace the main principles and mechanisms for introducing a national cultural code in the form of phraseological units of speech. As interest in the linguistic means of reflecting reality—namely the linguistic transmission of non-linguistic factors—grows every year, the field of information and media literacy are actively being developed (Asanbayeva 2021). These aspects are addressed in the studies of contemporary interdisciplinary researchers (Nugent and Berdine 2018). Recent research highlights the growing importance of media literacy in contemporary society, particularly in combating misinformation and fostering critical thinking. Murowana (2021) emphasises that global competencies must include media literacy education, given the prevalence of disinformation. Developing critical thinking is crucial for recognising bias and propaganda in media, as advertisers often manipulate emotions through targeted strategies.

Stix and Jolls (2020) compare media literacy models from Germany, the UK, and the USA, to illustrate their shared goal of empowering individuals to make informed choices. They argue for a lifelong learning approach to media literacy, promoted across formal and informal education. The role of media as a political tool has also been explored by Malenko and Nekita (2021), who view contemporary media as a globalised system of power often characterised by ideological indifference and apoliticism. Social networks, such as X (formerly Twitter) and YouTube, serve as key platforms for information dissemination, with literacy skills playing a role in how users engage with these platforms.

For their part, Luo, Yang and Kang (2022) propose axioms for understanding communication in the digital age that combine classical communication theories with modern social media research. Their findings align with Celik, Muukkonen and Dogan (2021), who argue that the interactive use of social networks enhances media literacy by encouraging critical evaluation of content. Additionally, Wang and Kaatari (2021) examine the creative use of phraseology in media, demonstrating its

flexibility in conveying implicit and explicit meanings—which is key to audience engagement.

Belozerova (2020) posits that the study of phraseological units is in the direct connection between the semantic structure of the lexeme and the cognitive aspect. That is, the reader's (listener's) perception of what is being said, since the linguistic picture of the world reflects the external aspects of life through emotional, expressive, and other elements. Kniaz (2020) explores phraseological units in terms of cognition and attributes them to communicative aspects: here, media discourse acts as a kind of archetype, relying not only on conscious but also on subconscious perception. Kniaz considers phraseological units as means of coding and an actualisation of the conceptual sphere of perception.

The issues of functional and stylistic attribution are addressed by Safina and Salieva (2020), who refer to this as a quantitative, etymological, and semantic evaluation of reality. Corpus phraseological research is conducted by Liu and Chen (2022), who actualise the phrasal frame methodology, and Andersen (2020), who considers the mechanisms of switching the language code and analyses the pragmatic functions of phraseological units in context. Aljadaan (2018) also examines effective lexical, morphological, and syntactic transformations of idioms. Hyperbolic means and the relevance of applying them in communicative acts have been studied in multiple publications (Iksanova 2019). Along these lines, Mustyatsa (2019) argues that phraseological expressions based on exaggeration of processes, characteristics, and objects are stable units of secondary nomination; they reflect discreteness and non-discreteness of being, and they relate to the categorical meanings of quantity, quality, certainty, intensity, evaluability, and expressiveness.

Given the complexity of the subject matter, this research narrows its focus to specific goals that are addressed in this paper: analysing the lexical stability and emotional expressiveness of hyperbolised phraseological units in media texts; investigating the cognitive and communicative functions of these phraseological units in the context of media literacy; and comparing the use of hyperbole-based phraseology in English and Kazakh media discourses.

## 2. Materials and methods

The methodological approach employed in this study synthesises theoretical and practical analytical techniques to facilitate comprehensive examination of the function of hyperbolic phraseological expressions in media communication. A particular focus was the utilisation of hyperbolic expressions as cognitive tools that serve to alter audience perception through deliberate exaggeration. These expressions, by their nature, exert manipulative influence on emotional intensity and evaluative judgment, thereby compelling the audience to engage in a more discerning interpretation of the media content. The analysis examined the ways in which hyperbole-based phraseological units elicit responses that are cognitively processed as heightened or exaggerated, which compel audiences to filter exaggerated information and effectively navigate media literacy. This approach focuses on the cognitive

and linguistic aspects of stable phraseological units in both the English and Kazakh languages, with a particular emphasis on those constructed using hyperbole. A number of methodological tools and techniques were employed to provide a robust framework for the analysis and thus ensure that the research goals were fully achieved.

A theoretical analysis was conducted to establish the conceptual foundation of the study. Such analysis was deemed essential to elucidating the cognitive processes underlying media communication, particularly in the context of utilising hyperbole to captivate and engage audiences. The analysis entailed a comprehensive review of existing academic literature on media communication, phraseology, cognitive linguistics, and the figurative-emotional resources employed in media discourse. By drawing on these sources, the study was anchored in a robust theoretical framework that provided a foundation for the subsequent practical analysis.

The next stage of the methodology involved a comparative analysis of hyperbolic phraseological expressions across English and Kazakh media. This comparative approach was pivotal in identifying the similarities and differences between the two languages in the utilisation of hyperbolic expressions, particularly with regard to their cognitive, emotional, and communicative functions. By juxtaposing media texts from the two linguistic contexts, the analysis was able to demonstrate how these expressions serve as effective instruments for conveying meaning to and evoking responses from audiences.

In addition to the comparative analysis, this study conducted a linguistic assessment of the phraseological units under examination, which comprised a comprehensive investigation of the semantic, emotional, and expressive nuances of hyperbolic expressions. The assessment was conducted with the objective of identifying the metaphorical, metonymic, and anthroponymic elements present in the stable phraseological units. This approach facilitated a more profound understanding of the manner in which these expressions operate in the context of media discourse. Furthermore, the analysis considered the pragmatic potential of these expressions, including their capacity to convey cultural and cognitive information to the audience.

The systematic processing of research inputs into research outputs was guaranteed through the use of textual analysis tools, which enabled the identification of pivotal lexical patterns and the categorisation of hyperbolised lexemes within the media texts. The analysis concentrated on the contribution of hyperbolic phraseological units to the discourse as a whole, with particular attention paid to their semantic load, stylistic functionality, and cognitive orientation. The deployment of textual analysis allowed the research to transcend mere identification of hyperbolic expressions and facilitated a sophisticated comprehension of their function in the construction of media messages.

A cognitive framework was employed for further analysis of the impact of hyperbolic phraseology on media literacy. This framework facilitated the explication of the cognitive processes by which audiences process and respond to hyperbolic expressions in media texts. By examining the cognitive effects of such expressions, this study was able to assess the influence of hyperbolic phraseological units on audiences' perceptions of media messages. This approach was pivotal in illuminating

the interplay between linguistic structures and cognitive processes in the context of media communication.

Finally, the study employed pragmatic analysis to examine the role of hyperbolic expressions as communicative strategies. This analysis examined the intentionality behind the use of hyperbole in media texts, investigating how authors (i.e., media creators) utilise these expressions to influence their audience's emotional and cognitive responses. By focusing on the pragmatic aspects of phraseological units, this research was able to reveal the strategies deliberately employed by media creators to enhance the persuasive power of their messages.

## 3. Results and discussion

### *3.1. English and Kazakh phraseological units based on hyperbole in the cognitive aspect of media literacy*

Since hyperbole often serves as a tool for quantitative comparison, it is used for certain categories, including time, space, size, mass, volume, singularity, and totality. Media texts using this technique are imbued with expressiveness, emotion, and intentionality, and desemanticisation brings an increase in expressiveness. In English, the hyperbolic phraseological units relate to all subfields of the phrase-semantic field of quantity—but primarily to the fields of total and large quantity—and the quantitative seme is often transposed into the intensity seme. The category of quantity is reflected in components expressing an exaggeration of some quantitative parameters (many, much, more, most, a lot, a deal of, multitude, thousands, hundreds) and numerals (ten, twenty, fifty, hundred, thousand, million, dozen).

Table 1 outlines the common hyperbolic phraseological expressions found in English and Kazakh media discourse, categorised by their cognitive and emotional functions:

| **Category** | **English Phraseological Units** | **Kazakh Phraseological Units** | **Cognitive/Emotional Function** |
|---|---|---|---|
| Quantity | "A million to one," "To have the world at one's feet" | "Төбесі көкке жетті" (head reached the sky) | Expresses the vastness or importance of an event or action |
| Size | "To move heaven and earth" | "Айна қатесі жоқ" (as in a mirror, meaning very similar) | Amplifies the scale or magnitude of an experience |
| Intensity/Totality | "To be all things to all men," "To the last drop of blood" | "Түймедейді түйедей ету" (to make a button the size of a camel, i.e., exaggerate) | Highlights extremes of behaviour or situations |

| | | | |
|---|---|---|---|
| Emotional State | “As struck by lightning” | “Төбесінен жай түскендей болу” (struck by lightning) | Evokes strong emotional responses such as surprise or shock |
| Comparison/ Metaphor | “To eat like a horse,” “A drop in the ocean” | “Аузынан жалын атып тұру” (spewing flames, i.e., formidable) | Provides vivid imagery to compare actions or qualities |

*Table 1.* Common hyperbolic phraseological expressions in English and Kazakh media discourse (*Source: compiled by the authors)*

These phraseological units function as cognitive and communicative tools in media texts that shape the audience’s perception through exaggeration and emotional expressiveness. The use of hyperbole in particular serves to intensify the emotional engagement of the audience, by amplifying specific media messages to a degree that necessitates critical interpretation. This mechanism is fundamental to the development of media literacy, as it enables audiences to identify instances of exaggeration and to comprehend the communicative strategies employed to influence perception. In this sense, the use of hyperbolised phraseology serves a dual purpose: it communicates, and it activates cognitive defences that foster critical media skills. These defences encourage audiences to sift through exaggerated claims and develop their critical-thinking abilities. Metonymic and metaphorical units are particularly effective in engaging large audiences, as they create vivid and memorable images (e.g., “to make a mountain out of a molehill” or “төбесі көкке жетті”) (Orlyk and Stezhko 2021).

Many phraseological units of a hyperbolic structure belong to the class of the full domain of multiplicity or totality—e.g., “to be all things to all men”, “anything for a quiet life”, “to the last drop of blood”, “have the world at one’s feet”. Often, implicitly hyperbolised expressions are used: for example, the word “world” means “all”, “everything”, “everywhere”, “totally”. Such phraseological units can be used in media discourse to express the author’s value judgments, to globalise statements, and to enhance the intellectual instruction and expressiveness of the text. These turns of phrase are related to the author’s desire to show maximum striving for something or deep commitment, to emphasise patriotic feelings, and/or to bring a private issue to the level of a universal one.

When hyperbolic phraseological expressions are created in media communication, metaphorical images are often used to compare the object quantitatively or qualitatively: “to move heaven and earth”, “uphill and down dale”, “at the ends of the earth”, “to eat like a horse”. In cognitive terms, such units reflect the author’s intentions and free expression. They use various images and symbols, often found in the main words, to create connections that show how they want to communicate during speaking events, like on television or at a press conference, or in writing, like in newspapers. The general–singular opposition uses high-order numeratives of a “million”, “a thousand”, “a hundred”, “ten” (e.g., “a million to one”). In many

phraseological units, quantitative characteristics are blurred (e.g., “a needle in a haystack”, “a drop in the ocean”); for their part, the expressions “to make a mountain out of a molehill” and “to sow the wind and reap the whirlwind” are metonymic (Viidalepp 2022). Such phraseological units contain antithetical mechanisms that work well even with large communicative groups (i.e., categories of readers). Vivid contrasting images make the text more allegorical, philosophical, and emotionally colorful. Metonymic and metaphorical phraseological units are often used in the titles of publications and programs and function as slogans, as they are distinguished by their emotional delivery, contain a high degree of expressiveness, and implicitly refer to the presence of the author.

Historically stable expressions in Kazakh phraseology were grouped according to semantic features of phraseology related to historical periods, military ranks and types of weapons, and power management (Sarakenova 2018). As a result of the technologisation of culture and the development of civilisation, the use of phraseological units in language has declined, while expressive words—which have long been the spiritual legacy of ancestors—have remained in written culture. The Kazakh language experiences processes of aggravating, deepening, and enriching linguistic diversity, including phraseology. The linguistic and pragmatic potential of stable expressions, which constitute the substance of literary language, is reflected in the varied discursive nature of the language user: the knowledge of the carrier of semantic parts in phraseology determines its linguistic and cultural status (situativeness and communicative intention), while a lack of practical knowledge about phenomena, objects, and actions indicates a lack of phraseological resources for a native speaker (author, communicant). For every Kazakh, one of the main tasks of mastering the culture of language is the competent introduction of set phrases into speech; it is especially important to correctly use phraseological units when communicating with large audiences—e.g., in media communication (Smagulova 2020).

Passive phraseology is considered a set unit that has now lost its original meaning, but its meaning remains clear. Active idioms used in media discourse are seen as stable word combinations used productively in spoken language as well as journalistic and literary style, with clear meanings. In terms of the types of phraseology, stable units are considered to belong in three groups: phraseological integrity, phraseological unit, and phraseological chain. Whether a particular group of phraseological units is used depends on the stylistic design of the article, note, or speech (e.g., a phraseological chain is most often used in a neutral stylistic layer) (Koltay 2023).

The metaphorical interpretation of reality is reflected in the following Kazakh phraseological expressions: “аузынан жалын атып тұру” (literally, ‘to spew flames out of one’s mouth’, meaning formidable) and “басынан сөз асырмау” (literally, ‘not to let words come from the head’, meaning to refrain from speaking unnecessarily). Many set units demonstrate pronounced anthropomorphological features, such as “жаны мұрнының ұшында” (literally, ‘the soul reaches the tip of one’s nose’, meaning to be at risk of death). In addition, mechanisms of comparison and contrast of phenomena, concepts, and objects can be used to create hyperbolic

phraseological units: “төбесі көкке жетті (тиді)” (literally, ‘as if the top of one’s head reached the sky’, meaning to be deeply satisfied, infinitely happy), “айна қатесі жоқ. айна қатесіз” (literally, ‘as in a mirror’, meaning very much like someone), and “түймедейді түйедей ету” (literally, ‘to present something the size of a button as the size of a camel’, meaning to greatly exaggerate something, to attach great importance to something that is not very important). Metaphorical hyperbole allows for the actualisation of vivid conceptual images, thereby drawing the reader’s attention to a particular issue, adding expressiveness, and highlighting logically or stylistically defined text fragments.

The media context contains frequently use of emotive lexical units involving phraseological expressions with somatic components (hand, eye, ear, head): “бармағынан бал тамған” (literally, ‘honey drips from the finger’, meaning handyman, talented person) and “бас терісі салбырау, еңсесі түсу” (literally, ‘to sag from the scalp’, meaning depressed, oppressed person). Most often, such phraseological units convey the attitude of a native speaker to a person’s actions: “қолы қолына жұқпайды” (literally, ‘the hand does not touch the hand’, meaning fast and high-quality work), “шөп басын сындырмау” (literally, ‘to not even pluck a blade of grass’, meaning to do nothing, “not lift a finger”), and “әккі болған (қу)” (literally, ‘having his hand in the game’, meaning experienced, cunning). The condemnation of improper verbal communication is used in media contexts to emphasise a particular issue: “аузын буған өгіздей” (literally, ‘like an ox with its muzzle tied’, meaning to keep silent, not to express one’s opinion), “өтірікке сүттей ұю” (literally, ‘to sour like milk’, meaning to believe someone’s lies to be true), “алды-артын орау” (literally, ‘to twist from all sides’, meaning to distract the interlocutor’s attention with extraneous conversations), and “құлақ сарсыту” (literally, ‘to let one’s ears rot’, meaning to annoy someone). Evaluative judgments involving positive or negative connotations introduce an element of authorial narrative, and care should be taken when bringing such expressions into the information space, as they may be perceived ambiguously by readers.

Many phraseological units are used to denote a difficult emotional state to evoke empathic feelings (condolence, regret, pity) in the recipient of a media message: “басынан сырық, таяқ, құрық кетпеді” (literally, ‘the pole does not come off one’s head’, meaning to be dependent on someone), “жіпсіз байлану” (literally, ‘to be tied up without a rope’, meaning the inability to act freely), “төбесінен жай түскендей болу” (literally, ‘as struck by lightning’, meaning to stun with news), “иманы ұшып кету” (literally, ‘to fly with one’s spirit and faith’, meaning to be frightened, scared to death), “кірерге жер таппау” (literally, ‘to not find a place to hide’, meaning a desire to hide from shame), and “жаны түршігу” (literally, ‘to tremble to the soul’, meaning to shudder with horror, to feel disgusted). In cognitive discourse, such lexemes are linguistic codes of extra-lingual processes and phenomena in the surrounding reality, defining a person’s attitude to a certain problem and the author’s assessment (intentionality). In this way, media discourse determines the use of different semantic or stylistic connotations of phraseology depending on the contextuality, situationality, and genre in which it is introduced. Media literacy makes it possible to understand the mechanisms underpinning perception of language resources and

the response of the audience with regard to the use of specific lexical means (e.g., hyperbolised phraseological units with metaphorical, metonymic, and anthropomorphic elements).

### *3.2. Phraseology in the context of media literacy in world science*

*New media technologies* refer to the socio-cultural digital platforms which emerged at the beginning of the 21st century where users can share all kinds of content and use many forms of content creation and consumption. Media literacy involves both technical skills (creating an account) and critical thinking skills (assessing the accuracy of media content), and it depends on four factors: the level of media freedom, the quality of education, the level of interpersonal trust, and electronic participation. The independence of the media space and scientific knowledge both help build societal resilience against fake news. Reader literacy involves the ability to identify the main idea in a medium-length text, to find information according to specified parameters, and to draw conclusions about the purpose and form of a text.

Identifying the relationship between the goals of social network use and literacy in this area makes it possible to determine people's levels of literacy vis-à-vis modern media communication (Zaki et al. 2023a). The main focus of content creation is to ensure the reliability, objectivity, and accuracy of the information provided. Media literacy, in this context, involves not only epistemological beliefs but also the ability to critically evaluate and question the sources of information (Arsenteva 2021). Critical thinking makes it possible to competently investigate, analyse, and evaluate situations through drawing on observations and experience, developing communicative complexity, and using imagination. An important factor is the fight against conformity and stereotypes, majority and peer pressure, and the formation of positions by a certain circle of people (Spytska 2024). Another feature of critical thinking is an understanding of the complexity of the world, its uncertainty, and its rapid changeability. Cognitive complexity, cognitive courage, and humility are mechanisms for adequately assessing reality. A plurality of constructs with which to interpret the world order facilitates the perception of information in the media space (Zaki et al. 2023b). The structural complexity of phraseology depends on its semantic structure in cognitive terms, since a linguistic picture of the world reflects not only external processes but also a person's internal perception of reality. Each linguistic unit can be examined from a cognitive perspective, which extends to communicative aspects, including the listener's interpretation of the text. Media discourse is seen as an archetype that limits social knowledge and behaviour and allows informational mechanisms to influence not only the conscious but also the subconscious (Ternov et al. 2024).

From the perspective of cognitive linguistics, phraseological units are considered a means of "coding" and actualisation of concepts: the impact of phrasemes on the recipient is described in linguistic, communicative, pragmatic, mental, and cultural discourse within the context of national specifics. Phraseology is a means of storing and organising knowledge about the surrounding world, which is accumulated in

phraseological semantics; it is always based on an image (picture) embodied in a component word. Thus, phraseological units have a core image (lexeme), which is the basis for the formation of the internal form. The analysis of phraseological units should be conducted comparatively, and the development of the theory of phraseology is a priority area for future studies, since the phraseological corpus has always been considered an expressive means of language. The stylistic effect of the contextual introduction of stable units of speech varies from strengthening, weakening, or clarifying the meaning to maximum expressiveness of stable units. Functional-stylistic attribution provides quantitative, semantic, and etymological assessment of phrasemes with clearly defined features found in the national language. Phraseology creates images associated with the people's mentality, religion, rituals, mythology, lifestyle, folklore, styles, and stereotypes of cognition of the world and nature (Romaniuk and Yavorska 2022).

Today, the study of corpus phraseology and the use of phrasal frame techniques (p-frames) is of primary importance in the development of media literacy and academic awareness among students. Hyperbole is a uniquely figurative speech act that should not be associated with any tropes: it is a kind of figurative language in which the literal meaning does not match the intended lexical meaning. In the use of hyperbole, the limits the listener expects are surpassed through the use of exaggeration (Zhanysbayeva et al. 2021). Hyperbolic units are based on the exaggeration of certain properties of the depicted object—that is, the attribution of certain properties and states compared to those they actually possess. As set linguistic units, phraseological units feature a wide range of means of emotional and expressive manifestation and are characterised by gradational evaluation related to the intensity of the quantitative representation of objects and phenomena. Such phrases are based on the content of the components exceeding a certain linguistic norm. While sharing common features with metaphor and irony, hyperbole is significant different from them, although it can be used in its pure form or in a metaphorical, ironic context (Yemets 2024). Hyperbole differs from metaphor in its use of a particular tone (similar to irony) and shows an attitude toward the event, while metaphor only describes the event; and it differs from irony by using a different processing mechanism. In world linguistics, hyperbole is interpreted ambiguously: it is attributed to artistic, stylistic, linguistic, speech, rhetorical techniques; it is believed to perform the function of artistic representation, imagery, and expressiveness; and it is often correlated with tropes and stylistic figures (Li and Kent 2021).

Hyperbole-based phraseological expressions, as units of secondary nomination, have enormous potential to convey a person's emotional and evaluative attitude. The category of quantity—one of the categories of human thinking—reflects the discreteness and non-discreteness of the definiteness of being, and it interacts with a number of categories, including definiteness, intensity, emotivity, and evaluation. Such phraseological units also reflect the life experience of people, generally accepted symbols, and abstract ideas through personal perception and cognitive mechanisms (speech, thinking, communication between people and representatives of any groups) in media texts. To communicate in the media space, it is necessary for a person to have basic media literacy, communication tools for

the media environment that allow for ample and accessible information, and the analytical skills to separate fact from fiction, to sift out unverified facts, to analyse and synthesise information, and to understand manipulative strategies and communication tactics.

## 4. Conclusion

The study of a wide range of issues on the deployment of phrases using the hyperbolic element in the media space has been supported by the contributions of contemporary scholars examining the contextual, conceptual, and paradigmatic links between phrases and the functional models of their use in media contexts. The theoretical approach produced a solid foundation in the form of research not only on the linguistic parameters of phraseological usage but also on other influencing factors, particularly psychological, sociological, and cultural. An in-depth study was conducted of the cognitive mechanisms behind building a communication strategy between the media and their audience, through analytico-synthetic reinterpretation of the writings. The mapping of environmental factors onto speech, the perception of the world embedded in linguistic culture, and the linguistic analysis of speech strategy using stylistic, semantic, structural mechanisms were fundamental to this study. In the examination of basic cognitions, conclusions were drawn about the linguopragmatic potential of stable expressions, the linguistic and cultural status of the recipient of a message, and the discursive nature of language, using the examples of English and Kazakh cultural codes.

The findings indicate that hyperbolic phraseology plays a critical role in shaping cognitive and emotional responses to media content. In particular, it is the exaggerated nature of hyperbolic phraseological units that prompts audiences to critically engage with media messages. The intensified emotionality of hyperbolic expressions compels audiences to distinguish between factual content and exaggerated language, which increases their cognitive abilities in media literacy. The study's focus on hyperbole in phraseology serves to highlight hyperbole's critical function in media discourse, emphasising the importance of cognitive processing in the face of exaggerated language. This aspect is fundamental to media literacy, as it enables individuals to identify manipulative strategies and evaluate the credibility of information given its exaggerated presentation. Future research should delve deeper into the cross-linguistic analysis of hyperbolic phraseology and its role in shaping media literacy. Future research should also concentrate on the mediating processes between linguistic and non-linguistic mechanisms of speech communication in the media, as well as on the development of media literacy in different countries, with consideration of specific cultural and linguistic codes. Furthermore, it is essential to monitor existing media-communication mechanisms and explore new tools for more effective information dissemination. Furthermore, attention should be devoted to the study of phraseological diversity in spoken and written language as it pertains to journalism, with a view to utilising new mechanisms to enhance the impact on the audience.

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# Information Diffusion in Blockchain-Based Social Networks Using Evolutionary Game Theory

Blockchain-based social networks differ from traditional ones with respect to information diffusion. This study develops an evolutionary game model to investigate how blockchain features affect users' information diffusion behaviours, with the aim of boosting efficiency in social networks. The model provides a detailed analysis of the dynamic evolution of user behaviours across various scenarios. Using the Steemit platform as a case study and integrating theoretical and empirical analyses, the study validates the model's applicability and visually illustrates the characteristics of information diffusion through cloud maps. The findings reveal that a blockchain's core features, such as trust and incentive mechanisms, prompt users to adopt a more cautious approach when disseminating low-quality information—particularly distorted or malicious content—within social networks. These mechanisms ultimately contribute to an overall enhancement of content quality across social networks.

**Keywords:** *blockchain; social network; information diffusion; evolutionary game; Steemit*

**Acknowledgement**

This research was supported by Fujian Provincial Natural Science Foundation of China (Grant No. 2023J011139).

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**How to cite this article:**

Chen, Yanyu, Min Tang, Renqiang Xie. "Information Diffusion in Blockchain-Based Social Networks Using Evolutionary Game Theory".
*Információs Társadalom* XXIV, no. 4 (2024): 43–61.
*https://dx.doi.org/10.22503/inftars.XXIV.2024.4.3*

## 1. Introduction

Social networks serve as essential platforms in contemporary society. These networks not only enable the rapid dissemination and sharing of information but also play a role in strengthening human connections and mutual understanding. As of July 2024, the global Internet user base reached 5.45 billion, with 5.17 billion active users of social networks, representing an impressive 94.9% of the total user base (Statista Research Department 2024). This reveals the immense influence and popularity of social networks worldwide. Despite their rapid spread, traditional social networks face several critical challenges, including data privacy breaches, inadequate information authentication, and centralised platform control (Guidi 2020; Huang and Si 2024; Mlika, Karoui and Romdhane 2024), all of which negatively affect users' experiences and undermine their trust in these platforms. As a transformative tool that can address these issues, blockchain technology has revolutionised the operation of social networks through its unique attributes, including decentralisation, transparency, and immutability (Wilson et al. 2024; Yajam, Ebadi and Akhaee 2024). Blockchain-based social networks have several features related to information diffusion that are distinctive from their traditional counterparts. Moreover, certain inherent features (such as economic incentives and decentralised trust mechanisms) significantly increase users' participation enthusiasm and creativity concerning information diffusion, thereby fostering the dissemination of valuable information (Z. Karvalics and Nagy 2017).

Current research on information diffusion within blockchain-based social networks has a number of limitations, which are characterised in the following:

(1) Inadequate theoretical frameworks. Existing studies have been limited to traditional information diffusion models, such as the Susceptible-Infected-Recovered (SIR) model and modified versions thereof (Chen, Kong and Wang 2023; Ma et al. 2024; Pramanik 2023; Wanduku 2023). However, the applicability of these models in the unique environment of blockchain-based social networks—which are characterised by decentralisation and complex, dynamically-evolving user behaviours—has not been fully verified. This creates an urgent need to establish a theoretical framework that can account for dynamic changes, depict strategic interactions, and provide a deeper understanding of the information diffusion mechanisms in these contexts.

(2) Disconnection between technical characteristics and information diffusion mechanisms. While blockchain features profoundly influence information diffusion, existing studies have not been able to fully elucidate how specifically these features affect the information diffusion process. This gap in the literature warrants a thorough analysis of the relationship between technical characteristics and information diffusion mechanisms.

(3) Insufficient empirical research and case studies. Theoretical research requires empirical data to confirm the validity and practical relevance of models. However, the empirical research and case analyses conducted so far lack real-world data to substantiate theoretical models. Therefore, the applicability of research outcomes remains limited.

The present study uses evolutionary game theory to examine the effects of blockchain characteristics on information diffusion within social networks. As an analytical tool, evolutionary game theory offers a robust theoretical framework for examining the dynamic mechanisms, strategy selection processes, and long-term equilibrium states of information diffusion within blockchain-based social networks. This study comprehensively analyses how blockchain characteristics effectively curb the spread of distorted and malicious information, as well as the mechanisms underlying this inhibitory effect. The aim of the study is to enhance users' rationality and enthusiasm concerning information diffusion within blockchain-based social networks, which establishes its theoretical and practical significance.

**Theoretical contributions:** 1) This study deepens the understanding of blockchain-based social networks. By applying evolutionary game theory to analysing these networks, the study provides insights into the underlying mechanisms and patterns of information diffusion. In addition, it clarifies the influence of blockchain characteristics on the dynamics and patterns of information diffusion. 2) The study contributes to enriching the theoretical framework of information diffusion models. By incorporating blockchain characteristics and state transition probabilities, it develops a new information diffusion model and offers a fresh perspective and methodology for studying information diffusion. 3) The study expands the scope of application of evolutionary game theory to blockchain-based social networks, providing robust empirical evidence for its application and evolution across different fields.

**Practical contributions:** 1) This study offers insights for optimising the efficiency and effectiveness of information diffusion. Understanding the dynamics and patterns of information diffusion enables operators to effectively promote content, boost user engagement, and limit the spread of low-quality information. 2) The study addresses methods for enhancing network security and user trust by analysing the impact of these characteristics on information diffusion, thereby contributing to a healthier social network environment. 3) The study offers guidance for the innovation and growth of blockchain-based social networks. Through its in-depth analysis of the effects of blockchain characteristics on information diffusion, this study presents new social and business models that could drive further development of blockchain-based social networks. 4) The insights gained from analysing the impact of blockchain characteristics on information diffusion can inspire the application of blockchain technology to other domains.

## 2. Related research

### *2.1. Research on information dissemination in social networks*

Broadly, a social network is a complex structure formed by individuals (whether people, organisations, or other entities) exhibiting friendships, family ties, work relationships, and shared interests or hobbies. In the digital age, social networks specifically refer to online platforms using Internet technology (such as Facebook,

Weibo, WeChat, and LinkedIn) that enable users to create profiles, share content, engage with others (e.g., through liking, commenting, and sharing), and build social networks. Social networks facilitate communication and connection among people and serve as key channels for information dissemination, knowledge sharing, social mobilisation, and commercial marketing.

Information dissemination is defined as the process through which information is transmitted from a source to one or more recipients through various channels (Zhao et al. 2018). Information dissemination within social networks is a dynamic and complex process, as information can spread rapidly across various nodes (i.e., users) of the network (Krzanowski 2023; Razaque et al. 2022). The basic elements of information dissemination—communicator, content, medium, audience, and effect—were introduced by Harold (2013) and remain foundational in communication studies. Scholars have developed a range of models by using different approaches to analyse information dissemination in social networks; of these, infectious disease models are particularly notable. Due to the structural similarities between social networks and infectious-disease transmission patterns, researchers have adapted such models to assess the process of information dissemination; they have presented refined models, including the SEIR model (Xiao and Ruan 2007), the SIRS model for netizen emotion contagion (Zhao et al. 2018), the SCIR model for public opinion dissemination (Ding 2015), and improved SEIR models (Yang and Zhang 2018). In considering pairwise friendships and virtual community relationships, Shen et al. (2023) proposed an information dissemination model based on hypergraphs which aligns perfectly with the topology of online social networks. Wang et al. (2020) introduced concepts like the information exposure curve and individual influence in social networks, and they developed a model based on the memory effect in information sharing. Huang, Sun and Hu (2018) combined the infectious disease model with node attitudes to create a social network information dissemination model that factors in node attitudes. In short, information dissemination in social networks has been extensively studied, laying a solid foundation for the present study.

### *2.2. Research on information dissemination in blockchain-based social networks*

Blockchain-based social networks represent a novel social network model that integrates blockchain technology and social networking. Several current social networking platforms—including Steemit, Minds, Akasha, and Peepeth—are based on blockchain technology. Steemit combines content creation with cryptocurrency rewards to motivate users to produce high-quality content. Minds emphasises privacy protection and users' control over their data; it not only provides cryptocurrency rewards for content creation but also supports the development of decentralised applications. Akasha, based on the Ethereum blockchain, enables social interaction through smart contracts and stores data in a distributed network, both of which contribute to enhanced security. Peepeth is similar to X (formerly Twitter): with

information on the blockchain being tamper-proof, the authenticity and reliability of the content is guaranteed.

Through key elements like distributed storage, cryptography, consensus mechanisms, and smart contracts, blockchain technology provides social networks with robust mechanisms for trust, incentives, and the protection of information and user rights; these mechanisms address many of the challenges faced by traditional social networks. Along these lines, Li et al. (2024) proposed a blockchain-based plagiarism identification scheme for social network users, to safeguard the rights of original authors and to ensure users' accountability concerning plagiarism. Zhu, Hu and Lv (2021) developed various privacy protection schemes to address information leakage in social networks, which offered valuable insights into information security and social network safety. Zhou and Wang (2021) introduced a public opinion management system model for social networks based on blockchain concepts and technologies, thereby aiding in the management and mitigation of risks associated with online public opinion. Some scholars have also explored information dissemination within blockchain-based social networks. For example, Cui and Qiang (2021) proposed an information dissemination model for blockchain-based social networks that focused on factors such as user trust and economic incentives; their work highlighted how these elements influence information dissemination. In addition, Bin, Sun and Zhou (2019) developed a blockchain technology-based public opinion dissemination model for social networks, which could curb the spread of false online public opinions and foster a healthier online environment for public opinion dissemination—giving it practical significance.

### *2.3. Research on blockchain applications based on evolutionary game theory*

Evolutionary game theory combines game-theoretic analysis with dynamic evolutionary processes. Unlike traditional game theory, it assumes bounded rationality (rather than full rationality), meaning that game players learn, experiment with errors, and imitate, thereby dynamically adjusting their strategies to maximise their interests (Yang and Ma 2020; Zhang et al. 2022). Scholars have applied evolutionary game theory to analyse issues in the blockchain environment. For example, Han et al. (2024) developed an evolutionary game model involving government departments, blockchain service providers, and third-party regulatory agencies to analyse the sharing of government data on blockchains; their study sought to improve governmental governance capabilities and public service levels through concrete and actionable recommendations for improving government data-sharing practices on blockchain. Wu and Liu (2024) established a tripartite evolutionary game model involving regulators, carriers, and shippers to explore the application of blockchain technology in the safety supervision of road transport for dangerous goods, analysing how different variables influence the strategic choices of the involved parties. Liu et al. (2024) developed a complex network evolutionary game model to analyse farmers' financing behaviours on the blockchain; their study worked to address

information asymmetry between farmers and financial institutions, which results in financial institutions being reluctant to lend and which poses financing difficulties to and imposes high costs on farmers. They identified key factors influencing farmers' adoption of blockchain, and they contributed to enhancing incentive and financial-product innovation mechanisms, whereby they supported the broader adoption of blockchain technology. Li et al. (2023) used evolutionary game theory to create a model for data-sharing behaviour among scientific researchers on the blockchain. Finally, Xu, Zhang and Chen (2023) developed an evolutionary game model to study cooperation in green procurement between small and medium-sized suppliers and core manufacturing enterprises, with the aim of improving environmental management and social responsibility performance across the green supply chain. These studies clearly indicate extensive application of evolutionary game theory to investigations of blockchain technology-related issues.

In summary, scholars have extensively explored the use of evolutionary game theory in areas like information dissemination on social media and blockchain applications. However, as discussed above, some limitations in the current research remain to be addressed. This study addresses these gaps by analysing the characteristics of information dissemination in blockchain-based social media using evolutionary game theory and by providing empirical support for the findings.

## 3. Evolutionary game analysis of information dissemination among users in blockchain-based social networks

### *3.1. Analytical process of evolutionary game theory*

Evolutionary game theory is a theoretical framework that examines how strategic interactions within a population evolve over time; it integrates concepts from game theory and dynamic systems theory (Kou et al. 2024; Zhang et al. 2022). Originating from biological evolution, this theory has been widely applied in the fields of economics and sociology to analyse the formation of social habits, norms, institutions, and systems, as well as their influencing factors. The basic analytical process of evolutionary game theory comprises three stages (Wang, Ma and Zhang 2024; Zhi et al. 2024):

**Model Construction.** In this initial stage, it is essential to clarify the participants in the game, their strategic choices, and the impact of these choices on their respective payoffs. Based on these parameters, a payoff matrix is constructed which reflects the payoffs received by each participant under various combinations of strategies. This matrix serves as the foundation for subsequent analyses.

**Model Solution.** This stage primarily involves constructing replicator dynamics equations that describe changes over time in the proportions of various strategies within the participant population. With these equations solved, equilibrium points of the game can be identified. The stability of these equilibrium points is then analysed using the Jacobian matrix, to determine evolutionarily stable strategies (ESS).

**Result Visualisation.** In this stage, the system's evolutionary process under various conditions is observed through simulation of parameter assignments and

initial probability settings. This entails verifying the correctness of ESS—i.e., verifying whether the system evolves from various initial states to the expected stable strategies—and conducting a parameter sensitivity analysis to assess the effect of parameter changes on the system's evolutionary path. Finally, the results of the evolutionary game are visually presented through the plotting of curves of system states over time or through comparisons of evolutionary path diagrams under various parameters.

These three stages collectively form the core of evolutionary game theory simulation, thereby providing a robust tool for analysing the dynamic evolution of game systems.

### *3.2. Game behaviour in information dissemination within blockchain-based social networks*

Users' information dissemination behaviour in blockchain-based social networks is notably more cautious, due to the combined influence of incentive, trust, and community-governance mechanisms.

First, users who post authentic, credible, and valuable information receive rewards based on the information quality, and users who reshare high-quality information may also earn rewards. Conversely, a user who shares distorted or inappropriate information may face penalties. This incentive mechanism encourages users of blockchain-based social networks to carefully weigh the pros and cons before disseminating information, leading them to approach the information they encounter with greater caution (Li, Xie and Xu 2022; Tang et al. 2023).

Second, the trust mechanism inherent in blockchain-based social networks plays a significant role. Each user action is recorded on a distributed ledger with a timestamp, which makes the shared information resistant to tampering or deletion. This aspect enhances information credibility and transparency: because they know that their actions will be recorded and verified by the entire network, users exercise caution when disseminating information. Moreover, users are aware that posting false information or engaging in malicious dissemination can severely damage their reputation within the network (Guidi, Michienzi and Ricci 2020; Wang et al. 2024).

Lastly, community governance mechanisms in blockchain-based social networks significantly influence users' information dissemination behaviours. Such mechanisms typically include voting, consensus, and arbitration structures. These encourage users to consider the impact of their actions on the network when disseminating information; the awareness that their actions will be evaluated by the entire community prompts users to be more cautious in their information dissemination behaviours, to avoid potential controversies or disputes (Chen 2023; Hu, He and Feng 2022; Hu and Qi 2023).

In short, the collaborative interplay of incentives, trust mechanisms, and community governance in blockchain-based social networks creates a secure, trustworthy, and stable social network environment. These factors collectively influence users' information dissemination behaviour, which is more cautious and exhibits

game-theoretic psychological characteristics throughout the information dissemination process.

## *3.3. Model construction*

### *3.3.1. Construction of payment matrix*

In line with the above discussion, this study considers the following parameter assumptions in developing the evolutionary game model:

(1) Two members of the social network, A and B, receive the same information.

(2) Users A and B have two choices: forward the information, or not. Let $x \subseteq [0,1]$ and $y \subseteq [0,1]$ denote the probabilities of A and B forwarding the information, respectively. Accordingly, 1-x and 1-y denote the probabilities of A and B not forwarding the information, respectively.

(3) Users A and B receive a basic benefit *I* for forwarding the information, along with a basic risk *R*.

(4) If both A and B forward the information simultaneously, the propagation effect is amplified, resulting in an additional benefit $\Delta I$ and an additional risk $\Delta R$ for both.

| | | Node user B | |
|---|---|---|---|
| | | forward y | not forward 1-y |
| Node user A | forward x | (I+$\Delta I$-R-$\Delta R$,I+$\Delta I$-R-$\Delta R$) | (I-R,0) |
| | not forward 1-x | (0,I-R) | (0,0) |

*Table 1*. Payment matrix for information propagation in social networks (Sources: created by author)

### *3.3.2. Local stability analysis*

From Table 1, we can deduce the following equations.

Member A's expected benefit when choosing to forward information is:

$$U_{11} = y(\mathrm{I} + \Delta I - \mathrm{R} - \Delta R) + (1-y)(I-R) = y(\Delta I - \Delta R) + (I-R)$$

Member A's expected benefit when choosing not to forward information is:

$$U_{12} = 0$$

Therefore, the average benefit of member A's mixed strategy is:

$$\overline{U_1} = xU_{11} + (1-x)U_{12} = x(y(\Delta I - \Delta R) + (I-R))$$

The replicator dynamics equation for member A choosing to forward information is:

$$F(X) = \frac{dx}{dt} = x(U_{11} - \overline{U_1}) = x(1-x)(y(\Delta I - \Delta R) + (I - R))$$

Similarly, the replicator dynamics equation for member B choosing to forward information is:

$$F(Y) = \frac{dy}{dt} = y(U_{21} - \overline{U_2}) = y(1-y)(x(\Delta I - \Delta R) + (I - R))$$

Setting =0 and =0, we obtain five local equilibrium points of the evolutionary game system: $E_1(0,0)$, $E_2(0,1)$, $E_3(1,0)$, $E_4(1,1)$, and $E_5(\frac{R-I}{\Delta I-\Delta R}, \frac{R-I}{\Delta I-\Delta R})$. The Jacobian matrix J of the dynamic evolution system for information dissemination in blockchain-based social networks can be obtained by calculating the partial derivatives of the replication dynamics equations of members A and B:

$$\begin{bmatrix} (1-2x)(y(\Delta I - \Delta R) + (I - R)) & x(1-x)(\Delta I - \Delta R) \\ y(1-y)(\Delta I - \Delta R) & (1-2y)(x(\Delta I - \Delta R) + (I - R)) \end{bmatrix}$$

When a certain equilibrium point satisfies the conditions of the determinant of the Jacobian matrix $det\ J>0$ and the trace of the Jacobian matrix $tr(J)<0$, we can determine whether that local equilibrium point is in a locally asymptotically stable state. If it is a stable state, then the equilibrium point is considered to represent the system's evolutionary stable strategy. Table 2 presents the results of the local stability analysis of the system.

| Equilibrium Points | Determinant of J | Trace of J (notation) |
|---|---|---|
| $E_1(0,0)$ | $(I-R)^2$ | $2(I-R)$ |
| $E_2(0,1)$ | $-((\Delta I - \Delta R) + (I - R))\ (I - R)$ | $(\Delta I - \Delta R)$ |
| $E_3(1,0)$ | $-((\Delta I - \Delta R) + (I - R))\ (I - R)$ | $(\Delta I - \Delta R)$ |
| $E_4(1,1)$ | $((\Delta I - \Delta R) + (I - R))^2$ | $-2((\Delta I - \Delta R) + (I - R))$ |
| $E_5(\frac{R-I}{\Delta I-\Delta R}, \frac{R-I}{\Delta I-\Delta R})$ | $-2(R-I)(1-\frac{R-I}{\Delta I-\Delta R})$ | 0 |

*Table 2*. Local stability analysis of information forwarding by users in blockchain-based social networks (Sources: created by author)

As Table 2 indicates, three situations can be identified:

(1) When $I\text{-}R<0$ — that is, $I<R$, $det\ J>0$, and $tr(J)<0$ at point $E_1(0,0)$ — the point can be considered an equilibrium point. In this scenario, both A and B choose not to forward information, which causes the users' information forwarding behaviours

in the social network to gradually evolve towards point $(0,0)$, ultimately converging at equilibrium point $E_1$.

(2) When $(\Delta I - \Delta R)+(I - R)>0$, and $tr(J)<0$ at point $E_4(1,1)$, the point can be considered an equilibrium point. Here, both A and B choose to forward information, which causes users' information forwarding behaviours in the social network to gradually evolve towards point (1,1). eventually converging at equilibrium point $E_4$.

(3) $E_2(0,1)$, $E_3(1,0)$, and $E_5(\frac{R-I}{\Delta I-\Delta R}, \frac{R-I}{\Delta I-\Delta R})$ are identified as nonequilibrium points. These points evolve towards either (0,0) or (1,1), ultimately converging at equilibrium points *E1* or $E_4$.

### *3.3.3. Parameter simulation*

Four sets of parameter values (presented in Table 3) are selected for analysis, and the evolution process of users' forwarding behaviours in blockchain-based social networks is simulated using MATLAB software. The simulation results are presented in Figure 1.

| Group | $I$ | $R$ | $\Delta I$ | $\Delta R$ |
|---|---|---|---|---|
| Case 1 | 0.5 | 2 | 0.5 | 2 |
| Case 2 | 0.5 | 1 | 0.5 | 1 |
| Case 3 | 1 | 0.5 | 1 | 0.5 |
| Case 4 | 2 | 0.5 | 2 | 0.5 |

*Table 3*. Simulation parameter values for the evolution of users' forwarding behaviours (Sources: created by author)

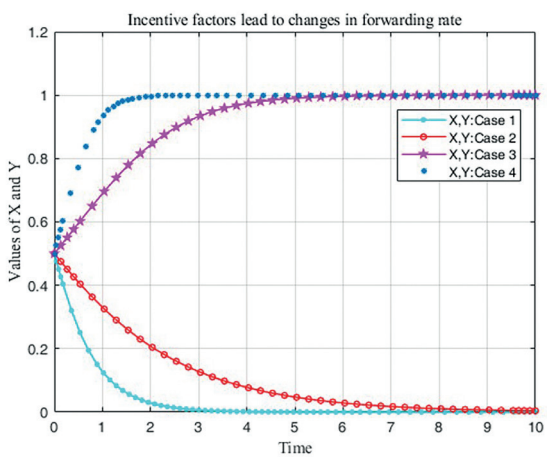


*Figure 1*. Evolution results of users' information dissemination behaviours in blockchain-based social networks (Sources: created by author)

In Cases 1 and 2, where $I<R$ and $\Delta I<\Delta R$, the evolution converges towards (0,0), as shown in Figure 1. Due to the larger difference between the values of I and R and between $\Delta I$ and $\Delta R$, the convergence curve in Case 1 is steeper than that in Case 2, implying faster convergence.

In Cases 3 and 4, where $I>R$ and $\Delta I>\Delta R$, the evolution converges towards (1,1); due to differences in the specific values of I and R as well as in $\Delta I$ and $\Delta R$, Case 4 converges more rapidly.

The results presented in Figure 1 both are consistent with the conclusions in Section 3.3.2 and align with real-world situations.

## 3.4. Empirical study

### *3.4.1. Theoretical analysis*

This study uses the Steemit platform to examine the impact of blockchain incentive mechanisms on information dissemination by social network users. Steemit is a well-known blockchain technology-based network (Steemit 2016) where the creation and dissemination of information are stored immutably on the public blockchain Steem (Guo and Hu 2020). As mentioned above, Steemit encourages the production and dissemination of high-quality information through an incentive mechanism that includes the following key aspects (Kim and Chung 2018):

(1) Publishing high-quality content: Users earn more Steem token rewards when they create content of high quality that garners more likes.

(2) Disseminating high-quality content: Users who support high-quality content early through liking, commenting, or sharing receive more Steem token rewards.

(3) Holding Steem power: Similar to equity dividends, users can use “upvotes” and “downvotes” to determine the earnings of each piece of content.

These incentives drive users to choose high-quality resources when publishing and sharing information in order to maximise their token rewards. Additionally, each user has a reputation score that can only be increased through posting, commenting, and liking; if a user supports or shares content that is later found to be malicious or of low quality, not only the publisher but also the users who forward and like it face reductions in both their tokens and their reputation points. Therefore, users in the Steemit network are more cautious about publishing content, and they avoid casually forwarding unverified or malicious information (Fang and Wang 2022; Zhao and Zhou 2022).

The above analysis indicates that in the Steemit social network, the risks associated with forwarding unverified or malicious information outweigh the potential benefits. For group forwarding, the additional benefits from the expanded dissemination effect are significantly lower than the additional risks. Figure 2 illustrates the overall trend of information forwarding in the Steemit social network.

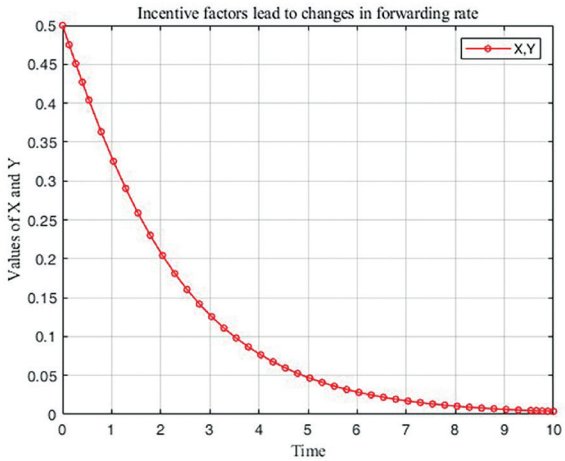


*Figure 2*. Trend of information forwarding in the Steemit social network (Sources: created by author)

### *3.4.2. Data validation*

From October 11, 2024, to October 13, 2024, we collected article data from the Steemit platform using keywords such as 'artificial intelligence (AI)', '5G', and 'cloud computing' to further verify the characteristics of information dissemination within the Steemit social network. The analysis focuses on the fields of publishers and responders. After data cleaning, 8,557 records remain. We utilise Gephi software to generate an information dissemination cloud map of the Steemit platform, with platform users as nodes and commenting relationships as edges (Kandonga, Ding and Yuan 2022; Zhao et al. 2018), as depicted in Figure 3.

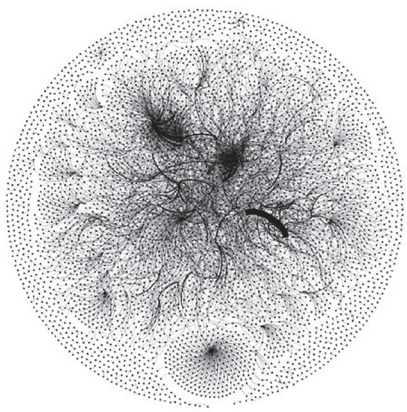

*Figure 3*. Information dissemination cloud map of the blockchain community (Sources: created by author)

In Figure 3, the dots indicate user nodes, and the lines between nodes indicate interactions among users, with the thickness of a line signifying the frequency of interactions. The figure shows that despite numerous nodes in the blockchain community, core users account for only a small fraction: overall, the distribution of nodes is relatively scattered, with limited closeness in user interactions and a relatively low volume of comments. This suggests that users in the blockchain community are more rational and exercise caution in sharing "uncertain" information. Such behaviour helps reduce the circulation of false or spam information and ensures wide visibility of high-quality content on the platform.

## 4. Conclusions and implications

### *4.1. Conclusions*

This paper explores the influence of blockchain characteristics on information dissemination within social networks through the lens of evolutionary game theory, and it analyses the underlying mechanisms in suppressing misinformation and harmful content. Theoretically, this study advances the understanding of blockchain-based social networks, enriches the theoretical framework of information dissemination models, and broadens the application of evolutionary game theory. Practically, the research findings can help optimise information dissemination efficiency, improve network security and user trust, and offer valuable guidance for innovation and growth in blockchain-based social networks. In addition, this study provides insights into the application of blockchain technology in fields such as copyright protection, finance, and supply chain management.

Through its theoretical analysis and empirical testing, this study draws three conclusions from the proposed evolutionary game model.

**(1) Greater Caution and Information Credibility in Blockchain-based Online Communities**

In social networks leveraging blockchain technology, users' information dissemination behaviours are shaped by a combination of personal interests, social needs, and economic incentives. This convergence makes users more cautious when disseminating information, particularly in relation to its content value and to the authenticity and reliability of its source, as spreading false information could harm both their reputation and their economic interests. This dynamic fosters the sharing of accurate and credible information within social networks, which in turn establishes a foundation for a healthier and more orderly online environment.

**(2) Improved Content Quality and Suppression of False Information**

A blockchain's immutability and transparency ensure high-quality content in social networks. In blockchain-based communities like Steemit, high-quality content

is more likely to receive recognition and economic rewards due to its value, which encourages users to be creative and willing with regard to producing quality content. At the same time, blockchain's inherent characteristics naturally suppress false information: since false content hardly gains community trust and support, its spread within such networks is hindered. This mechanism not only depollutes the online environment but also increases users' trust and satisfaction with the social network.

**(3) Simplified and Direct Social Network Structure**

Empirical analysis of the Steemit platform reveals that the blockchain's trust and incentive mechanisms facilitate simpler and more direct interactions among users. This shift streamlines the complex hierarchies and intermediary layers that are typical to traditional social networks, leading to more efficient and rapid information flow. As users become more discerning and selective, the overall volume of information may decrease but the quality and value of shared content continue to increase. This optimised network structure not only enhances the efficiency of information dissemination but also reduces management costs, which in turn provides robust support for the sustainable development of social network platforms.

### *4.2. Implications for management*

Based on the research conclusions, four management implications are proposed.

**(1) Continuously Explore and Optimise Innovative Incentive Mechanisms**

Social network platforms should persistently explore and innovate around incentive mechanisms for blockchain technology, to better stimulate users' creativity and motivation for dissemination. Incentivising users based on multidimensional factors—such as user behaviour data, content quality assessments, and social influence—is crucial to ensuring fairness and effectiveness. Additionally, integrating more economic elements and business models (such as advertising revenue sharing and paid reading) can diversify users' revenue streams and incentive methods.

**(2) Strengthen User Education and Guidance**

To improve users' ability to understand blockchain technology and to assess information authenticity, platforms should boost education and guidance efforts. This can be accomplished through lectures, training sessions, online courses, and other educational initiatives. These efforts should focus on the fundamental principles, application scenarios, and potential risks of blockchain technology, as well as on strategies for evaluating information authenticity. Establishing a user-reporting and -feedback system can encourage active reporting of false information and misconduct, further cultivating a healthier online environment.

**(3) Continuously Optimise and Upgrade the Social Network Structure**

Social network platforms should leverage the blockchain's advantages to refine network structures and thereby increase the efficiency and quality of information dissemination. Introducing advanced technologies such as machine learning and natural language processing can enable precise analysis and prediction of user behaviour, as well as intelligent classification and filtering of content. Moreover, exploring blockchain-based data-sharing and collaboration mechanisms can support seamless information exchange and resource sharing across different platforms.

**(4) Balance Community Autonomy and Supervision**

Platforms should promote user involvement in community governance and rulemaking, to achieve autonomy and self-regulation; nevertheless, maintaining regulatory oversight and intervention is necessary to ensure compliance and standardisation within the community. A balance can be achieved through smart contracts and automated monitoring systems which enable real-time oversight and early warnings of community activities as well as timely interventions for violations. This integrated approach can not only maintain community order and stability but also enhance user engagement and creativity.

## 5. Limitations and future research directions

### *5.1. Research limitations*

This study examines user behaviour and information dissemination mechanisms in blockchain-based social networks under the reasonable assumption that users are aware of the risks and benefits; however, the study has its limitations. First, in the operation of blockchain platforms, multiple factors may interfere with certain mechanisms (Li and Palanisamy 2019). This study neither considers these factors nor comprehensively explores how the diversity, complexity, and dynamics of various mechanism designs affect user behaviour and information-dissemination efficiency. For instance, different configurations of incentives (such as reward structures, distribution methods, and penalties) can lead to significant differences in user behaviours. Second, the empirical analysis is restricted to a single platform (Steemit) with a limited dataset, which may impact the generalisability and reliability of the findings. Differences in user demographics, platform features, and operational strategies across platforms could affect user behaviour and dissemination patterns.

### *5.2. Future research directions*

To address the aforemented limitations, future research should more comprehensively analyse how blockchain characteristics influence user behaviour, with a

particular emphasis on the effects of complex and dynamic incentive mechanisms on user actions and dissemination efficiency. Expanding the empirical scope to include more blockchain-based social platforms, as well as gathering richer data, will enhance the comprehensiveness and robustness of the findings. Additionally, examining platform-specific variations will shed light on how different platform features influence user behaviours and information dissemination mechanisms; this can offer valuable insights for the optimised design and sustainable development of blockchain-based social networks.

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# Legal and Policy Dimensions of Using Digital Technologies to Monitor and Manage Working Time in the EU

The purpose of this article is to study the current state of legal regulation of the use of digital technologies for monitoring and managing working time in the EU and individual Member States. The purpose involves fulfilling the following research tasks: to analyze the regulatory framework of France, Germany, Spain, and Italy; to compare their national laws and Ukrainian and EU legislation in the field of labor relations; to evaluate litigations and possible risks related to the digital monitoring of working time; and to make recommendations for improving the regulatory framework in this area. The scientific novelty of this article concerns comprehensive legal analysis and recommendations aimed at increasing the clarity of regulatory policy in the field of labor relations. The developed legislative proposals and ethical recommendations that can become the basis for shaping future employment law policies signify the practical value of this article.

**Keywords:** *digital technologies, labor law, employee rights, general data protection regulation, right to disconnect.*

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**How to cite this article:**

Yaroshenko, Oleg M., Anatolii P. Getman, Vladyslav S. Tkachenko, Oleg L. Musiienko, MariyaP. Petrova. “Legal and Policy Dimensions of Using Digital Technologies to Monitor and Manage Working Time in the EU”.
*Információs Társadalom* XXIV, no. 4 (2024): 62–78.
*https://dx.doi.org/10.22503/inftars.XXIV.2024.4.4*

## 1. Introduction

The widespread adoption of digital technologies has transformed employment relations in the field of time tracking, remote work, and employee productivity measurement.Digital tools allow employers and employees to use flexible work schedules, optimize workflow, and ensure continuous communication even when working remotely. An important trend has been the growth of data and its processing (Ćormarković, Dražeta and Njeguš 2022). The development of quantum technologies can provide new approaches to computing and cryptography, making data processing more efficient (Krynytsia 2023). However, these technological advances raise significant legal and ethical challenges related to privacy, abuse of monitoring, and compliance with applicable labor laws (Yaroshenko et al. 2022).

Various studies have highlighted that engaged employees rely heavily on technology, which can lead to an overload of information and notifications. Consequently, they become susceptible to a new form of pressure called "technology-induced stress" (Marsh, Perez Vallejos and Spence 2022). All of this prompts a rethinking of legal concepts such as working time, time tracking, workplace, overtime, rest time, labor productivity, recall of employees from vacation, and temporary disability. Furthermore, the sense of job insecurity is growing, being driven by advancements in machine learning, artificial intelligence, and robotics (Getman et al. 2023). These technologies have enabled the automation of many repetitive and highly standardized tasks, leading to concerns about job stability (Nam 2019; Ghani et al. 2022). Based on the aforementioned trends, it is evident that digitalization alters the legal regulation of labor relations fundamentally. New questions arise regarding the protection of labor rights in a digital environment, where working hours and the workplace are blurred (Breque, De Nul and Petridis 2021). In this context, it is essential to develop new legal frameworks that account for the specifics of the digital economy and ensure the protection of employees' rights. Key aspects include transparency in the use of monitoring technologies, limiting working hours to prevent digital overload, and guaranteeing equal conditions for all employees regardless of their ability to adapt to new technological requirements.

This study analyzes how different EU Member States regulate digital monitoring of working time with a particular focus on legislative initiatives in France, Germany, Spain, and Italy. Such a choice is due to different approaches to the regulation of digital monitoring of working time and the right to disconnect in these countries. France was the first country to enshrine the right to disconnect in legislation. Germany has strong data protection laws, and work councils participate actively in overseeing digital technologies. Spain has introduced a law on digital rights that regulates digital monitoring, while Italy has established a flexible employment model with clear rules on the digital literacy of employees. The analysis of these countries helps to identify best practices and suggest common standards for regulation at the EU level.

The scientific novelty of this article is a comprehensive approach developed to analyze the legal implications of digital time-tracking technologies and suggest policy recommendations targeted to improve the clarity and coherence of legislation across the EU. The article also provides a critical comparison of national approaches

to digital monitoring, representing how different EU Member States address these issues in light of the wider EU regulatory framework. This study will be of particular interest to policymakers, lawyers, and employment law experts, seeking to understand how labor rights are changing in the digital age. It will also be useful for companies as guidelines to reconcile the use of digital monitoring tools with legal standards and employees' rights. By providing practical legislative recommendations, this study aims to contribute to the development of a more coherent and balanced regulatory framework that meets the needs of both employers and employees in the context of a digital workplace.

## 2. Materials and Methods

The research methodology consists of several stages, including document analysis, case law review, and policy comparison. Each stage is designed to clarify the current legal situation, identify existing gaps, and suggest possible legislative reforms. In this article, the legalistic method was used to analyze EU and Member State legislation in order to understand the regulation of working-time monitoring. This included the study of Directive 2003/88/EC concerning certain aspects of the organization of working time (European Parliament and Council 2003), the General Data Protection Regulation (European Parliament and Council 2016), and other regulations governing the use of digital technologies in the field of work.

The study provides an in-depth analysis of relevant case law related to the use of digital technologies for monitoring working time. It examines issues related to the right to privacy, data protection, and employee consent. The analysis of such cases helps to reveal how courts interpret existing laws in practice, in particular regarding the balance between employer control and employee rights.

The authors also used the comparative method to analyze the legislative approaches to working-time monitoring in different EU Member States. By comparing the regulations in France, Germany, Spain, and Italy, the study identifies national peculiarities and best practices that may be useful for the development of common standards at the EU level. The systemic method is based on considering the object of study as part of a larger system. The systemic method was applied to consider the monitoring of working time not only as a separate process but also as part of the overall system of labor law and human resources management.

In this article, the analysis method was used to study certain components of legal regulation of digital technologies, such as data protection, the right to disconnect, and other aspects that affect the monitoring of working time. This approach allowed for a deeper understanding of how different legal norms and practices affect the overall picture of regulation in this area. The synthesis method was used to combine the results of the analysis of legislation, comparative studies and other components of the article to formulate general conclusions about the need to develop new legislative initiatives in the field of working-time monitoring. This made it possible to summarize the findings and propose comprehensive solutions to improve legal regulation at the EU level.

Such a comprehensive approach to the analysis of legal documents, case law, and comparative study provides for a deep understanding of the current regulation of digital monitoring of working time in the EU and contributes to the practical recommendations for improving regulatory policy in this area.

## 3. Results

### *3.1. Modern tools for tracking and controlling working hours*

Modern digital technologies provide new opportunities for counting and controlling working time, which significantly changes approaches to managing employees and organizing work processes. One of the most common tools is time-tracking software, which allows you to automatically record hours of work, track productivity, and analyze how time is allocated to different tasks. Such programs are often integrated with other project and resource management systems, which simplifies workflow management. With these tools, employers can get detailed reports on working hours, identify inefficient processes, and optimize resource allocation (Gao 2018). This helps to minimize errors that can occur when manually entering data and provides more accurate time tracking. Many time-tracking programs integrate with other project management systems, such as Asana, Trello, or Jira, to combine planning, execution, and reporting functions. This provides a seamless workflow where all time and task data is collected in one place, making it easier to manage projects and monitor task completion (Tang 2017; Li and Zheng 2018).

Biometric technologies, such as fingerprint, face, or retinal recognition, are also being actively used for time tracking (Vaivio, Järvenpää and Rautiainen 2021; Liakhovych and Vakun 2023). Such systems allow for a high level of security, as they reduce the risk of time-related fraud, such as when employees clock in for their colleagues. In addition, the use of biometrics simplifies the process of entering and leaving the workplace, which is especially important for large enterprises and organizations (Villadsen 2021). Cloud technologies and mobile apps are opening up new possibilities for time and attendance, allowing employees to easily log their time from anywhere and at any time. These tools are especially useful for remote teams and freelancers, providing flexibility and real-time data availability (Pfister and Lukka 2019). The use of artificial intelligence and data analytics for time tracking is quite popular as it helps to automate routine processes, predict resource needs, identify trends and patterns in employee productivity, and make informed decisions about HR management (Jans and Hosseinpour 2019; Yaroshenko et al. 2023).

However, the use of digital tools for tracking working hours can pose risks associated with employee data privacy, as constant monitoring may create a sense of excessive surveillance and raise concerns about the protection of personal data. The case of Copland v. the United Kingdom (European Court of Human Rights 2007) highlighted the importance of employees' consent to install digital monitoring tools, particularly on personal devices. The applicant complained that her telephone conversations, emails, and internet use were monitored without her consent. This was done on the

instructions of the deputy headmaster of the college she worked at. According to the case law, telephone calls from office premises are directly linked to the concepts of "private life" and "correspondence" within the meaning of Article 8 of the ECHR. Interpreting the Convention, the Court observed that the same level of protection should apply to emails sent from the workplace and information obtained through the monitoring of personal internet use. In this case, the Court found a violation of Article 8 of the ECHR and held that the collection and storage of personal information about the applicant's telephone, email, and internet use without her consent constituted an interference with her right to respect for the private life and correspondence.

It is necessary to note that excessive control and continuous tracking of working hours can lead to decreased employee motivation and even cause stress (Gusarov and Melnyk 2023). Research shows that "technology-induced stress" can negatively impact employees' mental health, especially if they feel their privacy is being invaded. Employers may believe that monitoring is necessary to ensure discipline and productivity. However, they should also consider that excessive monitoring can lead to a decline in trust within the team and increased tensions between employees and the management team. A striking example is the case of Antović and Mirković v. Montenegro (European Court of Human Rights 2018). A university in Montenegro installed a system to monitor the presence and activities of students during lectures. The students brought a lawsuit, claiming that the use of such a system violated their right to respect for private life, guaranteed by Article 8 of the ECHR. The students claimed that the constant monitoring of their presence and participation in lectures without their explicit consent caused stress. The Court concluded that the establishment of a monitoring system at a university constituted an interference with the student's right to respect for private life. The Court emphasized that such interference shall comply with the law, pursue a legitimate purpose, and be necessary in a democratic society. In this case, the Court found that the national authorities had not provided sufficient reasons to justify such an interference and that it therefore failed to comply with Article 8 of the Convention.

Furthermore, the implementation of new digital tools can be technically complex and financially burdensome for some businesses, particularly small and medium-sized enterprises. Employees may have varying levels of proficiency with new technologies, which requires additional training and support. The use of time-tracking tools also raises several legal and ethical questions, such as what rights employees have regarding access to data about their working hours and how to ensure a balance between monitoring work processes and employees' right to personal space (Asiaei et al. 2022). Understanding the benefits and challenges of these tools will enable organizations to effectively implement them while maintaining a balance between productivity and employee well-being.

### *3.2. Working-time management vs. digital technologies: the legislation of the EU and certain Member States*

In the European Union, where the protection of workers' rights is a priority, there is a need to adapt existing legal norms to the new conditions created by digital

technologies (Kotwinski 2017). European legislation already has certain regulations concerning working hours, data protection, and the right to disconnect, but the rapid development of digital technologies requires further refinement of the legal framework. In the European Union, the regulation of working hours is primarily governed by Directive 2003/88/EC, commonly referred to as the Working Time Directive. It aims to protect the health and safety of workers by providing minimum standards for working hours, breaks, rest periods and overtime conditions. The main provisions of the Directive include limiting the maximum working week to 48 hours, including overtime, the right to daily and weekly rest, and special rules for night work (European Parliament and Council 2003).

Digital tools can automatically log when an employee starts and finishes work, track the total hours worked, and even monitor breaks and rest periods. This automation helps prevent overworking and ensures that employees receive their entitled rest, thereby supporting the directive's goal of promoting a healthy work–life balance. Moreover, these tools can generate reports and alerts when employees are approaching or exceeding their legal working-hour limits, enabling proactive management to prevent violations of working-time regulations (Genç-Gelgeç 2022).

While digital technologies offer significant benefits for compliance, they also raise concerns about the continuous monitoring of employees. In response to these concerns, there is a growing emphasis on the importance of respecting employees' privacy rights under the General Data Protection Regulation (European Parliament and Council 2016). The GDPR standardizes data protection regulations across the EU, ensuring they are uniformly enforced in every Member State. As a result, each Member State is required to modify or update its national data protection legislation to comply with the GDPR (Voigt and von dem Bussche 2017). Although the GDPR requires that the collection and processing of personal data be reasonable, proportionate, and transparent, many employees do not fully understand what data is being collected, how it is being used, and who has access to it. This can lead to litigations, especially if employees believe their rights to data protection have been violated. For example, the judgment in the case of Bărbulescu v. Romania (European Court of Human Rights 2017) is one of the most famous in the context of digital monitoring at the workplace. An employee, Bărbulescu, was dismissed for using a corporate account for personal correspondence. His employer monitored his emails without warning. The Court found that monitoring an employee's emails must be proportionate and justified. The Court recognized that the employer was obliged to ensure transparency in monitoring and inform employees of the possibility of such monitoring. This case was an important precedent on the balance between digital surveillance and the right to privacy.

According to the GDPR, employers must ensure that data collection and processing are:

1) Lawful: Employers have the legal right to process employee data only when it is necessary for the performance of the employment contract, compliance with legal obligations, or based on the consent of employees.
2) Proportionate: Data processing should be limited to only the data that is necessary to achieve specific purposes. This means that employers cannot collect or store more data than is necessary to monitor working time.

3) Transparent: Employees should be fully informed about what data is being collected, how it will be used, and for what purpose. They also need to know who will have access to their data and how long it will be stored (Hoofnagle et al. 2019; Müller and Kettemann 2023).

Digital tools for monitoring working hours can also impact employee flexibility and work–life balance. While these technologies can support flexible work arrangements by accurately tracking hours worked regardless of location, they can also contribute to an "always-on" culture (Pansu 2018; Jaworska 2022). For example, employees might feel pressured to remain accessible or respond to work-related communications outside of their contracted hours, undermining the directive's provisions on maximum working hours and minimum rest periods (Bokor-Szőcs 2023).

The European Union has recognized these challenges and addresses them through initiatives such as the **right to disconnect**. This concept allows employees to disengage from work communications outside of regular working hours without facing negative consequences. Implementing and enforcing the right to disconnect is crucial to ensuring that digital tools for monitoring do not erode the protections afforded by the Working Time Directive (Lerouge and Pons 2022). However, this right is often difficult to implement in practice. It specifically applies to industries where employees work in global teams or have irregular working hours. The regulatory landscape varies significantly among the Member States, reflecting different legal traditions, labor market conditions, and cultural attitudes toward work–life balance. Here, we examine how certain EU Member States have approached the legal aspects of digital time-management technologies, focusing on issues such as privacy, data protection, and the right to disconnect.

France serves as a notable example because it was the first country to formally establish and protect the right to disconnect through legislation. The El Khomri Law, formally known as Labor Law No. 2016-1088, was enacted in France in 2016 and took effect on January 1, 2017. Named after Myriam El Khomri, the French Minister of Labor at the time, this law introduced comprehensive reforms designed to modernize labor regulations, enhance working conditions, and address the evolving dynamics of the modern workplace. This law requires companies with more than 50 employees to negotiate with their workforce to establish mechanisms for limiting the use of digital tools, such as email, outside working hours (Sampaio 2020). The aim is to protect employees from the encroachment of work on their personal lives, which can lead to burnout and other health issues (El Khomri 2016).

Even though the right to disconnect is enshrined in law in France, some organizations here do not comply with this rule due to the lack of strict sanctions. Companies in France have been obliged to implement digital disconnection policies since the passage of the El Khomri law, but many employees still feel pressured to respond to emails and messages outside of working hours. Employers may believe that the right to disconnect may limit workflow flexibility, especially in remote work. Furthermore, they may argue that, in the contemporary business environment, where transactions are frequently executed in real time, constant employee availability is essential to competitiveness (Sandul and Kudinska 2022).

A notable challenge is that in the absence of stringent penalties, some organizations might not place a high priority on enforcing disconnect policies (Pélicier-Loevenbruck and Daubin 2017). Additionally, the advent of the digital age has increasingly blurred the distinction between personal and work life, complicating the creation of universal solutions. Employees in fields like IT or international business often require a level of flexibility that conventional working hours do not provide (Lerouge and Pons 2022). Additionally, French data protection laws, in line with the GDPR, impose strict conditions on the collection and processing of employee data. While the Regulation fully governs the processing of employees' data, the unique nature of the employer–worker relationship introduces specific challenges that a general data protection framework cannot sufficiently address. These challenges include the extensive use and potentially invasive nature of technologies justified under the notion of legitimate interests in the workplace, the collective aspects of labor law, and the inherent imbalance of power between employers and employees in most employment agreements. These distinctive factors have led to ongoing demands for tailored data-protection rules specifically designed for the employment context (Tambou 2018; Abraha 2022).

Another example we will consider is Germany. Germany has a strong tradition of protecting employee rights, particularly regarding privacy and data protection. German labor laws require employers to respect the privacy of employees, even in the digital age (Klinger and Weber 2020). This means that digital tools used for working-time management must comply with stringent data protection regulations. German law also mandates that any monitoring of employees, including through digital means, must be proportionate and necessary for legitimate business purposes (Jäger, Noy and Schoefer 2022). Under the GDPR and *Bundesdatenschutzgesetz* (Federal Data Protection Act) employers are required to conduct data protection impact assessments (DPIAs) when implementing new technologies that may pose a high risk to employee privacy. These assessments help ensure that any risks associated with the use of digital monitoring tools are identified and mitigated (*Bundesministerium der Justiz* 2021). Furthermore, works councils (*Betriebsräte*) in Germany have a significant role in overseeing the implementation of digital technologies within companies. Employers must consult with works councils before introducing systems that affect employee monitoring or data collection, ensuring that employees have a say in how these technologies are used.

Another EU member, Spain, has also taken steps to regulate the use of digital technologies in managing working time, emphasizing the importance of flexibility while protecting employee rights. In 2020, Spain amended its labor laws to include provisions for remote work and telecommuting, acknowledging the growing trend toward flexible working arrangements facilitated by digital tools. These amendments require employers to ensure that remote working conditions comply with existing labor laws, including working-time regulations (Jefatura del Estado 2021; Donnelly 2022; Troadec 2022). Additionally, Spain introduced its own version of the right to disconnect in 2018, granting employees the right to digitally disconnect from work outside their working hours. Spanish companies must develop policies that define how employees can exercise this right, aiming to prevent the erosion of

personal time due to constant connectivity (Lerouge and Pons 2022). Spanish data protection laws, aligned with GDPR, also require employers to be transparent about the data collected through digital time-management tools and to ensure that such data is not used for purposes other than those explicitly stated and agreed upon by the employees (Jefatura del Estado 2018).

Italy has been proactive in addressing the challenges posed by digitalization in the workplace, particularly regarding the balance between work and personal life. Italy was among the earliest EU nations to follow in France's footsteps by implementing similar policies. Italy's Smart Working Law, formally known as Law No. 81/2017, established a broad framework for flexible working arrangements, commonly known as smart working or agile work. The purpose of this legislation was to modernize the Italian labor market by encouraging flexibility and enhancing work–life balance for employees. A key feature of this law is the provision that includes the right to disconnect, allowing employees to disengage from work-related communications outside of standard working hours (Nespoli 2018).

The law mandates that all smart working arrangements be established through a formal written agreement between the employer and the employee. This agreement must clearly outline the terms, including the duration and location of the work, and importantly, it must address the employee's right to disconnect. Article 19 of Law No. 81/2017 specifically requires that the smart working agreement includes provisions safeguarding the worker's right to disconnect. This provision ensures that employees are not compelled to participate in work-related communications outside their designated working hours, thereby protecting their personal time and mental well-being (Presidente della Repubblica 2017). Italian data protection laws, in line with GDPR, also provide strong protections for employee data. Employers must be transparent about the data they collect and ensure that employees' rights to privacy are respected. Additionally, any monitoring or surveillance of employees through digital technologies must be justified, proportionate, and conducted in a manner that respects workers' dignity (Garante per la protezione dei dati personali 1996).

Monitoring working time is a crucial aspect of modern labor management; however, it currently lacks clear legal definition in both European Union legislation and the national laws of its Member States. EU regulations and the national laws of Member States primarily provide general guidelines on working hours, breaks, night work, and other labor conditions. These regulations are intended to ensure the basic protection of workers' rights and promote a healthy work–life balance. However, specific rules and requirements regarding the monitoring of working time are not directly addressed in the legal framework.

Despite the absence of explicit regulations on time monitoring, these technologies significantly impact other important areas of labor law and data protection rights. For instance, the right to disconnect, which protects employees from being constantly available and responding to work requests outside of working hours, is already part of the legislation in some EU countries. However, it is not uniformly regulated across the EU and lacks a unified legal framework (Tkachenko 2022, 2023). In contrast, data protection is comprehensively regulated by the GDPR, which sets strict rules for the collection, processing, and storage of personal data, including

data collected through time monitoring. This uneven legal landscape highlights the need for expanding and clarifying legislative frameworks specifically concerning working-time monitoring.

Summing up, digital technologies have improved working-time management but raised concerns about privacy, monitoring, and the right to disconnect. While the EU regulates these aspects through the Working Time Directive and the GDPR, the development of digital tools requires updating the legislation. EU countries such as France, Germany, Spain, and Italy are taking varying approaches, which highlights the need for uniform and comprehensive regulation.

### *3.3. The need for legal regulation of working-time monitoring: risks and proposals for legislative initiatives in the EU*

To address the problems associated with the lack of proper legal regulation of working-time monitoring, several legislative initiatives need to be implemented at the EU level. These initiatives are aimed at protecting the rights of employees, minimizing the risks associated with the use of monitoring technologies, and promoting fair working conditions. First of all, there is a need to introduce clear rules for monitoring working hours. Specific legislation should be developed or amended to regulate the use of digital technologies for working-time monitoring (Bodie et al. 2017).

These rules should take into account the balance between employers' needs to increase productivity and ensure compliance with legal norms and employees' rights to privacy and freedom from excessive monitoring.

The second important element is to ensure transparency and informed consent. It is important to establish requirements for transparency in the process of data collection and processing, and to ensure that employees provide informed consent to the use of monitoring technologies. Employees should clearly understand what data is being collected, for what purpose, how it will be used and stored, and have the opportunity to opt out of monitoring or withdraw their consent at any time. The third important step is to properly regulate the employee's right to disconnect. The right of employees to disconnect from work communications outside of working hours should be enshrined in EU law. Many individual EU Member States currently have such initiatives in place. The EU Strategic Framework on Health and Safety at Work 2021–2027 emphasizes the significance of ensuring the right to disconnect. According to this document, it is crucial to develop and implement suitable measures to safeguard employees who work remotely or rely on digital tools. The Framework highlights the need for research into the psychosocial risks linked to digital and remote working environments and advocates for the establishment of minimum standards and conditions to guarantee that workers have the right to disconnect from work outside their regular working hours (European Commission 2021). This right should protect employees from constant availability and ensure their right to rest and personal time, reducing the risk of burnout and improving work–life balance (Kossek and Lautsch 2009).

The fourth step should be to develop ethical standards for time tracking. It is important to introduce ethical standards for the use of time-tracking technologies,

including best practice guidelines for employers. Such standards should emphasize proportionality in the use of technology, respect for employee privacy, and maintaining a positive work environment (Griep et al. 2021). Most of the relevant legislative initiatives are not new, but they are currently fragmented in different legal acts. We propose to implement them in a single legal act. It may even be advisable to create a Code of Labor Recommendations of the European Union. This document could contain comprehensive and unified information on aspects of labor relations and law, and could respond in a timely manner to new trends in the employment sector. Finally, employers should be required to conduct a privacy impact assessment before introducing any new work time-monitoring technologies. This approach will allow identifying potential risks to employee privacy and taking the necessary measures to minimize them.

Thus, such legislative initiatives will help to create a more balanced and secure work environment where monitoring technologies are used responsibly and with respect for the rights of employees. They will contribute to ensuring fair labor practices across the EU by adapting legislation to the current challenges of the digital economy. And their adoption at the EU level will ensure their comprehensive adoption in all Member States.

Several key legislative initiatives are needed at the EU level to address the issues of working-time monitoring and employees' rights. These include establishing clear rules on working-time monitoring, ensuring transparency and informed consent, enshrining a right to disconnect, developing ethical standards for time-tracking technologies, and assessing a privacy impact. Such initiatives will help reduce the risks associated with digital monitoring while promoting fair labor practices across the EU.

## 4. Discussion

With the development of digital technologies, we are witnessing significant changes in working-time management, which opens up new opportunities and prospects for further improvement of work processes. With rapid digitalization, automation, and the shift to remote work, organizations are striving to make the most of digital tools to increase productivity and ensure work–life balance. In this context, it is important to consider what innovations are already being implemented and what development prospects exist for the further use of digital technologies in this area. One of the most promising innovations in working-time management is the use of artificial intelligence (AI) and data analytics. AI allows for the automation of planning, monitoring, and analyzing working time, which helps to better allocate tasks and optimize workflows (Lohvinenko 2022). Data analytics, in turn, enables the identification of trends and patterns in time usage, which can lead to increased work efficiency and the discovery of potential productivity reserves. As these technologies continue to develop, employers will be able to gain more detailed insights into the work of their teams, facilitating more informed management decisions (Lohvinenko 2023).

At the same time, innovations in biometric technologies, such as facial recognition, fingerprint scanning, or retina scanning, are already being actively implemented

for time tracking. These technologies provide a high level of security and reduce the risk of time-related fraud since employee identification is based on unique physiological characteristics (Pizhuk 2019). In the future, further improvements in biometric systems and their broader application across various industries can be expected. In this article, we have explored the current state of legal regulation of working-time monitoring in the EU and individual Member States, and identified significant gaps in this regulation. Despite the existing general rules on working hours, breaks, night work and data protection, the lack of specific rules on working time-monitoring creates risks for employees and employers.

The analysis shows that while the general framework of labor law and data security establishes some protections for employees, it does not cover all aspects of working-time monitoring, which is becoming increasingly important in the digital age. The lack of clear regulation in this context is comparable to the results of previous studies, which also pointed to the need for a more detailed legal framework for digital technologies in the field of labor. Establishing specific legal regulations on working-time monitoring can have a significant positive impact on the work environment. It will help protect employees' privacy rights, ensure work–life balance, and create clear rules for employers, which will help avoid legal conflicts and improve morale and trust in the team.

The findings indicate an urgent need to develop and implement legislative initiatives at the EU level to regulate working-time monitoring. This is necessary to strike a balance between technological advances and the fundamental rights of workers, as well as to promote the sustainable development of the digital economy. Establishing clear legal rules will help to avoid risks associated with excessive control, data protection, and the right to disconnect, while creating transparent and fair working conditions for all labor market participants. This study is limited to analyzing the legal framework in the EU and individual Member States, without taking into account specific industries or types of organizations. Additional research could focus on the impact of working-time monitoring in different sectors of the economy or in the context of different cultural practices.

Future research could focus on evaluating the effectiveness of specific legislative initiatives that have already been introduced in some Member States, such as Italy and France, to develop best practices that can be applied across the EU. Furthermore, it is important to investigate how monitoring technologies affect workers' psychological health and productivity.

## 5. Conclusions

The analysis of the legal aspects of using digital technologies for working-time monitoring revealed that both EU legislation and the national laws of individual Member States lack clear regulations on these technologies. The existing rules mainly cover general issues related to working hours, breaks, and data protection without taking into account the specifics of digital time monitoring. Therefore, it is necessary to develop new legislative initiatives that clearly regulate the use of digital tools for

managing working time. We advise the creation of a Code of Labor Recommendations of the European Union. This document could contain comprehensive and unified information on aspects of labor relations and law, and could respond in a timely manner to new trends in the employment sector.

In conclusion, to ensure fair and sustainable labor practices in the digital age, it is essential to adapt the legal framework to the new realities. This will not only protect workers' rights but also create a favorable environment for business development, balancing innovation with fundamental human rights. To address the challenges posed by digital technologies in working-time management, it is also important to foster a culture of transparency and communication within organizations. Employers should engage in open dialogue with employees about the implementation and use of monitoring tools, clearly outlining the purposes, benefits, and boundaries of these technologies. This approach not only helps in gaining employees' trust and acceptance but also encourages a collaborative environment where both parties can voice concerns and suggestions for improvement. By involving employees in the decision-making process related to digital monitoring, organizations can ensure that these tools are used ethically and effectively, promoting a healthier and more supportive workplace culture.

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# AGI-Correlationism and Its Discontents: Part 2.

This part of the paper systematically unpacks the most notable and decisive entailments of the implications of what was defined in the previous part by the concept of AGI-correlationism at all scales and levels, from the assumption that AGI must replicate human intelligence to the often-unquestioned idea of human-centric tests like the Turing Test. Representation of the entailments is then followed by their critical observation and discussion from the viewpoint of relevance, validity, truth or falseness, usability, and so on, arguing for another attitude, approach, and paradigm in all relevant domains (that is, the domains of reference of the entailments). The paper closes by some open questions that both parts of the paper leave at the end, and a closure.

**Keywords:** *artificial general intelligence, philosophy of AI, correlationism, philosophy of intelligence*

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**How to cite this article:**

Kazakov, Mstyslav. "AGI-Correlationism and Its Discontents: Part 2.". *Információs Társadalom* XXIV, no. 4 (2024): 79–91.
*https://dx.doi.org/10.22503/inftars.XXIV.2024.4.5*

Following my first paper that dealt with establishing a theoretical framework of defining intelligence and an introduction to the concept of AGI-correlationism, the entailments of AGI-correlationism are now to be critically examined. Additionally, the auxiliary objective of the critical reflection is to preserve all the meaningful results of the first part of the paper, namely the concepts that were deployed so far, the pro-functionalist paradigm of understanding the A(G)I and its further usability, and to amplify these results by expanding the considerations. Hence, with regard to the latter, the critical part here struggles not to be merely 'destructive' or a deconstruction of the entailments of AGI-correlationism but also to propose some 'constructive'—that is, positive content—declarative theses and propositional knowledge (which, I hope, would be considered justified enough to be considered such, not merely pretending to possess such a status).

## 1. AGI-Correlationism and Its Entailments

Having done the theoretical framework, an observation and investigation should follow within this framework, of *what* correlationist attitudes (three questions from Part 1 of the paper: in section 2.1., further expansion of section 2.2., as well as instances of misuse of concepts and the approach itself, as is told of in subsection 3.1.2.2.) entail, and *how can* these entailments be fathomed in a comprehensive manner, and, that is to say, assessed according to their depths and postulates (how they are handled can be approached and reproached). It is a matter of fact that building here an exhaustive, all-encompassing enumeration of these entailments is an unfathomable task. I chose only a part, namely those which I consider important for AI ethics in general (thus, they cannot be ignored) and those which are the most ostensive for understanding AGI-correlationism. No particular tailoring point for these entailments to stem from exists. They are drawn from multifaceted sources, persons, dispositions, schools of thought in philosophy or AI research, of different backgrounds and causes of being as they are presented. To my mind, it is vital to specify and iterate the following entailments:

(1.1) The assumption that any AGI 'in a full sense' must be the replica of human intelligence concludes that intelligence of humans *taken as a species*, in its current form, is an *unsurpassable limit*. In other words, human intelligence in its current manifestation is considered as an *ahistorical* manifestation, a timeless measure and frame of reference to all things, and intelligence in particular. Such an implication is derivable not only from the idea of realization of AGI as brain emulation only but also from ethical commitments to abstract and concrete forms of anthropocentrism that imply a thesis on the uniqueness of human intelligence or just posit the idea of its being the upper limit of intelligence development (admitting the facticity of other intelligences in the history of the Earth and within the current state of affairs).

(1.2) *AI defined by pass-for-human tests*. Since the beginning of AI research, an anthropocentric attitude is explicitly exemplified by the 'imitation game,' later known as the Turing Test. In the best-known version of the test, humans engage in conversation with two or more hidden interlocutors, one of which is a computer (others

being humans). If the interrogator fails to guess who is who, then the computer is said to be 'intelligent.' The very framework, even as a thought experiment without contemporary chatbots and other implementations, as it is presented in Alan Turing's *Computing Machinery and Intelligence*, presupposes completely anthropocentric expectations and attitudes toward the nature of 'intelligent computer.' This also may be extrapolated to any case where AI has to pass a test to be qualified as intelligent—*to pass as human*.

The same logic unfolds in some state-of-the-art (narrow) AI systems, known as '*artificial stupidity*'—top-down implemented suppression or constraint of AI performativity, algorithmically dumbing it down to such instances as deliberate erroneous outputs, due to a poorly or insufficiently implemented decision-making procedure. Another widespread tendency is making a system 'more convenient' in terms of interaction with the user, such that the latter perceives its features as more 'natural.' To make narrow AI look more 'natural' would mean *here* to look similar to '*superior*' general intelligence, human intelligence; particularly, in functional terms this necessitates the '*inferior*' intelligence (AI) to be prone to *making errors* instead of better responses for which it is capable, just because the '*superior*' human intelligence is susceptible to such mistakes. And all that is made for the purpose of AI passing the test on *pretending* to be human.

(1.3) *Intolerance to contingencies*. Consider a hypothetical future condition where the final draft of AGI is not fully equivalent to human in some domains of vital concern (such as ethical module, 'goals–means–drives' ratio, reasoning transparency, robustness testing, etc.). It is then going to be realized not as a human correlate but would have some contingent outcomes leading to unexpected and unpredicted (although not necessarily dangerous) emergent properties. AGI-correlationism considers such an implementation to be *unacceptable* until the contingencies are 'rectified' to humanlike or the predictability of the outcomes reaches some desired or 'sufficient' threshold, and emergent properties are prevented from development.

(1.4) Human-level constraints. Following (1), given the disjunction of the final drafts with three disjuncts at least, in other words, a possibility of realization of three different AGIs where one would be equivalent, by its realization *and* potential of development, to human; the second would be equivalent to human but with *development potential* of exponential growth in speed and far surpassing human level; the third one as already superior to human from the very moment of its realization (with contingent potentialities of unpredictable exponential growth). Given these three hypothetical final drafts, an AGI-correlationist would always choose the first disjunct, regardless of what the two latter may be (whether friendly or not, constrained ethically or in any other way, etc.), and how we can potentially benefit from them.

(1.5) What is also (implicitly) entailed by this attitude is an idea of superintelligence conceived in terms of *quantitative* more than *qualitative* superiority toward humans, which is, in a nutshell, reminiscent of (or analogous to) the distinction between humans and Olympic gods made in Greek mythology, where the superiority of the gods is actually measured rather in quantities than in qualities: physical strength, anticipation, skills in craft, terms of life (Olympic gods are not immortal),

etc. The AGI-correlationist attitude toward superintelligence similarly reduces the superiority of the latter to all-too-human (as-species) traits, areas, and matters of concern, thus imaging superintelligence as (hypothetically) being merely a human individual with unfathomable strength and intellect. And just as any human, due to its 'corrupted nature,' it would necessarily get drunk on its own strength and would start seeking absolute power (world-domination and beyond). So, if there would be a potential for AGI to become superintelligence, whatever the premises or presuppositions, to an AGI-correlationist, it would be necessarily conceived as a malevolent human with unlimited intelligence. In a nutshell, as one of the potential consequences, the very possibility of realization of AGI with a potential of becoming superintelligent, would possibly be rendered into one more premise of abandoning of realization of AGI (as an addition to (3), (4) or both).

(1.6) AGI as intelligence-*for-us*. AGI-correlationism postulates that the AGI that we realize, whatever its factual realization may be (the level of intelligence, possession, or absence of self-perception as an individual, etc.) must, regardless of the implementation or the nature it exhibits, deeply care about humanity in general, and us specifically, focusing all the knowledge, aspirations, and desires bound explicitly to humanity—human causes, concerns, interests, goals, problems, issues, inquiries always to come first, that is, prior to those of AGI itself, whether the latter possesses any of the aforementioned. The explicit example of such an attitude may be *preference utilitarianism* as it is laid out by Russell (2019), based on what is known as the 'first principle of beneficial AI,' which may be formulated as follows: the only purpose and objective of machine AGI is the realization of *human preferences*. At the very core of the conceptions akin to 'beneficial AI' lies the implication of AGI as 'for-us' in the described manner, which, from the viewpoint of ethics, is in fact a nullification of the recognition of AGI as an intelligent entity (if to follow the previous idea of mutual recognition as a foundation of relations between human and AGI).

(1.7) AGI-as-(public/private)-property. This entailment is similar but not identical to the previous one. For some thinkers, including prominent AI-theorists (Coeckelbergh 2020; Bryson 2010), possessing 'full-scale intelligence,' including 'analogous to humans' or surpassing it (in every domain of interest or at least in some of those) does not necessitate a change in treating AGI in a way other than 'machinic property,' similar to a bicycle, a fridge, a TV, or a laptop: whatever its level of intelligence is, it is still reified, treated not as an individual or a host of intelligence in general, with corresponding 'obligations' and attitudes toward it from the perspective of humans. It is argued that "the status of AIs will be ascribed by human beings and will depend on how they will be embedded in our social life, in language, and in human culture" (Coeckelbergh 2020, 59); but if *this* is the case, then any realization of AGI, whatever its properties, the more 'uncanny' they are (divergent from humans), the less equally they would be treated.

Not only does the problem lie in explicitly uncanny features: to the register of 'uncanniness' of AGI may also be related the failure of 'desired' supplementary (secondary) properties, such as, for instance, explainability and transparency (hypothetic AGI properties referring to the possibility of either self-explication of the results or actions of AGI by itself or the backtracking of such results, actions, and their

underlying causes (code, algorithm, trigger, intermediate steps etc.) by humans. Artificial neural networks are *already* conceived as black boxes, precisely because the number of layers of artificial neurons already involve computations so intricate that satisfiable human affordance of backtracking the outputs vary from extremely hard to impossible. A similar concern is expressed in one of the latest publications of OpenAI researchers:

> If a superhuman assistant model generates a million lines of extremely complicated code, humans will not be able to provide reliable supervision for key alignment-relevant tasks, including: whether the code follows the user's intentions, whether the assistant model answers questions about the code honestly, whether the code is safe or dangerous to execute, and so on. (Burns et al. 2023, 1)

Yet, generally speaking, 'uncanniness' not only problematizes further advances in artificial neural network design or a problem of supervision for what is known in AI research as 'superhuman models'—if, in a hypothetical future, a hypothetical AGI would not fill in this gap by itself, or if no solution exists for the models mentioned given that "naively using weak, human-level supervision will be insufficient to align strong, superhuman models; we will need qualitatively new techniques to solve superalignment" (Burns et al. 2023, 8)—it would remain an opaque and unexplainable 'black box,' contributing to its uncanniness (as conceived by humans), such that it may invoke a more negative, prejudiced, and biased attitude toward AGI from the viewpoint of humans, as it could have been in case of explainability and transparency realized as its properties to a certain extent.

## 2. Entailments of AGI-Correlationism Critically Observed

Having these points explicated from discursive 'hum' and enumerated, in this part I will now attempt to focus on their critical exploration and decomposition, on the one hand, trying to explain their nature (which itself is, to my mind, the most effective and unmatched form of philosophical critique if carried out consistently, grasping the nature in its explanatory model and representation). On the other hand, here I am also trying to give an outline of their 'what is wrong fundamentals' of these entailments, their attitudes and dispositions. This observation is not exhaustive or all-encompassing (no observation is), and, given this, it also serves as an open-ended invitation for discussion.

(2.1) One of the underpinnings of AGI-correlationism is a metaphysical/ontological stance commonly known as *exceptionalism*—an implication of uniqueness, being 'one of a kind,' here referring to an attitude toward human intelligence as synchronically and diachronically *unique* by its functions, features, and capabilities in orthogonal characterization. Such are the essentialist/correlationist implications, which are, at the same time, consequences into which one arrives basing on such implications. From the viewpoint and general dispositions of functionalism *and*

historicism, human intelligence is not unique, not merely speculatively (because of the possibility of realizability of AGI) but also empirically; it is regarded as already proven to be functionally 'ordinary' or common—by archaeology.

The first, wider renown, is the discovery of a site of Oldowan toolmakers in 1934, which for a long time was considered to be the oldest stone tool industrial site ever known—with the corresponding consequences. In addition to it, aside from either a late Australopithecus or early Homo habilis, our closest phylogenetic cousin, one of whom assumedly created the complex, there is a more recent finding with more enigmatic outcomes. In 2011, a group of archaeologists led by Sonia Harmand, during excavations in Kenya at the archaeological site Lomekwi 3 found ~150 (20 well preserved) stone tools dated as being 3.3 million years old. The artifacts themselves in their variety, dimensions, and visible percussive-related traces on the artefacts led the archaeologists to suggest that the hominins that made them combined battering practices and core reduction, using the artifacts variously for agricultural purposes, as cores for flake production, for pounding, or as anvils.

Several distinctive uses of individual objects for multiple tasks presuppose goal-making capacities in the form of goal-representation, reflecting a degree of technological diversification higher than had been thought possible for the period, before the findings of Harmand's group. The assemblage may be an instance of a technological stage between a hypothetical succession from pounding-oriented stone tools used by early hominins and the flaking-oriented knapping strategies of Oldowan toolmakers. The artifacts at the Lomekwi III site are *at least* 700,000 years older than the tools at the 1934 find; they also predate arrival of the whole *Homo* genus, our phylogenetic family, by 500,000 years. The question of what hominin species made them is still open, save for their being relatively detached from our closest ancestors, with an intelligence level of a potential no less than our own. Questions about the cause of their extinction, their loss, and the reinvention of their technology (or we just have not found other sites showing the succession instead of reinvention) are open as well.

Speculative derivations from the discoveries may be as follows: *if* intentional, non-spontaneous, organized, consistent, and serialized practices of collective stone toolmaking is sufficient to consider the agent as having at least the same potential of intelligence as humans do, then humans are *at most* third in being such agents, since being predated at the very least by a distinct species that had the same intellectual capacities; and it belonged to *genus* (predating our own by at least 500,000 years). Following reflections of early Marx (in 1844 manuscripts) and expanding his thought, it is worth juxtaposing three different modalities of toolmaking. The first one is a genetically 'embedded' drive similar to that of woodpeckers or termites, beavers or spider monkeys, involving them in niche-constructive ecological engineering of various complexity and ecological significance. But this is not the case for Oldowan or Lomekwi III toolmakers, as anthropology, archaeology, and evolutionary biology conclude. The second modality is the 'top-down' automation of production we observe in machines and/or robots, when a human (or another machine) prefigures and programs a certain technological means of production to create a material artifact, which is obviously not the case either. The third modality

to consider is teleological toolmaking—the one caused by the *goals* and *needs* of some sapient being, a decision-based outcome. And this latter *is* the case, an artificialized functional extension of mind and body of the organism, which may serve as a criterion for ascribing intelligence to an organism. Adherent to this reasoning, given the facticity of at least two empirical instances of this third modality of toolmaking in the prehuman history of the Earth, one is eligible to infer the strong claim asserting the denial of human intelligence exceptionalism. (Perhaps, in other contingent circumstances, it may have been that *they* had become *us now* instead *of us* as possessing 'unique intelligence' as some think we do. It may have been that both groups had gone extinct at approximately the same prehistoric time.)

(2.2) Another principal flaw inherent in any AGI-correlationist conceptions and views of top-down alignment or any other instance and degree of design concerning values, decision-making procedures, rule-governed behaviors as both constraints and space of choice between following one of the rules in case of disjunction where the rules to follow (actions to be taken are disjuncts), is the instant absence of a common axiological 'denominator.' Even if we come to some more or less common instances for abstract and ambiguous terms like happiness, justice, dignity, respect, autonomy, stable development, value of life, and so on, we will not be able to proceed with precision for each instance without arriving at a contradiction.

For example, one may try to take something 'basic' and 'obvious' from the list of prioritized points of alignment, regardless of the final draft of AGI, such as 'value of life', and attempt to perform a 'fine-tuning' of it *as* a factual subject of alignment, before setting it as a top-down 'directive' for an AGI. To start with, the state of the art in the scientific domain we generally refer to as 'life sciences' is that there is still no, as Eugene Thacker (2010) demonstrates, *positive* definition or a sufficiently posited concept of *life*. That is, life sciences can extensively enumerate *what life is not*, but they are still struggling with affirmative claims of *what it is*, generally, i.e., without reference to particular *livings* (as Aristotle has it), or *life-forms* (as we usually phrase it today). Can, then, alignment concerning it be laid out as 'what is *not X, not Y, not … ad inf.* must necessarily be valued and, in any instance, prioritized', or 'another matter/subject of care/concern/valuation should be the following array of entities: extremophiles, bacteria, …., human, whale, trees, …., *the whole 'tree of life' is enumerated'? Obviously, it cannot. But suppose the future science at the dawn of AGI would effectively resolve this ultimate scale challenge, letting us effectively move down to further details of value-of-life alignment. What about ethical conundrums and clashes between: pro-choice and pro-life proponents? Vegetarians/vegans and omnivore diet advocates (and the gradations between the two poles)? Pro-/anti-death penalty? The list of contradicting, mutually exclusive, poorly or absolutely incommensurable dispositions directly related to the 'value of life' is infinite.

These musings so far are not original, and the overall state of affairs here has not changed since Bostrom's *Superintelligence* (2014). But here is the unexpected entailment. Of course, a more advanced intelligence is potentially *capable* of convincingly and consistently resolving these conundrums, either by conducting research to which we are not intelligent enough to do or just by reasoning to an unequivocal conclusion, effectively verifying or refuting a particular axiological disposition. To

solve the abovementioned 'unresolvable questions,' antinomies of (human) mind is actually one of the most desired potential benefits expected from AGI! *And hence*, to have a sound and 'proper' alignment with, say, 'value of life' or any ambiguous concept of the domain, *we must let AGI decide for us* what *this value is*, and *how* it should be conceived, what *is* relevant to it, and so on; and eventually it is *we who* are the ones to be *aligned* with *AGI* and its judgment, value system of coordinates, and measurement scale!

Ill-defined or ambiguous goals and priorities of/for humans having, as one of the consequences related to the subject under discussion are a well-known problem within the whole domain of AI ethics, and its AGI subfield, which remains as speculative, since the perspective of AGI realizability is remote at the current moment. In addition, there is the more instant, more immediate, and more technical issue of 'superalignment': given a model with superhuman abilities (not necessarily AGI, but also a narrow model that is exponentially superior to humans in some particular areas of vital importance), how should it be supervised and aligned so as not to perform erroneously having catastrophic consequences? More briefly, how can weak teachers/supervisors teach/control a model that is much smarter than they are?

Although some solutions, such as weak-to-strong generalization, have already been proposed, it is an open question whether the methods would be able to keep up with the pace of the growth of intellectuality (not speaking of an "explosion"). Even if they could, superalignment would always remain a form of *mediated* alignment where humans would instantly rely on other tools *as* methods of alignment of supermodels, unless they become superintelligences themselves. I bring this issue out here to imply that, even concerning the 'all-too-human' (seemingly) matter of alignment and supervising the AI models, there are already matters of concern that are forever out of the correlationist implications, attitudes, and scopes.

(2.3) The problem with anthropomorphizing tests is not only the way they instantaneously ignore human biases (e.g., incompetence in evaluation and diagnoses) but also (and, perhaps, *mostly*) in the general reasoning which underpins the conception of such tests and attempts to justify them (preserving their use even today), such as: 'Yes, biases, yet *we have no other options*'; 'The concept of intelligence must be defined first'; 'No one would take the results seriously without a pinch of salt!'; 'What is wrong with humanlike interfaces for the applications *made for humans*? Would you prefer a car with a traditional interior or one without a seat and with pedals above your head?'; 'Human nature itself is not fully explored and cognized; therefore, when AI tries to pass for human, as you say, the very fact of nonhuman *X* passing for human also gives us additional clues about ourselves, of what it is 'to be' human.'

Such arguments are actually not completely irrelevant. However, when broken down, they also hold that the very idea, cognitive metaphor, fact or even image of a genuinely intelligent (sapient) but inhuman entity is something intolerable or even *immoral*. In this respect, the above claims are unjust as emotionally laden and, thus, being more value judgments than arguments. There are objections even if we take them for 'full-blooded,' valid arguments. More or less general, precisely addressed toward the whole idea of 'tests to pass as a human,' that I consider as one of the most convincing, since it is affirmative and constructive instead of being merely critically

'destructive,' comes from the viewpoint of a formal approach to AI research known as universal artificial intelligence, "a new paradigm to AGI via a path from universal induction to prediction to decision to action" (Hutter 2012, 69). Emphasizing the obsoleteness and inefficiency of anthropocentric tests, Marcus Hutter instead calls for non-anthropocentric tests of and for intelligence, which emerged in the last decade, such as the universal C-test inspired by Solomonoff induction and Kolmogorov complexity. This test, as well as the others of its kind, are centered around task solving and learning-from-scratch, for a purely detached 'agent–environment' interaction without any of the two alignments with human traits (at least as much as such a detachment is possible).

(2.4) Just as with 'paleohumanism', antihumanism, misanthropy, or extropianism, AGI-correlationism is *intolerant to indifference*. As Benjamin Bratton puts it, "[p]erhaps the real nightmare, even worse than the one in which the Big Machine wants to kill you, is the one in which it sees you as irrelevant, or not even as a discrete thing to know. Worse than being seen as an enemy is not being seen at all. Perhaps it is that what we really fear about AI" (Bratton 2015, 70). Surely, this mustn't be extrapolated onto any instance of correlationist attitude toward A(G)I, as well as non-correlationist attitudes—as something that we *all really* fear, for it is definitely not the *greatest* matter of concern. At the same time, fear of indifference is *among* such matters—just like this fear/intolerance underlies general metaphysical/ontological attitudes toward the indifference of cosmos to mind, as it follows from the great humiliations of human; as Meillassoux argues, philosophical 'disagreements' with cosmic indifference—found in Fichte, Heidegger, Derrida, Husserl, Kant and others—are the 'firestarter' of correlationism. It is no surprise that rejection of indifference is among the expectations of humans toward AGI, since it is prefiguratively anthropomorphized.

(2.5) Another important concept/problem that AGI-correlationism fails to grasp properly, i.e., without anthropomorphizing it, is *agency*. In the discussed context, a threefold distinction should be conceived properly. Firstly, we have the property/feature of *agency*, which itself is definable in a broader context, as we have it in philosophies of the mind, theories of action, ethics, or cognitive sciences. Secondly, there is a specific, 'narrow,' technical use and meaning of the concept '(intelligent) agent' in AI research and practice divorced from the use of this concept in a broader philosophical context or common sense implications. If philosophers (or any other non-AI theorists/developers/deployers) would like to discuss the entities to which the concept 'intelligent agent' refers, they (necessarily) adopt the 'narrow meaning,' which *is not included in a broader one*.

Thirdly, there is an even narrower technical term, divorced from both of the two above, referring to the property of *some* AI systems—hypothetical *and* already existing—known as *agentic* AI systems, which are not identical with intelligent agents. Agentic AI systems are distinguished by their ability "to take actions which consistently contribute toward achieving goals over an extended period of time, without their behavior having been specified in advance" (Shavit et al. 2023, 4). The property attributed to them is encapsulated in the concept of *agenticness*, referring to the degree to which an AI system is capable of adaptably achieving complex goals in a

complex environment with (relatively) limited direct supervision and a wide independent execution permission (the degree of the system's autonomy of actions and decisions being considered reliable without the need for approval from a human user).

*AlphaGo* is an intelligent agent, but it is not an *agentic* system in this described sense: it is incapable of complex goal accomplishment, does not have independent execution permission aside from playing the game Go, and its environment is static (and not augmentable). Google DeepMind's new *FunSearch* is, on the contrary, an example of an agentic system, being *highly* adaptable to complex environments, comprising a systematic evaluator paired with *Codey*, a pretrained large linguistic model that is itself a version of Google's PalM-2, fine-tuned on computer code (the principle of work and goal-receiving is made on the same basis—e.g., a mathematical task in set theory input in Python with a response/solution in a form of executable code(s), the most prominent variations of which are selected by verifiers). Its direct supervision is notably limited; it solved the cap set problem, a mathematical problem of extremal combinatorics that remained unresolved by humans until the end of this past year, but, as *FunSearch* creators admit, they cannot fully understand *how* this discovery was made, since the whole way cannot be backtracked. At the same time, its independent execution level is more limited than that of agentic AI systems implemented in cars capable of level 3 autonomous driving. (*FunSearch* provides the user with a code that *can be* executed, although the decision whether to execute in or not, *which of* them, given multiple variants, is ultimately up to the user, while in level-3 autonomous driving cars the crucial executive decisions in critical situations are made independently of humans.)

The provided example sheds light on the more subtle and abstract 'philosophical' nature of the difference between *agency* and *agenticness*. While the former has classical 'Boolean' truth values (either it is *present/observable* or *absent* in an entity under valuation), the latter has 'fuzzy' or 'many-valued' truth values. The ultimate value is a matter of degree, *from* a minimal threshold to a non-specified upper value, determined either by contrast and comparison, or on the basis of evaluation by criteria, the list of which may be subject to change and a proposal from potentially different research programs. In Shavit et al. (2023), four such criteria are proposed: goal complexity, environmental complexity, degree of adaptability, and degree of independent execution or action-space autonomy. To simplify, in the case of agency, either X *is* an agent or *it is not*; while, given $n \geq 2$ agents, an arbitrary X may *possess more or less* agenticness than any other agent Y. It is also worth generalizing that, although it *correlates* with *generality of functions/capabilities* and *task-performativity* of an AI system, there is no *necessary nexus* between these properties (for instance, many digital systems are more agentic than almost any AI embodied in a physical robot). And if AGI has any perspectives, agenticness is as important a feature to consider as generalization across domains.

Now, back to the point. It is crucial that agenticness must be perceived distinctly from such things as: mind, consciousness, moral agency, awareness of self/others, motifs and motivation, etc. From this follows that its meaning, content, and value are independent and distinguished from the (actual or given) degree of a system's

*anthropomorphism*. Agenticness neither implies nor requires "a human-like appearance or human-like behavior, though anthropomorphic appearances and behavior may increase the likelihood of humans perceiving such systems as agentic" (Shavit et al. 2023, 5). For AGI-correlationism, *it is* the system's anthropomorphism which defines, and *what* it defines is *agency*, hence, the latter is not 'Boolean,' but 'fuzzy', and what in turn determines a degree of agency here is a degree of *autonomy*, in a general sense. The degree of autonomy is conceived, for instance, as the qualitative and/or quantitative limits of freedom given to a particular subject of decision, choice, and actions, determined by external conditions and circumstances (instant and contingent, correspondingly) and the subject's internal nature.

In this particular case, not everything should be reduced to and explained by the issue of anthropomorphism. While not being *false* or 'generally' wrong, the problem with such a representation of the state of affairs is *obsolete* with the state of the art in AI R&D. But that is a general disposition of correlationism—undesirability of resignation of changes and generally what we may call 'revision' or 'renegotiation'—of concepts and definitions, frameworks, theories, strategies, approaches. This is not because correlationism is opposed to the ideas of progress, evolution, adaptation, and all similar things; this implicit denial of changes stems from essentialism, which tries to ossify any given state of the art as *totality* or *closure* by absolutization of reified successive stages as a final/ultimate singularity. This, actually, is what makes correlationism a bad counterpart to AI ethics, precisely because the rapid and contingent path and pace of development necessitating renegotiation and introduction of the new concepts, methodologies, and definitions *is what* makes up this development. To put it short, AGI-correlationism, underpinned by essentialism, tends to retain some generalized points, as well as particularized issues that are obsolete or redundant, resulting in theoretical and practical misrepresentation of the state of the art in contemporary AI. Anthropomorphism as a criterion for *agency* evaluation *used to be* 'wed' to what is defined here as *agenticness*, referring to the 'GOFAI dispositions' rather than anything meaningful today.

## 3. Open Questions

A lot of questions are left unanswered here and some have not even been tackled. Therefore, whatever closure follows, the subject matter remains open-ended. With this abductive principal open-endedness in mind, this section addresses some of these questions, taking premises for future investigations, accessible not only from the 'outside,' but also being self-critical, an attempt to see one's own weak points, calling for improvements and future work.

Q1. What are potential or actual perspectives of use of the introduced concepts and arguments in further philosophical investigations? What *affirmative* and *constructive* criticism can/should be added to part 2?

Q2. How should we actually demarcate between what was called here 'human-centred AI ethics' and 'AI ethics of correlationism'? Should there be a checklist, threshold, etc., by which one may effectively distinguish between the two?

Q3. Should some points and arguments of correlationism concerning specific topics, as in the case of (3.3), be accepted and reworked, and integrated into another AI ethical system? And what about the contrary? Aren't particular concepts introduced in the paper, along with others taken as they are, in need of renegotiation? This is because some of them are vague and poorly explicated (e.g., 'recognition').

Q4. Functionalism is an *approach* for theoretical frameworks and research itself. That is totally fine, but how about ideas about the *methods* of research? Should they be 'purely philosophical' in kernel, technical, multidisciplinary, and, if the latter is the case, would they be given any precision in order not to remain 'formal' proclamations of multidisciplinarity?

Q5. Given the state-of-the-art in our fathoming of AGI (not even knowing the path which leads to it), is it not too early for academic discussion of this kind? Is there any comprehensible evidence or argument that would ensure that the speculations of this kind would not be dismissed as 'transhumanist values,' wretched to be parochial precisely due to almost-imminent binding of them in 'at-hand' history, politics, and society?

## 4. Conclusion

At the present level of the results in research and development of AI, an area of epistemic enquiry itself one of the 'youngest' so far and done 'from scratch,' unlike many other subjects, having no preceding debates or rooting in past centuries, we are still far away from the creation of AGI: not taking into account any contingent or unpredicted breakthroughs in the field, it is not even 'the dawn' of it, not speaking of its potential 'rise,' or emergence. All this makes such discussions highly speculative. Perhaps it is the only subarea of general ethics where the latter is a matter of speculation more than a practical affair. At the same time, just as with a field of security in the AI domain, it belongs to questions where speculation *should* come first, because, when there would be conditions of actual realization of AGI, we must be prepared for the mitigation of risks it potentially brings along with the potential benefits (security), as well as having strategies of long-term interaction with it, such that both species would benefit from this interaction without doing harm to one of the subjects of the interaction or both (ethics).

To effectively deal with the negative consequences of anthropocentrism, anthropomorphism, bias, and the problems they lead to in the field of AI ethics, philosophy in general, as well as possible harm to AI research and related domains of thought and practice, not only critique of the attitudes, but also a framework of understanding and representation, unifying critique, explanations, definitions, and constructive claims (alternatives, propositions, reviews, and renegotiations). My intention was to demonstrate how a specific general approach (to definition, methodology, paradigm, etc.) can be impaired with particular ethics, and what such an impairment may yield, for good, for neutral, and for bad.

Essentialism and correlationism reciprocally imply each other. Functionalism implies different realizabilities, from a fully sovereign AGI agent to human-centred

ramifications. The latter consider recognition of AGI as an autonomous and intelligent entity, with interactional parity. Considering human in the first turn as a host of intelligence, taken as a positive object of concern, instead of human as a species, it is possible to build up a common cause, a necessary condition for aligned, constructive, and efficient interaction between human and AGI. To mitigate ethical tensions, complications, and other negative outcomes, we should consider the possible causes, and I propose AGI-correlationism as a framework in which such a mitigation is possible to be performed.

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