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The Perceptions of Romanian Students on the Adoption of Artificial Intelligence and Emerging Technologies

Maria Cristina Enache[★]

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ABSTRACT

Emerging digital technologies such as Artificial Intelligence (AI), blockchain, Non-Fungible Tokens (NFTs), cryptocurrencies, and the metaverse have radically altered the landscape of industries worldwide. As these technologies continue to evolve, understanding how younger generations perceive and interact with them can offer valuable insights into future adoption trends. In this article, we present a detailed theoretical explanation of these technologies, paired with a comprehensive statistical analysis based on survey data from Romanian students. By applying advanced statistical methods such as correlation analysis, comparative analysis, and cluster segmentation, we aim to uncover not just familiarity and interest but also the underlying factors that shape students' attitudes toward these groundbreaking technologies.

1. Theoretical Overview of Key Technologies

The global landscape of industries has seen significant transformation with the introduction of cutting-edge digital technologies like blockchain, cryptocurrencies, Artificial intelligence (AI), Non-Fungible Tokens (NFT) and the metaverse. These technologies are changing established business models, improving operational efficiencies, and opening up new markets because of their distinct qualities and prospective uses. AI is the term for machines that have been programmed to think and learn in order to simulate human intelligence. Its capabilities, which have a substantial impact on numerous sectors, include machine learning, robotics, computer vision, and natural language processing. AI is transforming personalized treatment and diagnostics in the healthcare industry. AI-driven applications can improve the accuracy of healthcare delivery by personalizing treatment recommendations based on a patient's genetic composition and past data. AI has also been used by the finance sector, which uses it for algorithmic trading, risk management, and fraud detection.

Artificial intelligence (AI) systems can detect anomalies in real-time and drastically lower the risk of fraud by examining transaction patterns and behaviors. AI trading algorithms are able to process market data faster than human beings, allowing them to make trades based on predictive analytics. AI improves customer experiences in retail by managing inventories and making tailored recommendations. Businesses can effectively meet demand by customizing their marketing strategies and optimizing stock levels through the analysis of customer behavior and preferences. AI-powered chatbots are revolutionizing customer service by offering immediate assistance and information.

Blockchain is a decentralized, distributed ledger technology that guarantees the immutability, security and transparency of digital transactions, being currently associated with cryptocurrencies, but it can also be used in other associations, not only with virtual money. Among the possible applications we can mention voting systems, supply chain management or digital identity verification. Because blockchain is based on decentralized governance, it is highly secure and tamper-proof. Decentralized ledger technology, or blockchain, makes safe and open record-keeping possible. Its attributes, including as security, transparency, and immutability, have broad ramifications for numerous businesses. Blockchain improves accountability and traceability in supply chain management. Because every transaction is logged in an unchangeable way, companies are able to trace the origin of their products. This is especially helpful in sectors where maintaining the integrity and safety of products is crucial, including the food and pharmaceutical industries. Blockchain helps the financial services industry by lowering costs and improving transaction efficiency. Intermediaries are frequently used in traditional banking systems, which causes delays and higher expenses. Peer-to-peer transactions are made possible by blockchain, which dramatically expedites procedures and lowers the cost of international payments.

★ Dunarea de Jos University of Galati, Romania. E-mail address: mpodoleanu@ugal.ro (M. C. Enache).

Blockchain can streamline real estate transactions by offering a transparent and safe marketplace for the purchase, sale, and rental of real estate. By doing away with the need for middlemen and encoding the parameters of an agreement directly into code, smart contracts reduce fraud and streamline business procedures.

Cryptocurrencies - Cryptocurrencies are digital or virtual money that run without the assistance of a central bank and are secured by encryption. Although Bitcoin is one of the most well-known cryptocurrencies, there are many more, including Ethereum and Litecoin. Based on blockchain technology, cryptocurrencies provide a decentralized substitute for established financial institutions.

Diminishing the importance of traditional banks, cryptocurrencies have been revolutionizing the monetary systems by developing a decentralized functioning activity. They can do bitcoin, without needing a cash dispenser. This can be useful especially in areas where banking services are not easily available. In addition to this, cryptocurrencies allow sending money from one country to another which normally is processed through the banks with more transaction fees and time. In some ways, thanks to the development of technology and deep changes in society, the impact of cryptocurrencies on enlarging the possibilities for investments has been recognized. There is a growing appetite among investors for digital currencies as part of their overall portfolio, and this in turn fuels the growth in crypto exchanges and investment services. The introduction of DeFi Platforms helps in investing more actively as it allows the user to lend, procure, and earn on their cryptocurrency without the help of banks.

Non-Fungible Tokens (NFTs) - NFTs are distinct digital assets that are kept on a blockchain and are used to verify the ownership or authenticity of specific objects, such as virtual real estate, music, or artwork. As opposed to cryptocurrencies that can easily transpose as dollar notes and coins (e.g., the value of any random bitcoin equals that of another of the same denomination) NFTs are singular in all aspects. Because of this, they are valuable in digital collectibles, gaming and the art world. As defined in a single sentence, NFTs are digital tokens that signify the ownership of a certain asset or content, that is permanently linked with blockchain technology. And it is precisely this 'not fungible' element that makes NFT different from, for example Bitcoin type crypto currency. The space of digital art has undergone drastic changes with the advent of NFT technology. Through this, artists or other creators are able to sell their work directly to the audience without intermediaries such as galleries and auction houses as they can bundle accounting of their work. This shift in art has created new ways to earn bread for the creators and helped them in taking better charge of their work. For instance, in the gaming sector, many gamers own several virtual assets in the form of characters, skins for the virtual avatars, weapons, and virtual land among others. These items are tradable in other marketplaces or up for sale and as such the players basically make investments from the game experiences. The use of such kind of incentive in games has also created a new economy where such bureaucratic constraints do not exist and playing a game can earn people money. In addition, NFTs are making their way to the fields of sports and entertainment with respect to the use in ticketing and as collectibles. Teams and performers are able to issue NFTs for their fans or provide appreciation in the form of NFTs that allows better interactivity with fans and a fresh way of earning revenue.

The Metaverse - The internet, virtual reality, and augmented reality come together to form the metaverse, a communal virtual shared area. Avatars allow users to interact with the digital world and each other in a persistent virtual environment. The metaverse offers immersive experiences that beyond those of typical digital platforms, making it a promising tool in the fields of education, real estate, gaming, and tourism. The metaverse is a virtual universe where physical and digital reality combine, having both real objects and places converted into virtual formats, as well as pure elements from the digital space that have an impact on the real world. The metaverse is a highly interactive 3D environment, whereby users are able to communicate, play and perform numerous activities, making use of either VR or AR devices. In recent developments, Metaverse users have encountered better experiences for purposes such as entertainment and gaming. They can go to concerts, play games and create their own digital environments in the vast world of the metaverse. The creation of quality content and the generation of money are among the most important aspects of modern entertainment and interaction, because even if they start from the need for interaction of people, they are fundamentally based on the emotional capacity of the public to get involved in new experiences.

In business, collaboration and work designed for virtual space can be done through the metaverse. There is a need for a virtual office where the employees of a company are connected everywhere and live in a common virtual office. Team members can work better together, increase creativity and change the learning and work environment. In addition, Metaverse is also useful in education. For example, in school, physical folders are replaced with virtual subject folders, so students are always in a virtual environment. Medical professionals can acquire hands-on skills for newbies by performing surgery on virtual patients in a safe environment because there are no side effects.

2. Descriptive Statistics: Familiarity and Engagement

To understand how Romanian students perceive these technologies, we surveyed respondents, predominantly aged 14-20 years (60% of the sample), with a gender distribution of 60% female and 40% male.

The survey explored their familiarity with cryptocurrencies, NFTs, blockchain, and the metaverse, as well as their interest in investing or engaging with these technologies.

Familiarity with Key Technologies - In our study we sought to identify how familiar the participants are with key technologies such as blockchain, cryptocurrencies, NFT or metaverse. Thus, we observed that:

- Cryptocurrencies: When asked about cryptocurrencies, 82.7% of participants indicated that they are familiar with the concept, making it the most widely recognized technology among respondents.
- NFTs: In the case of NFTs, 55.2% of respondents reported having knowledge of this concept, though the awareness level was notably lower compared to cryptocurrencies.
- Blockchain: Regarding blockchain technology, only 38.5% of participants expressed familiarity, suggesting that while cryptocurrencies are widely recognized, the foundational technology behind them is less understood.
- Metaverse: The metaverse was the least recognized concept, with just 29.6% of respondents acknowledging familiarity. However, many of those aware of it had some insight into its potential uses.

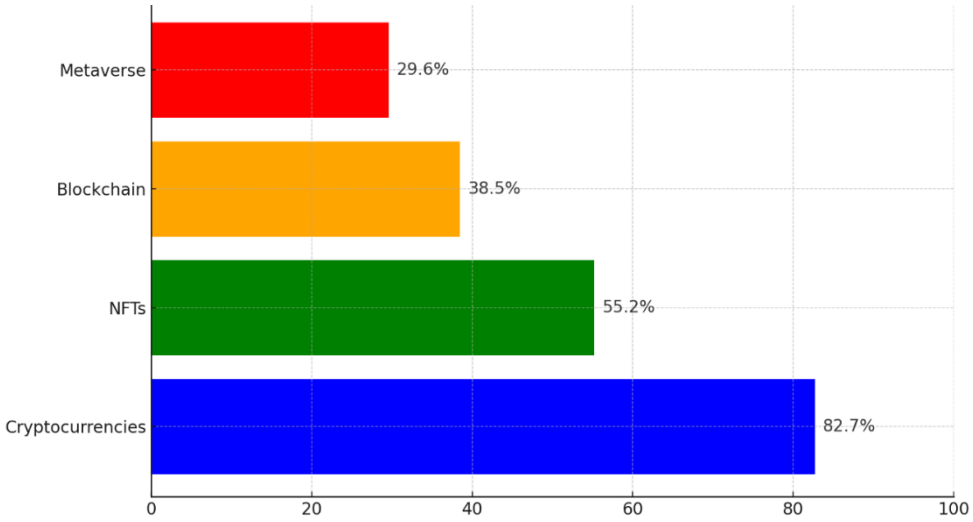

Figure 1. Familiarity with Key Technologies

Investment Interest - Regarding the intention to invest in such technologies, we found that only 18.3% of respondents expressed interest in investing in cryptocurrencies, despite high awareness. Interest in NFTs was even lower, with 12.1% indicating potential investment interest. There are a number of reasons for the disparity between the high level of knowledge about cryptocurrencies and NFTs and the lower level of intention to invest.

First of all, although being well recognized, cryptocurrencies are also infamous for their tremendous volatility. Cryptocurrencies, like Bitcoin, are dangerous investments because of their sudden and sharp price fluctuations. Consequently, even when people are aware of them, their perception of risk may prevent them from making an investment.

Second, many people do not have complete faith in the long-term stability of cryptocurrencies and NFTs, even though they are aware of this. This lack of confidence is exacerbated by worries about fraud, cyberattacks, and accounts of large financial losses, which makes people less inclined to invest.

The intricacy of the technology underlying these assets is another factor. Even while cryptocurrencies and NFTs are becoming more and more popular, not everyone is familiar with them or knows how to invest in them safely. Potential investors may become discouraged by this ignorance. In many nations, there are also unclear legislation pertaining to cryptocurrencies and NFTs, which adds to the uncertainty. Many would-be investors would rather wait until the markets are more stable and regulated in the absence of clear legal frameworks. Additionally, there is a belief that NFTs, in particular, are a part of a speculative bubble. Compared to cryptocurrencies, NFTs are perceived by many as having inflated values that do not accurately represent their genuine value, which further reduces investor interest.

Lastly, some people who are aware of these technologies might just not have the money to invest or they might be more cautious with riskier investments. Investing in more conventional and secure assets like stocks or real estate may be their preference. As a result, despite the general public's high degree of awareness of cryptocurrencies and NFTs, real investment interest is comparatively low due to a mix of perceived risks, legal uncertainties, and a lack of knowledge or trust.

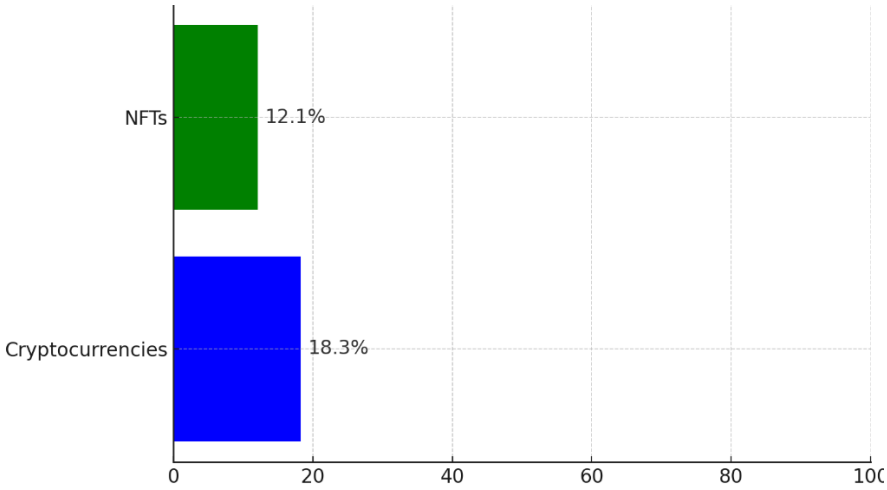

Figure 2. Investment Interest

Correlation Analysis: Exploring Relationships Between Variables

To uncover deeper insights, we conducted a correlation analysis using Pearson's correlation coefficient to examine relationships between demographic variables (age, gender, education) and technology familiarity or investment interest.

Key Correlation Findings

- Age and Technology Familiarity
  - There is a moderate positive correlation (r = 0.31) between age and familiarity with cryptocurrencies, suggesting that younger respondents (aged 14-20) are more familiar with cryptocurrencies than older respondents (21-30). This result is consistent with the idea that younger individuals, particularly students, are more exposed to digital environments where these technologies are prevalent.
  - A weaker positive correlation (r = 0.24) was observed between age and familiarity with NFTs, indicating that younger respondents are more aware of NFTs, although less so compared to cryptocurrencies.
- Gender and Investment Interest
  - A weak negative correlation (r = -0.18) was found between gender (female) and interest in investing in NFTs, implying that male respondents are slightly more likely to express interest in NFTs. This aligns with global trends showing that digital asset markets, particularly NFTs and cryptocurrencies, have more male participants.
- Education and Blockchain Knowledge
  - There is a stronger correlation (r = 0.42) between educational background (technical vs. non-technical) and familiarity with blockchain. Respondents with technical backgrounds (e.g., computer science students) are significantly more likely to understand blockchain technology. This makes sense, as blockchain requires a certain level of technical understanding, particularly regarding cryptographic principles and decentralized systems.

These findings align with the theoretical understanding that younger individuals, particularly those immersed in digital cultures, are more familiar with emerging technologies like cryptocurrencies and NFTs. However, their limited interest in investing in these technologies suggests a disconnect between familiarity and trust or confidence in these digital assets. This hesitancy could be attributed to the volatility and abstract nature of these investments, as well as the lack of practical, tangible use cases that might make them more appealing.

To further explore the differences in perceptions across different demographic groups, we conducted t-tests to compare high school students and university students on their familiarity with the key technologies.

- High school students are more familiar with cryptocurrencies, with 85% familiarity compared to 78% among university students. The p-value (0.02) confirms this difference is statistically significant, indicating that younger students are more engaged with or exposed to cryptocurrency content, likely due to its prominence in digital culture.
- University students reported slightly higher familiarity with NFTs (58%) compared to high school students (52%), though this difference was not statistically significant (p = 0.15).
- Interestingly, university students are more familiar with the metaverse, with 32% compared to 27% of high school students. This could be due to the more complex nature of the metaverse and its

potential professional applications, which may resonate more with older students or those studying technology-related subjects.

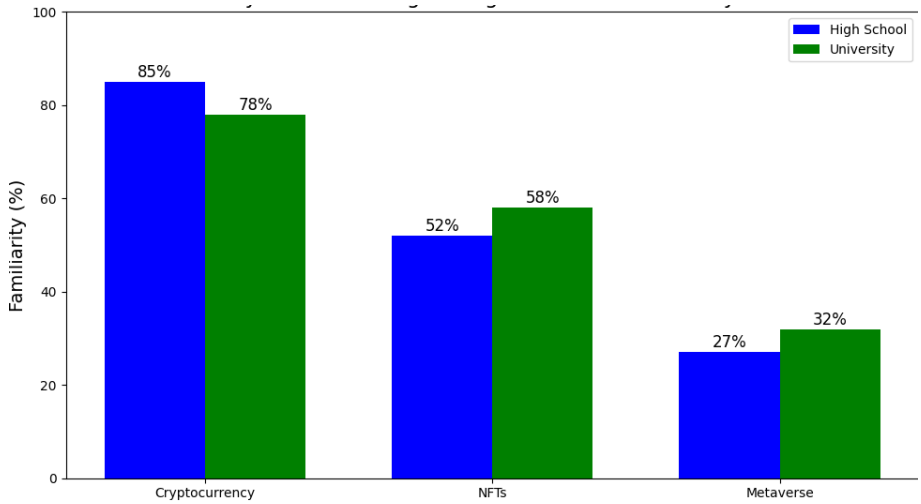

Figure 3. Familiarity with Technologies

Cluster segmentation is an analytical approach that groups individuals or entities based on shared characteristics or behaviors. This method allows us to identify distinct behavioral groups. We applied k-means clustering to segment the respondents into distinct groups based on their responses to questions regarding familiarity, investment interest, and perception of technology. The Elbow Method determined that three clusters best represent the data.

Cluster 1: The "Tech-Savvy Enthusiasts" (25% of respondents)

- Characteristics: This group demonstrates high familiarity with all technologies and expresses strong interest in investing in both cryptocurrencies and NFTs.
- Demographics: Predominantly aged 14-20, with a higher proportion of male respondents. Many are students in technical fields such as computer science or engineering.
- Theoretical Insight: According to Rogers' Diffusion of Innovations Theory, this group represents the "early adopters" who are more willing to take risks on emerging technologies, showing a high level of digital literacy and curiosity.

Cluster 2: The "Cautious Observers" (45% of respondents)

- Characteristics: Familiar with cryptocurrencies but have limited knowledge of blockchain, NFTs, and the metaverse. Investment interest is low.
- Demographics: A mix of ages, with a higher representation of females. Most respondents in this group come from non-technical fields.
- Theoretical Insight: These individuals represent the "early majority" in the diffusion curve, who are open to innovation but remain cautious. They may be waiting for the technology to become more stable or mainstream before engaging further.

Cluster 3: The "Traditional Skeptics" (30% of respondents)

- Characteristics: Low familiarity with all technologies, especially blockchain and the metaverse. Very low interest in investing in NFTs or cryptocurrencies.
- Demographics: Includes older respondents (21-30 years) and those in non-technical fields.
- Theoretical Insight: This group corresponds to the "laggards" in Rogers' model, who are resistant to adopting new technologies and prefer traditional, proven solutions.

3. Advanced Interpretation: Correlating Theory with Data

From both a theoretical and empirical perspective, the survey highlights a complex but evolving relationship between Romanian students and emerging technologies.

- Familiarity Does Not Equal Engagement: Although younger respondents are highly familiar with cryptocurrencies and NFTs, their low investment interest suggests that while they are aware, they are not yet fully convinced about the value or utility of these technologies. This aligns with Technology Acceptance Model (TAM) theory, which posits that perceived usefulness and ease of use are critical factors in technology adoption. The abstract nature of digital assets like NFTs may deter students from engaging with them.
- Blockchain's Hidden Role: The low familiarity with blockchain, despite its foundational role in cryptocurrencies, reflects the broader global challenge of educating users on the back-end technologies

that drive digital innovation. According to Diffusion of Innovations Theory, a "knowledge gap" exists, where consumers may recognize a product (cryptocurrency) without fully understanding the underlying technology (blockchain).

- Metaverse's Future Potential: The metaverse, while currently less familiar, has significant perceived potential in fields like education and tourism. As noted by Gartner's Hype Cycle, the metaverse is likely still in the "innovation trigger" phase, where awareness is low, but expectations for future applications are high.

Conclusion: An Evolving but Cautious Adoption

This analysis of Romanian students' perceptions of AI and emerging digital technologies reveals a blend of curiosity and caution. While younger respondents, particularly those in technical fields, are more familiar with and interested in these technologies, most students remain hesitant to invest in them. These findings highlight the need for further education, as well as more tangible use cases for digital assets and the metaverse, to bridge the gap between familiarity and active engagement. As these technologies continue to mature, and as their practical applications become clearer, we can expect shifts in student perceptions and behaviors. For now, however, Romanian students reflect a broader global trend: awareness of digital innovation, tempered by a cautious approach to adoption.

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