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Drones in Everyday Life: A SWOT Analysis of Social Perception in Hungary

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Table of Contents

I. TODO / Questions / Notes ... 3
II. Abstract ... 4
Keywords ... 4
III. Introduction ... 5
Mea culpa maxima ... 5
Drone ... 5
Social perception ... 5
SWOT analysis ... 6
Likert scale ... 7
IV. Literature review ... 8
V. Objectives ... 18
Hypotheses ... 18
VI. Methods ... 19
Questionnaire ... 20
VII. Results ... 23
Demographic profile ... 23
Reliability analysis ... 25
Spatial analysis ... 26
Descriptive analysis of variables ... 26
Hypothesis testing ... 26
Methodology ... 26
Significance ... 27
Hypotheses ... 27
Psychographic Clusters (Optimist vs Skeptic) ... 33
VIII. Discussions ... 36
IX. Conclusions ... 37
X. Future work ... 38
XI. Attachments ... 39
Formulas and metrics ... 39
List of Abbreviations and Expressions ... 39
Images ... 41

I. TODO / Questions / Notes

1. Can we use AI Generated images as our own sources?
2. Sentiment vs Attitude… Have I chosen naming some metrics correctly?
3. Questionnaire or survey? Which terminology to use?
4. Category vs. group… Which terminology to use in what situation?
5. What to do with the “Profession / Foglalkozása” option? How to process such a free type form?
6. Who can help me lector the thesis?
7. Database: Diagram, UML, …
8. What is what:
    - 8.1. Abstract: A mini-version of the whole thesis (200-300 words) at the very start.
    - 8.2. Literature Review: A chapter of text where you analyze previous studies.
    - 8.3. Conclusion: Synthesis of findings and final thoughts.
    - 8.4. Summary: Usually unnecessary unless your university requires an "Extended Summary" (often in a different language).
    - 8.5. References: The bibliographic list of citations at the very end.
9. Can make a joke about:
    - 9.1. Typo on the KSH website: Average age: the weighted arithmetic men age of living population at a point of time. Arithmetic MEAN age…
10. Address concerns about the methodology and method:
    - 10.1. Drones in Everyday Life: A SWOT Analysis of Social Perception in Hungary
    - 10.2. Questionnaire was “public” and wide spread.
11. Create an article for the Gradus paper:
    - 11.1. Gradus_template_2.9_en.docx
12. I. TODO / Questions
13. II. Abstract
14. III. Introduction
15. IV. Literature review
16. V. Objectives
17. VI. Methods
    - 17.1. Come up with a sane sounding sampling strategy
18. VII. Results
    - 18.1. "Demographic Characteristics" or "Descriptive Statistics"
19. VIII. Discussions
20. IX. Conclusions
21. X. Future work
22. XI. Attachments

II. Abstract

As Unmanned Aerial Systems (UAS) or drones become more and more integrated into our everyday life, understanding social perception is crucial for the technological introduction, adoption and development of drones. In this thesis we researched ways to analyse the social perceptions of drones in Hungary. The focus of the literature review was to identify frequently measured or discussed questions for the base for our questionnaire and hypotheses. We found that utilizing the SWOT analysis method, which is usually used for strategic planning, we can average positive and negative attitudes and create 2 new metrics: SO_attitude (positive) from the strengths (S) and opportunities (O), WT_attitude (negative) from the weaknesses (W) and threats (T). To measure the attitude, a quantitative questionnaire is made which contains 16 questions (4 questions for each of the 4 SWOT quadrants, from which 8 is positive attitude and 8 negative attitude) to measure attitude on a 5 level Likert scale. The quantitative analysis of the participants responses of the questionnaire rejected three of the four null hypotheses. The results confirmed a statistically significant positive relation between knowledge and attitude (H1, $p = 0.031$). No significant correlation was found between gender and privacy concerns (H2, $p = 0.158$). Surprisingly, the urban population has a statistically significantly higher negative attitude (WT_attitude) towards drones (H3, $p = 0.002$) than their rural counterparts. Finally, we were able to confirm the statistically significant inverse correlation between the positive attitude and noise (H4, $p < 0.001$, $r = -0.208$) of a drone. The findings of this survey are expected to facilitate the development of strategies to increase the positive perception of Hungarian society for drones and drone technologies.

Keywords

1. Drone
2. Unmanned aerial system
3. Social perception
4. Hungary

III. Introduction

Mea culpa maxima

I often receive feedback from colleagues in the field of drone technologies, from hobbyists to operators, that the proper terminology is "Unmanned Aerial System" or "Unmanned Aircraft System" (UAS[3]). However, even journalists admit face to face, that the terminology "drone" is used by them as this is the accepted term by the general public.

Drone

"*drone - A land, sea, or air vehicle that is remotely or automatically controlled.*"[4]. The terminology, drone, requires some clarification regarding its scope in this thesis. Professionals in the industry have insights of the wide range and possibilities regarding drones and their capabilities (e.g.: on the Mars the Nasa drone helicopter Ingenuity[5], in the space the robotic spacecraft Boeing X-37[6]) thanks to the rapidly developing technology in this field. However, non-professionals mostly associate the terminology, drone, with noisy quad-copters above our heads. Having preliminary discussions with drone operators and laymen we faced a challenge: If we raise awareness in the questionnaire about the possibilities of drones we inadvertently would bias questionnaire participants towards a more positive view. Accepting that most people would associate the terminology with the "noisy quad copter" is just a pragmatic choice in order to have a non-biased base to start our research. Let me clarify with an example: If we would raise awareness in the questionnaire, that there are drones which were designed to operate in hazardous operating environments, not just military operational zones and taking wedding photos, we would instantly tip the balance of a previously negative attitude towards a positive direction. A person who just realised that drones can help monitor radiation levels without exposing personnel towards radiation in the Chornobyl Exclusion Zone[7] immediately would be biased towards a more positive attitude, even before having only negative experiences in real life.

Social perception

Construct validity[8] (Operationalization[9])
When the thesis was planned and the survey design started, we were curious
Horn bias (or the opposite Halo bias) because of the noise pollution which comes with operating drones.
Fundamental attribution error when we do not directly benefit from drone operation results.

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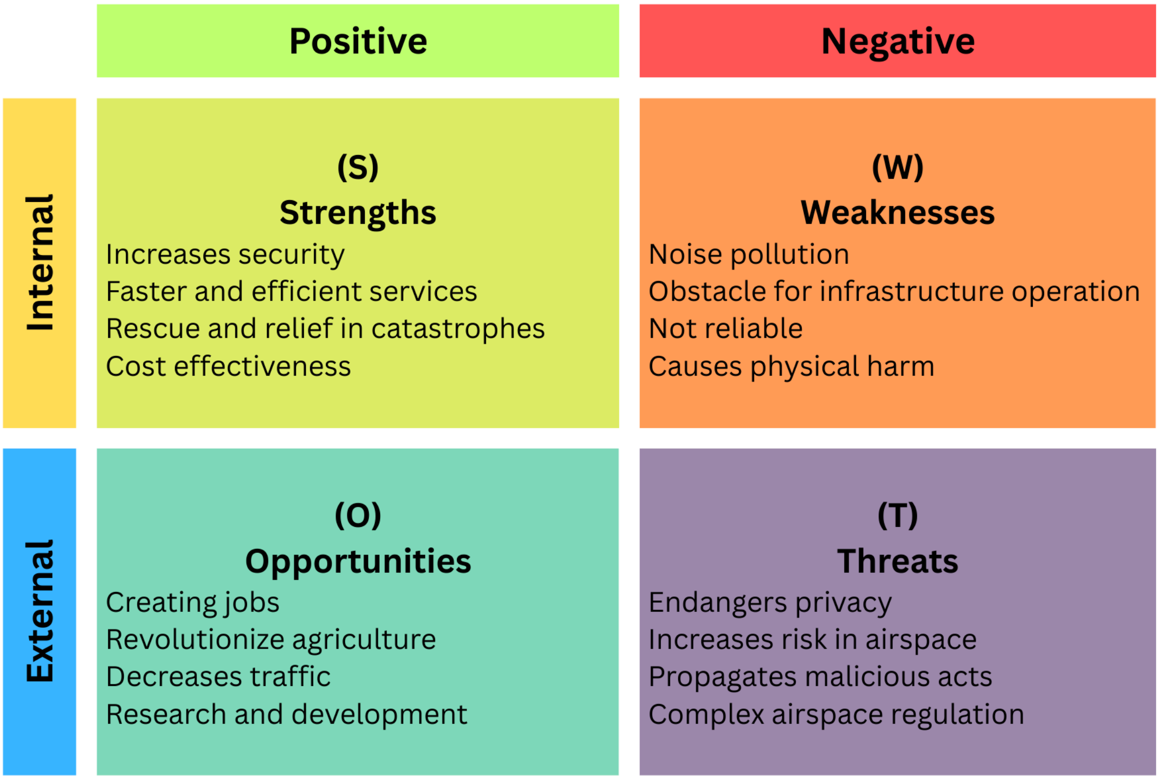
[3] https://en.wikipedia.org/wiki/Unmanned_aerial_vehicle 2025-11-26
[4] U.S. Joint Chiefs of Staff. Department of Defense Dictionary of Military and Associated Terms. Joint Publication 1-02. Washington, DC: Joint Chiefs of Staff, 2010. Incorporating changes through September 15, 2011.
[5] https://en.wikipedia.org/wiki/Ingenuity_(helicopter) 2026-01-25
[6] https://en.wikipedia.org/wiki/Boeing_X-37 2026-01-25
[7] Connor, Dean T., Kieran Wood, Peter G. Martin, Sevda Goren, David Megson-Smith, Yannick Verbelen, Igor Chyzhevskyi et al. "Radiological mapping of post-disaster nuclear environments using fixed-wing unmanned aerial systems: A study from chornobyl." Frontiers in Robotics and AI 6 (2020): 149.
[8] https://en.wikipedia.org/wiki/Construct_validity 2026-01-25
[9] https://en.wikipedia.org/wiki/Operationalization 2026-01-25

SWOT analysis



Image[10]: The SWOT quadrants or matrix.

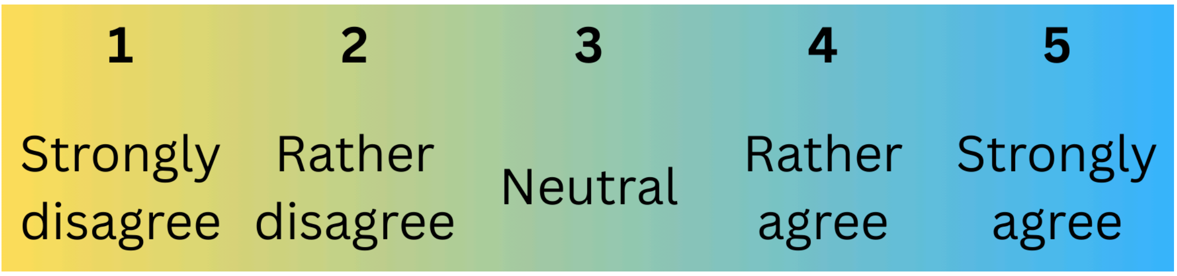
"*SWOT Analysis is an analysis method used to evaluate the 'strengths', 'weaknesses', 'opportunities' and 'threats' involved in an organization, a plan, a project, a person or a business activity*"[11]. Borrowing the approach methodology from the SWOT analysis techniques, we can identify four categories for our questionnaire questions:

1. Internal positive (Strengths): The positive microeconomic effects of drones.
2. Internal negative (Weaknesses): The negative microeconomic effects of drones.
3. External positive (Opportunities): The positive macroeconomic effects of drones.
4. External negítive (Threats): The negative macroeconomic effects of drones.

We split the internal and external effects into microeconomic and macroeconomic effects in order to have a more clear split between external and internal effects. Implementing this approach will help us keep focus on the general and large scale view on the measurements.
This will help us categorise the result of the questionnaire into positive and negative attitudes.

[10] SWOT_matrix_drone_attributes.png
[11] Gurl, Emet. "SWOT analysis: A theoretical review." (2017).

Likert scale



Image[12]: The Likert scale.

1. 1 = Strongly disagree
2. 2 = Rather disagree
3. 3 = Neutral
4. 4 = Rather agree
5. 5 = Strongly agree

[12] Likert scale - DroneSociety.png

IV. Literature review

1. Strawser, Bradley Jay. "Moral predators: The duty to employ uninhabited aerial vehicles." Journal of Military Ethics 9, no. 4 (2010): 342-368.
    1.1. https://etica.uazuay.edu.ec/sites/etica.uazuay.edu.ec/files/public/Moral%20Reasoning%20A%20Text%20and%20Reader%20on%20Ethics%20and%20Contemporary%20Moral%20Issues%20%28%20PDFDrive%20%29.pdf#page=462
    1.2. “There is a worry that UAVs could lead to autonomous weapons that make lethal decisions on their own.”
    1.3. “I argue that remotely controlled weapons systems are merely an extension of a long historical trajectory of removing a warrior ever farther from his foe for the warrior’s better protection.”
    1.4. “My argument rests on the premise that if an agent is pursuing a morally justified yet inherently risky action, then there is a moral imperative to protect this agent if it possible to do so”
    1.5. “For any just action taken by a given military, if it is possible for the military to use UAV platforms in place of inhabited aerial vehicles without a significant loss of capability, then that military has an ethical obligation to do so.”
2. Wiesner, Ina. "A Sociology of the Drone." Journal of Military and Strategic Studies 18, no. 1 (2017).
    2.1. https://jmss.org/article/download/58280/43836
    2.2. “According to an interpretation in favour of combat drones, states are ethically obligated to use drones as the means of choice to spare the lives of their soldiers.”
    2.3. “In contrast to these technology-deterministic and microeconomic perspectives on technology development, sociologists interested in technology since the 1960s have regarded innovation and the diffusion of technologies as a social process, as innumerable decisions are made and negotiations are conducted in the course of technology development”
    2.4. “The sociology of technology not only asks about the conditions for the development of technology but also about the consequences of the introduction for societies, organisations and people. Remaining at first at the microsociological level, the questions arise, whether and how the existence of combat drones influences individuals in their behaviour.”
    2.5. “Drones are currently the highest developmental form of a military strategy orientation of armed services who wish to minimise their footprint in the operational theatre.”
    2.6. “By contrast, sociology studies the reasons for the development of technology and their long-term effects on social action, considering a longer background of time.”
3. Emimi, Mohamed, Mohamed Khaleel, and Abobakr Alkrash. "The current opportunities and challenges in drone technology." Int. J. Electr. Eng. and Sustain. (2023): 74-89.
    3.1. https://ijees.org/index.php/ijees/article/download/47/23
    3.2. “The process of globalization is being significantly influenced by the integration of technology, and among the technological advancements, drone technology stands out as a prominent example. Drones have witnessed a remarkable increase in their usage across various disciplines, including agriculture, healthcare, and military domains.”

3.3. “However, it is crucial to acknowledge that despite their numerous benefits, drones can pose risks, such as potential injuries to individuals and damage to property, especially when operated by untrained personnel or in the event of component failures during flight. Moreover, extremist elements can be hijacking drones to further their agendas and redirect the payload accordingly”

3.4. “The integration of Global Positioning System (GPS) technology and the availability of customizable applications for smartphones and tablets have significantly enhanced flight durations, reliability, and ease of operation.”

3.5. “Moreover, drones can facilitate automated inspections to ensure compliance with social distancing protocols in public spaces, thus aiding in the management of the pandemic.”

3.6. “The utilization of drones for the swift delivery of critical and life-saving medications to all members of society can contribute significantly to the realization of the goal of achieving universal health coverage. Furthermore, the logistics and transportation sectors stand to benefit from the integration of drones, offering opportunities for improved efficiency in the movement of goods and passengers.”

3.7. “The transition of drones from their origins in military applications to their integration within civilian contexts has introduced regulatory challenges that must be addressed to fully harness the potential of this technology.”

3.8. “One significant contribution of the multifaceted applicability of drones in the military, medical, and agricultural domains is the ability to enhance efficiency, effectiveness, and safety in various operations and activities.”

3.9. “In agriculture, drones offer numerous benefits in improving farm management and optimizing agricultural practices. They provide real-time imagery, sensor data, and mapping capabilities, allowing farmers to monitor crop health, detect diseases, and assess the overall condition of their fields.”

3.10. “The delegation of life-and-death decisions to automated systems or remote operators raises questions regarding accountability, transparency, and adherence to international laws of armed conflict.”

3.11. “Drones also play a significant role in precision agriculture, where they facilitate the precise application of inputs, such as fertilizers, pesticides, and herbicides. By utilizing GPS and onboard sensors, agricultural drones can precisely and accurately target specific areas of a field, minimizing waste and ensuring optimal use of resources.”

3.12. “Drone technology has emerged as a disruptive force, transforming industries and revolutionizing data collection, analysis, and decision-making processes. At the heart of this transformative capability lies drone sensor technology, a crucial aspect that empowers unmanned aerial vehicles (UAVs) to perceive their surroundings and gather essential data.”

3.13. “Drone-to-Drone communication is currently not standardized, and its development is an area of active research. Machine Learning techniques can be employed to design and optimize an intelligent Unmanned Aerial Vehicle (UAV)-based wireless communication system, as suggested in reference. In many instances, Drone-to-Drone (D2D) communications can be conceptualized as Peer-to-Peer (P2P) communication. However, this P2P model renders communication vulnerable to various types of attacks, including jamming, such as Distributed Denial of Service (D-DoS) attacks, and Sybil attacks.”

3.14. "Emergency Medical Services: Drones have the potential to play a vital role in emergency medical services. For instance, drones equipped with automated external defibrillators (AEDs) can be rapidly dispatched to the scene of cardiac arrests, allowing for immediate intervention before medical professionals arrive."

3.15. "Disaster Response and Relief: Drones are invaluable in disaster response and relief efforts. They can assess damage, identify survivors, and facilitate search and rescue operations in hazardous or hard-to-reach areas."

4. Purahong, Boonchana, Thanavit Anuwongpinit, Aniwat Juhong, Isoon Kanjanasurat, and Chuchart Pintaviooj. "Medical drone managing system for automated external defibrillator delivery service." Drones 6, no. 4 (2022): 93.

4.1. https://www.mdpi.com/2504-446x/6/4/93

4.2. "CPR can only keep blood flowing to the heart and brain for a time. To restore the heart's normal rhythm, a device called an automatic external defibrillator (AED) must be used."

4.3. "When a person experiences a heart attack, their survival rate depends on the time elapsed between the onset of the heart attack and the time they are treated with an AED. The aim of our medical drone managing system is to deliver an automated external defibrillator to a patient in less time. The system can respond to the AED request within 5 min for a maximum distance of 5 km."

4.4. "The distance between the patient with the drone mobile app and the drone sever can be as far as 5 km. Local Wi-Fi hot spots cannot be applied, and 4G/5G mobile broadband must be used in our autonomous medical drone system for communicating with the PubNub cloud server."

4.5. "The drone ground station is designed to be mobile and can even operate the drones from a van equipped with 4G or 5G signals."

4.6. "The mission was successful. The weather conditions for the test fight date were as follows: temperature 29.4 °C, humidity 65%, and wind speed 12 km per hour. We also asked the drone administrator and volunteer for their opinions about the drone server application and the mobile application. The feedback was quite positive, especially regarding the ease of use, reliability, and accuracy of the application. The total elapsed time from the emergency call to the delivery of the AED was about 2 min, divided into ascending time of 6 s (30-m altitude), descending time of 12 s, and flight time of 2 min. The maximum flight time of the drone is 24 min for a payload of 800 g."

4.7. "One of the missing features of our medical drone managing system for automated external defibrillator delivery is obstacle avoidance. The medical drone managing system is hence not suitable to be operated in a city, where many obstacles can be found, including electrical wires and tall buildings. To be used in a city, an obstacle avoidance feature should be added."

4.8. "A drone propeller guard must be used to prevent any injury, especially when the drone flies near living humans or animals."

5. Tan, Lynn Kai Lin, Beng Chong Lim, Guihyun Park, Kin Huat Low, and Victor Chuan Seng Yeo. "Public acceptance of drone applications in a highly urbanized environment." Technology in Society 64 (2021): 101462.

5.1. https://dr.ntu.edu.sg/bitstreams/b73dd305-45fe-467e-8172-a13d23990c18/download

5.2. “First, using two knowledge tests, we were able to confirm that the majority of the public seems to have a good understanding of what a drone is. Second, acceptance levels towards drones did significantly differ depending on the context of use. Industrial areas had the highest acceptance level, followed by recreational areas and business districts while residential areas had the lowest acceptance level.”

5.3. “We provided preliminary evidence that two factors – fears and concerns, and perceived potential benefits – affected the public acceptance levels differently depending on the contexts of drone applications.”

5.4. “While drone technologies are not new, it has not permeated our daily lives until a few years ago. These days, news of emerging applications of drone technologies are ubiquitous. Be it for routine building inspection, constant security surveillance, or last mile commercial delivery, drone technologies have been touted as a cost-effective solution.”

5.5. “To ensure successful implementation, social and psychological dimensions of drone operations in urban environment must be fully understood in order to enhance public acceptance of the technology.”

5.6. “For instance, people may be more accepting of using drones for building inspection in industrial areas compared to residential areas. Similarly, people may be more receptive toward security surveillance in commercial and industrial areas compared to residential and recreational areas.”

5.7. “Participants were asked single-itemed demographic questions pertaining to their gender, age, level of residence, occupation, annual income, industry, nature of work, and their highest educational qualification based on the Singapore education system.”

5.8. “An independent t-test between males and females revealed that the gender effect on the picture-based test ($t(1042) = 3.51$, $p < .001$) where males were found to perform significantly better than females (male: $M = 4.87/ 6.00$, $SD = .76$, female: $M = 4.68/ 6.00$, $SD = .92$). However, there was no significant difference between males and females on the word-based test ($t(1043) = 1.27$, $p = .20$).”

5.9. “Based on a one-way ANOVA, there are no significant age effects on both test scores (picture-based: $F(6, 1043) = 0.54$, $p = .77$; word-based: $F(6, 1043) = .54$, $p = .39$).”

5.10. “There are significant differences between the various education levels of respondents on their scores on the picture-based test ($F(6, 977) = 3.51$, $p < .01$). There are also significant differences between the various education levels of respondents on the word-based test ($F(6, 977) = 6.33$, $p < .000$). For both tests, those who received a higher education were more likely to score high on the tests.”

5.11. “A one-way ANOVA test revealed non-significant effects of occupation (3 categorical options of student, working adult, or non-working adult) (picture: $F(2, 1047) = 0.25$, $p =.78$; word: $F(2, 1047) = 1.44$, $p = .24$).”

5.12. “Considering those who responded that they have active drone experience, those with

5.13. active experience scored significantly lower on the picture-based test than those without active experience with drones (active: $M = 4.67$, $SD = .86$; non-active: $M = 4.85$, $SD = .82$). There was no significant difference.”

5.14. “The top 4 fears and concerns indicated by the Singaporean public is misuse of drones by unauthorized personnel, inability to identify whether drones are filming or not, drones being a threat to one's physical safety if parts of it falls, and loss of privacy."

5.15. "A repeated measures ANOVA was conducted to analyse whether the acceptance levels towards drones differed significantly based on the location of drone operation. The results revealed that the mean difference between acceptance levels did indeed differ significantly from each other ($F(1, 1049) = 21840.82$, $p < .000$; Residential: $M = 3.87$, $SD = 1.24$, Recreational: $M = 4.40$, $SD = 1.12$, Business district: $M = 4.30$, $SD = 1.12$, Industrial: $M = 4.58$, $SD = 1.16$)."

5.16. "While we did not make specific hypotheses regarding their relationships, we do believe that the two factors, fears and concerns, and perceived potential benefits, would affect the acceptance level differently depending on the specific context."

5.17. "Fears and concerns were the main factor that affected one's level of acceptance for drone use in residential area while it has no effect on drone use in industrial areas."

5.18. "Is the public ready for extensive drone applications to be an integral part of their daily lives? As mentioned earlier, public acceptance of any technology is necessary for realizing their benefits fully."

5.19. "Generally, a majority of the public seem to have a good understanding of what a drone is. However, the study also revealed two features of drones that the public seemed unsure about, namely whether drones have an on-board pilot or not, and whether drones can be as large as commercial planes. Further analysis also reveals that those who are male, working in engineering industry, or more educated were more knowledgeable about drone than females, working in nonengineering industry, or less educated."

5.20. "the public generally support the applications of drone for search and rescue purposes; where they were more conservative toward photography or videography that impose a more serious concern of privacy"

5.21. "The top 4 fears and concerns were misuse of drones by unauthorised personnel, inability to identify whether drones are filming or not, drones being a threat to one's physical safety, and loss of privacy."

5.22. "Not surprisingly, the media industry appears to have a huge impact on public perceptions and their understanding of drones."

5.23. TODO: Continue…

6. Clothier, Reece A., Dominique A. Greer, Duncan G. Greer, and Amisha M. Mehta. "Risk perception and the public acceptance of drones." Risk analysis 35, no. 6 (2015): 1167-1183.

6.1. https://eprints.qut.edu.au/80007/1/Authors%20Version%20-%20Manuscript%20Final.pdf

6.2. "The neutral response is likely due to a lack of knowledge about the technology, which was also identified as the most prevalent public concern as opposed to the risks associated with its use. Privacy, military use and misuse (e.g., terrorism) were also significant public concerns. The results suggest that society is yet to form an opinion of drones."

7. Gurl, Emet. "SWOT analysis: A theoretical review." (2017).

7.1. https://www.academia.edu/download/109539676/jisr.2017.pdf

7.2. "SWOT Analysis is an analysis method used to evaluate the 'strengths', 'weaknesses', 'opportunities' and 'threats' involved in an organization, a plan, a project, a person or a business activity"

7.3. “Based on SWOT Analysis, organizations can choose the appropriate strategy.”
7.4. “Strategic choice is associated with vision, mission, objectives and the external and internal analysis of the organization; an organization is willing to make strategic choices. This is to say that an organization is able to choose its ‘theory of how to obtain a competitive advantage’.”
7.5. (Image) “Vision -> Mission -> Objectives -> ExternalInternal analysis” -> Strategic choice -> Strategy implementation -> Competitive advantage”
7.6. “SWOT Analysis is therefore a significant tool for situation analysis that helps the managers to identify organizational and environmental factors.”
7.7. “Strength is the characteristic that adds value to something and makes it more special than others.”
7.8. “Weakness refers to not having the form and competency necessary for something.”
7.9. “Opportunity means a situation or condition suitable for an activity. Opportunity is an advantage and the driving force for an activity to take place.”
7.10. “Threat is a situation or condition that jeopardizes the actualization of an activity.”
7.11. “The historical background of SWOT Analysis is as old as the concept of strategic planning. For this reason, it has been identified with strategic planning and accepted as the primary element of the strategic planning process.”
7.12. “SWOT Analysis can be applied at different analytical levels -individual level, organizational level, national level, international level-. It can be used by educational institutes, non-profit organizations, countries, governments, projects on multiculturalism etc.”
7.13. “Listing strengths on paper is prone to bias and is very different from testing the organization and experiencing the strengths at work.”
7.14. “Categorization of variables into one of the four SWOT quadrants is challenging. The same factor can be fitted in two categories. A factor can be a strength and a weakness at the same time. In addition, strengths that are not maintained may become weaknesses. Opportunities not taken, but adopted by competitors, may become threats. The classification of a variable also depends on the purpose of the practice.”

8. Niedenthal, Paula M., Lawrence W. Barsalou, Piotr Winkielman, Silvia Krauth-Gruber, and François Ric. "Embodiment in attitudes, social perception, and emotion." Personality and social psychology review 9, no. 3 (2005): 184-211.
   8.1. https://barsaloulab.org/Online_Articles/2005-Niedenthal_et_al-PSPR-social_embodiment.pdf
9. Swann, William B. "Quest for accuracy in person perception: A matter of pragmatics." Psychological review 91, no. 4 (1984): 457.
   9.1. https://www.researchgate.net/profile/William-Swann-2/publication/16691423_Quest_for_accuracy_in_person_perception_A_matter_of_pragmatics/links/0912f50e4d69d9302f000000/Quest-for-accuracy-in-person-perception-A-matter-of-pragmatics.pdf
10. Noor, Norzalina, Sukor Beram, Fanny Khoo Chee Yuet, Kumaran Gengatharan, and Mohamad Syafiq Mohamad Rasidi. "Bias, Halo Effect and Horn Effect: A Systematic Literature." International Journal of Academic Research in Business & Social Sciences 13, no. 3 (2023): 1116-1140.

10.1. https://www.researchgate.net/profile/Sukor-Beram/publication/369600152_Bias_Halo_Effect_and_Horn_Effect_A_Systematic_Literature_Review/links/642a9bbf66f8522c38f29295/Bias-Halo-Effect-and-Horn-Effect-A-Systematic-Literature-Review.pdf

10.2. “An initiative has been taken to minimise the raters’ conflicting attitudes and biases that they might have brought to their assessment by giving them assessment criteria and performance samples and asking them to take part in the training program.”

10.3. “Thorndike initially noticed the halo effect when he discovered that supervisors could not judge their subordinates separately on various character personalities. The halo effect is a cognitive bias that causes people to see another person’s qualities in a way that matches their past impressions of other characteristics. This phenomenon is known as the halo effect, meaning that positive qualities are more likely to be ascribed to individuals who display positive qualities in other domains (Thorndike, 1920).”

10.4. “The halo effect is the perception of a company’s success or failure based on its reputation. Companies can be the object of a ‘halo effect’ when their reputation is high. A brand’s excellent reputation has a significant impact on the overall perception of product quality.”

10.5. “A ‘reverse halo effect’ is accountable for these stigmatising assessments. Halo effects are a cognitive bias that affects how people create impressions and decide (Thorndike, 1920).”

11. Thorndike, Edward L. "Intelligence examinations for college entrance." The Journal of Educational Research 1, no. 5 (1920): 329-337.

11.1. https://scholar.archive.org/work/frwzdpukvvc7zbn3guol6lfbie/access/ia_file/crossref-pre-1923-scholarly-works/10.1080%252F00220671.1920.10879060.zip/10.1080%252F00220671.1920.10879060.pdf

12. Chamayou, GrŽgoire. A Theory of the Drone. New Press, The, 2015.

12.1. https://www.manosparnai.lt/e107_files/public/1646669620_3181_FT64165_a_theory_of_the_drone_2015.pdf

12.2. “Months of monotony and milliseconds of mayhem.”

12.3. “The drone family is not composed solely of flying objects. There may be as many different kinds as there are families of weapons: terrestrial drones, marine drones, submarine drones, even subterranean drones imagined in the form of fat mechanical moles. Provided there is no longer any human crew aboard, any kind of vehicle or piloted engine can be “dronized.”

12.4. “The best definition of drones is probably the following: “flying, high-resolution video cameras armed with missiles.””

12.5. “But the central question would be this: How do drones affect the war situation? To what do they lead, not only in terms of their relation to the enemy but also in terms of the state’s relation to its own subjects?”

12.6. “Where did the drone come from? What is its technical and tactical genealogy? And what are its consequent fundamental characteristics? This weapon extends and radicalizes the existing processes of remote warfare and ends up by doing away with combat. But in so doing, it is the very notion of “war” that enters into crisis. A central problem arises: if the “war of drones” is no longer quite warfare, what kind of “state of violence” does it amount to?”

12.7. "It is clear enough that by making it unnecessary to expose American lives to combat, the drone indeed spares them. However, it is less clear to see how it might at the same time "save" any lives other than those."

12.8. "Within what legal framework do drone strikes take place today?"

13. U.S. Joint Chiefs of Staff. Department of Defense Dictionary of Military and Associated Terms. Joint Publication 1-02. Washington, DC: Joint Chiefs of Staff, 2010. Incorporating changes through September 15, 2011.

13.1. https://edocs.nps.edu/dodpubs/topic/jointpubs/JP1/JP1_02_110915.pdf

13.2. "drone - A land, sea, or air vehicle that is remotely or automatically controlled."

14. Connor, Dean T., Kieran Wood, Peter G. Martin, Sevda Goren, David Megson-Smith, Yannick Verbelen, Igor Chyzhevskyi et al. "Radiological mapping of post-disaster nuclear environments using fixed-wing unmanned aerial systems: A study from chornobyl." Frontiers in Robotics and AI 6 (2020): 149.

14.1. https://www.frontiersin.org/journals/robotics-and-ai/articles/10.3389/frobt.2019.00149/pdf

14.2. "This study presents a new radiation mapping UAS based on a lightweight (8 kg) fixed-wing unmanned aircraft and tests its suitability to mapping post-disaster radiation in the Chornobyl Exclusion Zone (CEZ)."

15. Clark, Lee Anna, and David Watson. "Constructing validity: New developments in creating objective measuring instruments." Psychological assessment 31, no. 12 (2019): 1412.

15.1. https://psycnet.apa.org/manuscript/2019-14248-001.pdf

15.2. "Measurement is fundamental in science, and, arguably, the two most important qualities related to measurement are reliability and validity."

15.3. "construct validity is the foundation of clinical utility. That is, to the extent that real-world decisions (e.g., eligibility for social services, psycho- or pharmaco-therapy selection) are based on psychological measurements, the quality of those decisions depends on the construct validity of the measurements on which they are based."

15.4. "practitioners increasingly are asked to justify use of specific assessment procedures to third-party payers. Use of psychological measures whose precision and efficiency are well established within an articulated theory that is well supported by multiple types of empirical data (i.e., measure that have demonstrated construct validity) may be required in the future."

15.5. "progress in psychological science, especially as we explore more deeply the interface between psychosocial and neurobiological systems, is critically dependent on measurement validity. Detailed understanding of brain activity will be useful only insofar as we can connect it to phenotypic phenomena, so the more validly and reliably we can measure experienced affects, behaviors, and cognitions, the more we will be able to advance psychology and neuroscience."

15.6. "More generally, conglomerate constructs rarely fulfill their enticing premise that the total is greater than the sum of its parts. If development of such a construct is pursued, the burden of proof is on the developer to show that the conglomerate is superior to the linear combination of its components."

15.7. "Good scale construction is an iterative process involving several stages of item writing, each followed by conceptual and psychometric analysis that sharpen one's understanding of the nature and structure of the target domain and may identify shortcomings in the initial item pool. For instance, factor analysis might identify

subscales and also show that the initial pool contains too few items to assess one or more content domains reliably.”

15.8. “Items should be simple, straightforward, and appropriate for the target population’s reading level. Avoid (1) expressions that may become dated quickly; (2) colloquialisms that may be not be familiar across age, ethnicity, region, gender, and so forth; (3) items that virtually everyone (e.g., "Sometimes I am happier than at other times") or no one (e.g., "I am always furious") will endorse; and (4) complex or "double-barreled" items that assess more than one characteristic; for example, “I would never drink and drive for fear that I might be stopped by the police," assesses both a behavior’s (non)occurrence and a putative motive. Finally, the exact phrasing of items can greatly influence the construct that is being measured. For example, the inclusion of almost any negative mood term (e.g., "I worry about...," I am upset [or bothered or troubled] by...") virtually guarantees a substantial neuroticism/ negative affectivity component to an item.”

15.9. “Currently, the two dominant response formats in personality and clinical assessment are dichotomous responding (e.g., true/false; yes/no) and Likert-type rating scales with three or more options.”

15.10. “Likert-type scales are used with various response formats, including frequency (e.g., "never" to "always"), degree or extent (e.g., "not at all" to "very much"), similarity (e.g., "very much like me" to "not at all like me"), and agreement (e.g., "strongly agree" to "strongly disagree").”

15.11. “With an odd number of response options, the middle option’s label must be considered carefully (e.g., "cannot say" confounds uncertainty with a mid-range rating such as “neither agree nor disagree”), whereas even numbers of response options force respondents to "fall on one side of the fence or the other," which some respondents dislike. However, Simms et al. found no systematic differences between odd versus even number of response options. More research of this type is needed using a broad range of constructs (e.g., psychopathology, attitudes), samples (e.g., patients, community adults), type of response formats (i.e., extent, frequency), and so on.”

15.12. “Smith, McCarthy, and Anderson (2000) provide an excellent summary of the many challenges in developing and validating short forms. They address the tendency to try to maintain a similar level of internal consistency (e.g., coefficient alpha) by narrowing the content, which leads into the classic attenuation paradox of psychometrics (Boyle, 1991; Loevinger, 1954): Increasing a test’s internal consistency beyond a certain point can reduce its validity relative to its initially intended interpretation(s).”

15.13. “Too often, scale developers assume that their initial conceptualization is entirely correct, considering only the measure as open to revision. However, it is critical to remain open to rethinking one’s initial construct—to “listen to the data” not “make the data talk.””

16. Zhou, Qihou H., Qina N. Zhou, and John D. Mathews. "Arithmetic average, geometric average, and ranking: Application to incoherent scatter radar data processing." Radio Science 34, no. 5 (1999): 1227-1237.

16.1. https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/1999RS900062

16.2. “We examine the statistical characteristics of three commonly used estimators, arithmetic average, geometric average, and ranking as applied to incoherent scatter radar observations in the presence of interference. While the arithmetic average is effective in reducing the statistical error, it is very sensitive to "outlier" contamination, such as meteor returns.”

16.3. “If the data contain only outlier contamination, the geometric average is a better choice than either simple arithmetic average or the single ranking method.”

16.4. “When a parameter to be measured contains statistical fluctuation, the arithmetic average is typically used to reduce the fluctuation (variance). Although this method is simple and efficient most of the time, it is not robust when the data contain spurious contamination such as statistical "outliers." The median method and geometric average are more robust than the arithmetic average in dealing with data containing outliers.”

V. Objectives

Hypotheses

1. H1 hypothesis: Knowledge about drones has a positive effect on their perception.
    1.1. $H1_0$: There is no positive relationship between the level of knowledge about drones and the level of positive perception towards them.
    1.2. $H1_1$: There is a positive relationship between the level of knowledge about drones and the level of positive perception (or attitude) towards them.
2. H2 hypothesis: Women perceive drones as a greater risk to their privacy than men.
    2.1. $H2_0$: There is no difference (or no greater risk) in the perceived threat of drones to personal privacy between women and men.
    2.2. $H2_1$: Women perceive a significantly greater risk from drones to their personal privacy than men.
3. H3 hypothesis: Urban society views the presence of drones more positively.
    3.1. $H3_0$: The urban population perceives the presence of drones more positively than the rural population.
    3.2. $H3_1$: There is no significant difference in the perception of drone presence between the urban and rural populations.
4. H4 hypothesis: There is a correlation between noise pollution and utility of a drone.
    4.1. $H3_0$: There is no negative correlation between the perceived usefulness of a drone and the perceived disturbance caused by its noise.
    4.2. $H3_1$: There is a negative correlation between the perceived usefulness of a drone and the perceived disturbance caused by its noise.

VI. Methods

Talking with colleagues and fellow researchers, the question seems to arise with increasing frequency: How does Hungarian society perceive drones in our everyday life? We decided that this question requires a definite answer in order to plan future solutions and be able to have a more educated discussion for future topics. For example: Should building codes for public institutions mandate Automated External Defibrillators (AEDs[13]) in their first aid stations or the social attitude will be open towards a delivered-by-drone solution. After a quick study in scientific databases we were not able to find any available and comprehensive research to have a confident answer for our question. Hence the idea for this thesis was outlined.

We did literature review in the field of sociology and drone technology in order to identify existing researches which discussed existing practices, questions, concerns and possibilities regarding social attitude towards drones. During literature review, one of my personal observation was that the majority of research in sociology deals with attitudes towards combat and military drones. This part of our research confirmed that work has to be done in order to answer the thesis originating question. During literature review we registered questions that other papers have examined.

Once we identified the most frequent and popular topics we have chosen 4 of them as our hypotheses: Knowledge of drones and positive attitude (H1), female perception of drones and privacy (H2), rural society perception compared to urban society perception (H3), correlation between noise pollution and utility of drones (H4).

After identifying the base concepts for the hypotheses of this thesis we started discussions on the topic on how to measure social acceptance. To solve this part, we utilised the Likert scale[14] as this is a psychometric scale used in research questionnaires. We debated on if our scale should measure from negative to positive interval, but this approach seemed complex to have a simple statistical analysis done on its results. We identified a possible, but unconventional, approach with the use of a SWOT analysis[15]. The SWOT analysis method is most often used to evaluate positive and negative factors affecting an organization and with another dimension we can even split our analysis into 2 additional factors, making the possible research categories into 4 quadrants: Internal positive factors as strengths (S), internal negatíve factors as weaknesses (W), external positive factors as opportunities (O) and finally, external negative factors as threats (T). With these 2 dimensions (2 axis) our measurements can cover a range of positive-negative and internal-external. We identified and chose 16 questions from our literature review in order to populate our SWOT analysis matrix, 4 questions into each SWOT analysis quadrant.

In order to collect primer data points for our research, we incorporated the 16 selected questions into a web based form and published it under an url. As we were not able to identify a clear group who can represent the Hungarian society, we decided rely on the Law of Large Numbers[16] in our sampling design. Obviously, we were prepared to check and explain the demographic properties of the questionnaire participants.

In order to be able to compute significance from the study, we designed a positive (SO_Attitude) and a negative (WT_Attitude) metric to measure the respective attitudes. For the H1, H2, and H3 hypotheses a Students's t-test[17] was used for determining a statistical significance. For the H4

[13] https://en.wikipedia.org/wiki/Automated_external_defibrillator 2025-12-04
[14] https://en.wikipedia.org/wiki/Likert_scale 2025-12-04
[15] https://en.wikipedia.org/wiki/SWOT_analysis 2025-11-26
[16] https://en.wikipedia.org/wiki/Law_of_large_numbers 2025-12-05
[17] https://en.wikipedia.org/wiki/Student%27s_t-test 2025-12-07

hypothesis, the Person correlation method was selected to test the statistical significance and direction of the correlating relationship.
Utilising the above methodology we were able to compute significance and conclude results listed in the attachment[18] of this thesis.

Questionnaire

Published URL

https://docs.google.com/forms/d/14u9qZOu3aKaElrWuNK4D5cvv9NpWyBvI0cJ8vtLcyok/preview

Selecting questions into SWOT quadrants

Strengths (S)

Identifier	Focus of the statement	Attitude statement
S1	Public safety	The everyday presence of drones significantly increases public safety.
S2	Logistics	Drones enable faster and more efficient services.
S3	Disaster management	Drones help in disaster and rescue situations.
S4	Cost-effectiveness	Utilising drones is cost-effective in a lot of situations than deploying people.

Weaknesses (W)

Identifier	Focus of the statement	Attitude statement
W1	Noise pollution	The everyday presence of drones leads to disturbing noise pollution.
W2	Critical infrastructure	Drones possess a threat for critical infrastructure.
W3	Reliability	Drones are not yet technologically reliable.
W4	Immediate risk	Drones imply a great risk of physical threat for anyone who stands under them.

Opportunities (O)

Identifier	Focus of the statement	Attitude statement
O1	Labor market	The rapid spread of drones provide new jobs in the field of drone development, operations and service.
O2	Agriculture	Drones revolutionize the agricultural sector.

18 https://docs.google.com/document/d/1yhSNHgqUFwsVsQNXPbZdSon4-wTsxca2BZebGvT83HU/edit?tab=t.0#bookmark=id.4vozlqfw3358 2025-12-07

O3	Transportation	Utilising drones decreases traffic and environmental pollution on public roads.
O4	Research	Drone technology promotes scientific research and increases a country's potential for innovation.

Threats (T)

Identifier	Focus of the statement	Attitude statement
T1	Privacy	The spread of drones seriously endangers privacy.
T2	Accidents	Drones increase the risk of accidents in the airspace.
T3	Malicious act	Drones make it easier to execute malicious acts.
T4	Regulation	Drones require complex and expensive regulation of the airspace.

Demographic questions

Gender[19]

This question has 2 choices (Male, Female) and an "other" free entry text field.

Grouping questions

How familiar are you with drones or how often do you use them?[20]

This question had 4 group choices:

1. I have never encountered or engaged with drones[21]
2. I am aware of them; I have seen or heard about them in the media or in my environment[22]
3. I have operated a drone for a short period (e.g., at a friend's house)[23]
4. I regularly use drones (e.g., for hobby or as a profession)[24]

In order to group questionnaire participants into 2 groups for the independent samples Student's t -test, the following mapping have been applied:

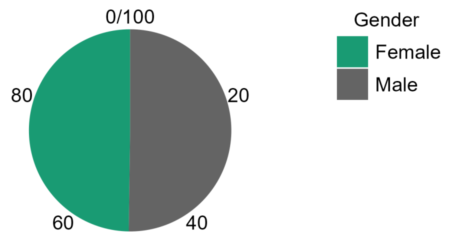
Old group	New group (Familiarity group)
I have never encountered or engaged with drones	Less
I am aware of them; I have seen or heard about them in the media or in my environment	Less
I have operated a drone for a short period (e.g., at a friend's house)	More
I regularly use drones (e.g., for hobby or as a profession)	More

[19] Neme
[20] Mennyire ismeri vagy használja a drónokat?
[21] Soha nem találkoztam / nem foglalkoztam velük
[22] Láttam már, vagy hallottam róluk a médiában / környezetemben
[23] Kezeltem már drónt rövidebb ideig (pl. ismerősnél)
[24] Rendszeresen használok drónt (pl. hobby vagy munka céljából)

VII. Results

Demographic profile

Gender

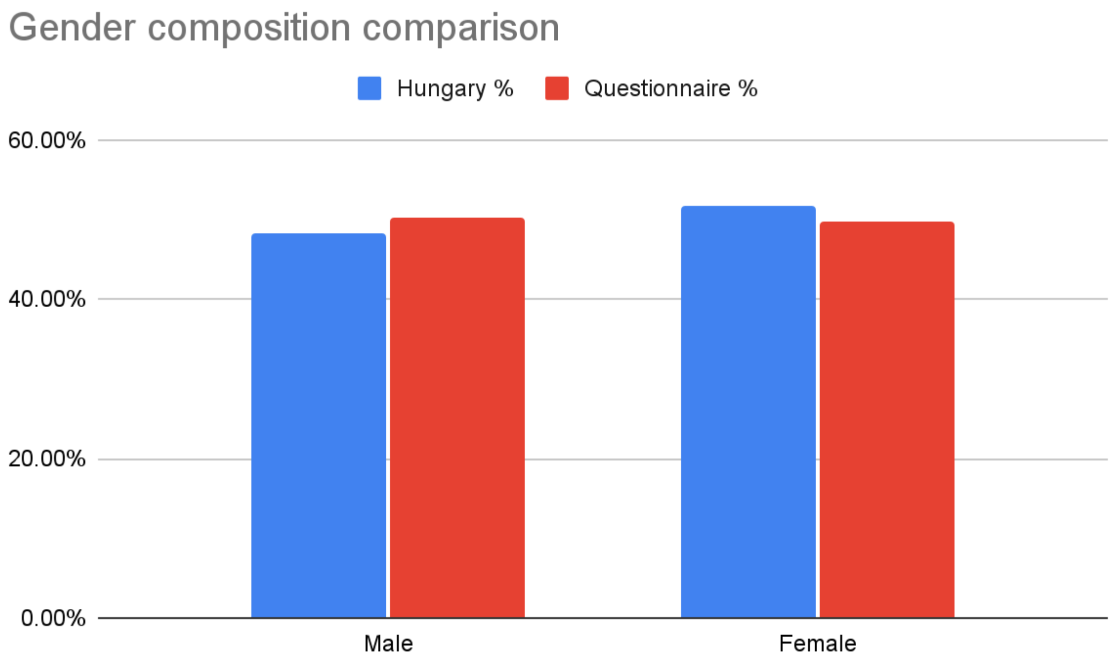


Image[25]: A pie chart showing the gender ratio of the questionnaire participants.

Descriptive Statistics

	Gender
Valid	233
Missing	0

Table[26]: Descriptive statistics of the gender responses of the questionnaire participants.



Image[27]: Hungary and questionnaire responders gender composition comparison.

	Hungary	Questionnaire	Hungary %	Questionnaire %	Difference
Male	4,605,666	117	48.28%	50.21%	1.93%

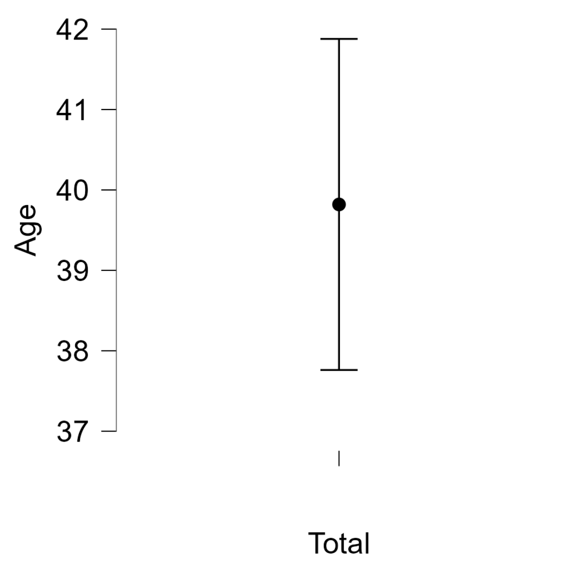
[25] Gender.png
[26] DroneResearch
[27] DroneResearch

Female	4,933,836	116	51.72%	49.79%	-1.93%
Total	9,539,502	233			

Table[28]: The gender composition comparison of Hungary and the questionnaire participants.

Comparing Hungary's gender composition from the KSH website[29] with the thesis questionnaire participants, we see a small difference of 1.93% male overrepresentation and 1.93% female underrepresentation.

Age

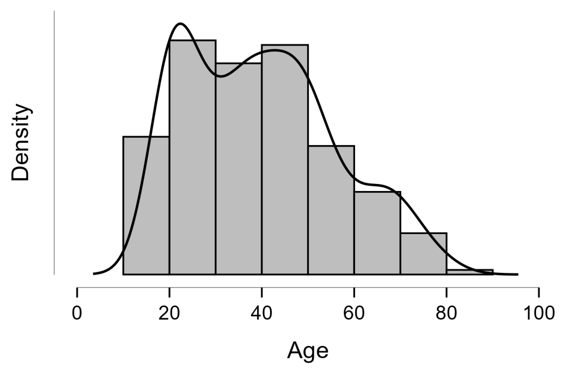
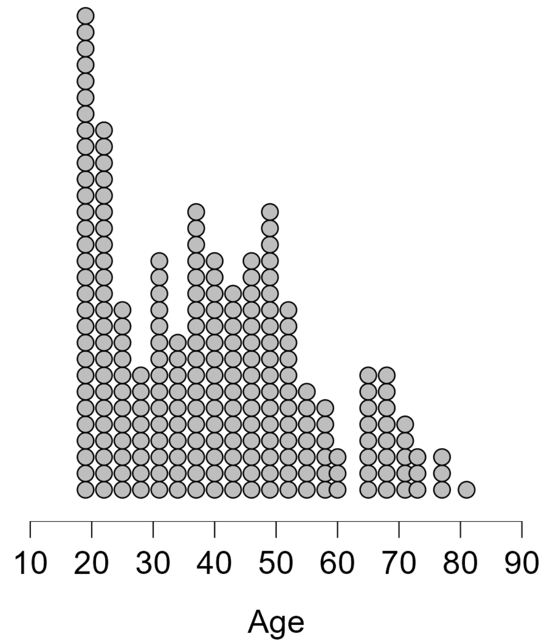


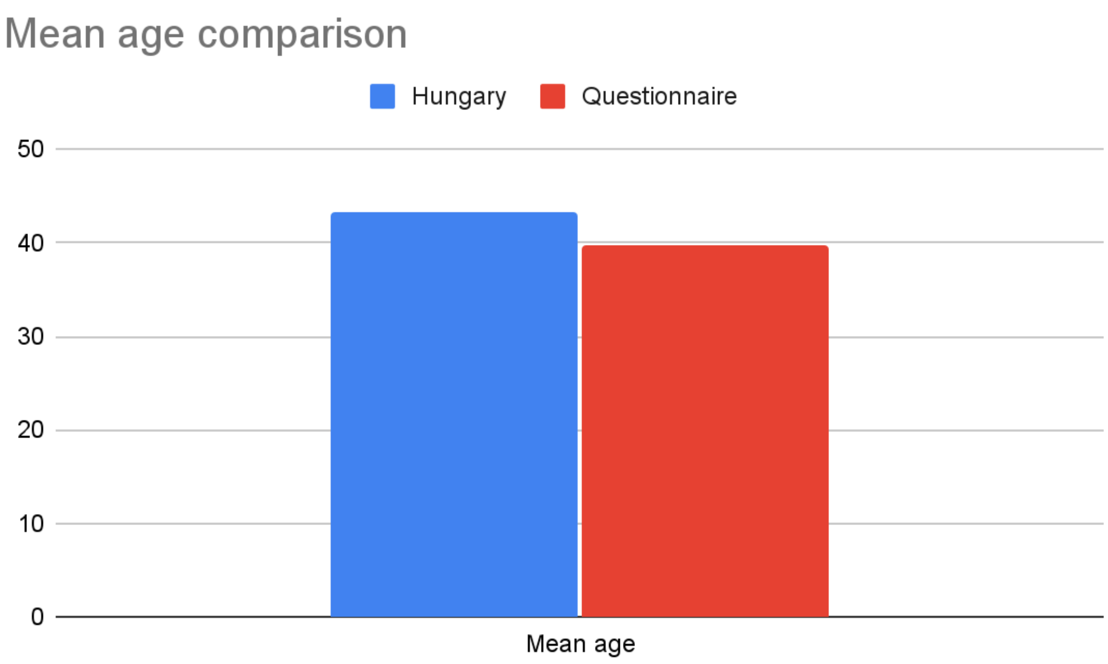
Image[30]: The interval plot of the age value from the questionnaire.

Descriptive Statistics	
	Age
Valid	233
Missing	0
Median	39
Mean	39.82
Std. Deviation	16.03
MAD	13
Range	63
Minimum	18
Maximum	81

Table[31]: The descriptive statistics of the age values from the questionnaire.

[28] DroneResearch
[29] https://www.ksh.hu/stadat_files/nep/en/nep0001.html 2026-01-31
[30] Age_interval_plot.png
[31] DroneResearch

	
Image[32]: Age distribution plot of the age value of the questionnaire participants.	Image[33]: Dot plot of the age value from the questionnaire.



Image[34]: Hungary and questionnaire responders mean age comparison.

[32] Age_distribution_plot.png
[33] Age_dot_plot.png
[34] DroneResearch

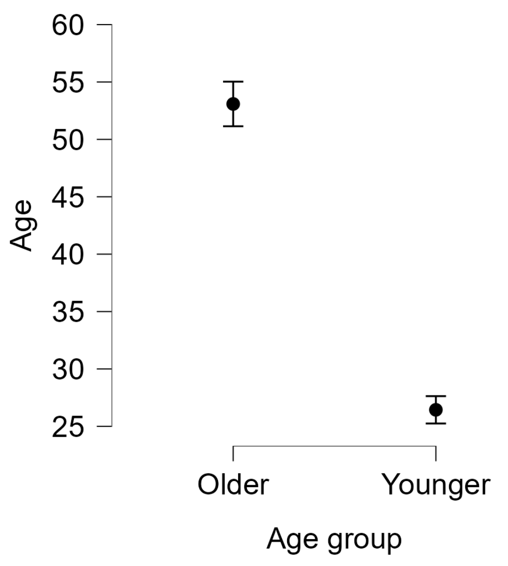
	Hungary	Questionnaire
Mean age	43.4	39.82
Standard deviation	unknown	16.03
Difference (absolute)		-3.58
Difference (percentage)		8.25%

Table[35]: Age comparison of Hungary and the thesis questionnaire.

Comparing the questionnaire responders mean age to the data available on the KSH website[36], we start to see a bigger deviation than we can see at the gender composition. The thesis questionnaire participants' arithmetic mean of age is 3.58 years younger than the Hungarian population's mean age.

Age group

The life expectancy at birth year in Hungary in 2024 was 76.64 years. We decided to half this value (38.32 years) and split the participants into the older and younger age groups according to their age submitted in the questionnaire.



Image[37]: The interval plot of age groups.

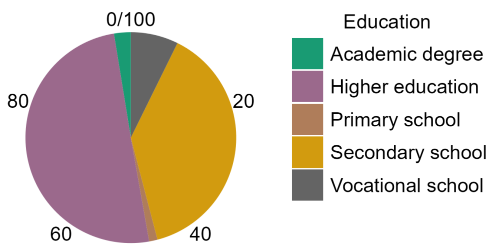
Descriptive Statistics

	Age	
	Older	Younger
Valid	117	116
Missing	0	0
Median	50	24.5
Mean	53.09	26.44
Std. Deviation	10.73	6.547
MAD	7	4.5
Range	42	20
Minimum	39	18
Maximum	81	38

Table[38]: Descriptive statistics of the questionnaire participants grouping into age groups by their selected age on the questionnaire.

35 DroneResearch
36 https://www.ksh.hu/stadat_files/nep/en/nep0001.html 2026-01-30
37 Age_group.png
38 DroneResearch

Education

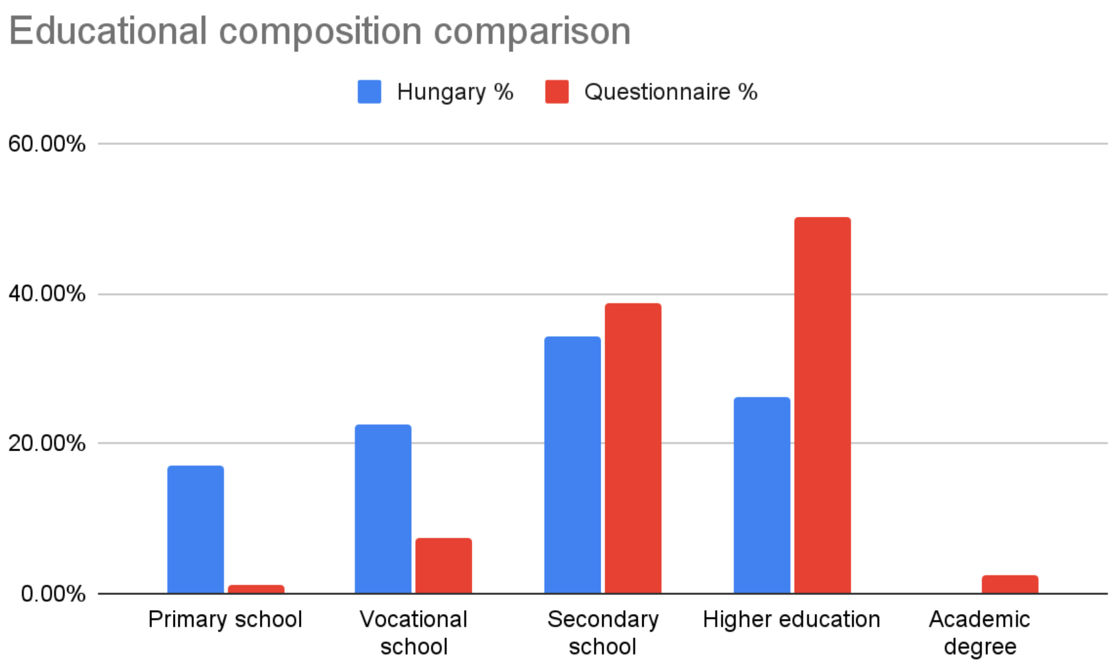


Image[39]: Pie chart of the distribution of the education among questionnaire participants.

Descriptive Statistics

	Education
Valid	233
Missing	0

Table[40]: Descriptive statistics of the education values selected by the questionnaire participants.



Image[41]: Hungary and questionnaire participants

	Hungary	Questionnaire responders	Hungary %	Questionnaire %	Difference
Primary school	1,221,200	3	17.06%	1.29%	-15.78%
Vocational school	1,606,100	17	22.44%	7.30%	-15.15%
Secondary school	2,448,800	90	34.22%	38.63%	4.41%

39 Education.png
40 DroneResearch
41 DroneResearch

Higher education	1,877,700	117	26.24%	50.21%	23.98%
Academic degree	2,919	6	0.04%	2.58%	2.53%
Total	7,156,719	233			

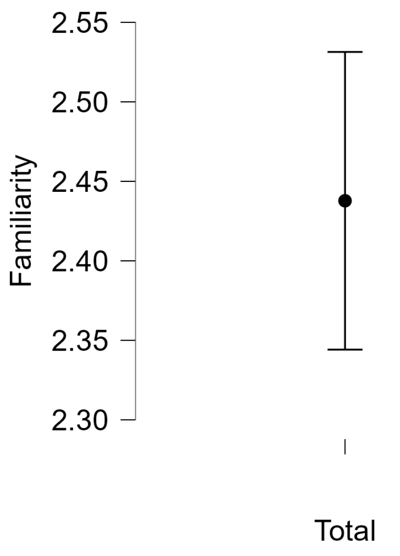
Examining the difference between the Hungarian educational composition and questionnaire participants' educational composition, we can see that the higher than vocational school education is overrepresented and the lower education is underrepresented. The secondary school and academic degree representation is the closest to the Hungarian levels. The higher education group is the most overrepresented (by 23. 98%).

Familiarity

We asked the questionnaire participants to define their level of familiarity with drones: "To what extent are you familiar with or do you use drones?[42]". The questionnaire provided 4 options to choose from:

1. I have never encountered or dealt with them[43]
2. I have seen or heard about them in the media or in my surroundings[44]
3. I have operated a drone for a short time (e.g., at a friend's or acquaintance's)[45]
4. I use drones regularly (e.g., for hobbies or work)[46]

And we assigned a numerical value for analytical purposes for each answer: 1-4. This can be considered as a 4 level Likert. The mean of the scale is 2. 5.



Image[47]: The interval plot of the familiarity values of the questionnaire.

Descriptive Statistics

	Familiarity
Valid	233
Missing	0
Median	2
Mean	2.438
Std. Deviation	0.729
MAD	0
Range	3
Minimum	1
Maximum	4

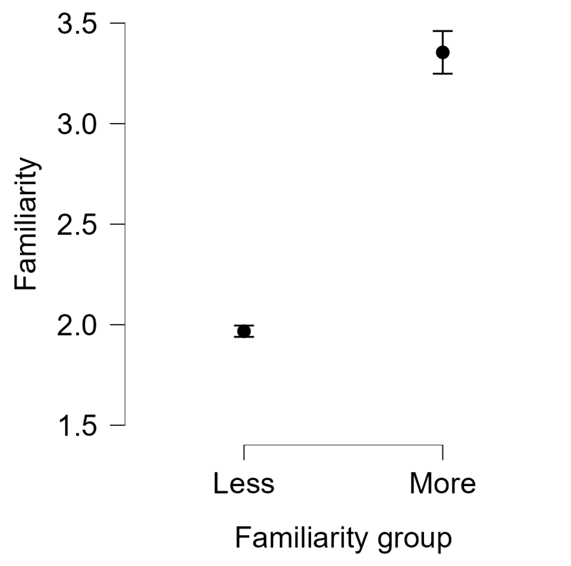
Table[48]: Descriptive statistics of the questionnaire participants familiarity with drones.

[42] Translation from: Mennyire ismeri vagy használja a drónokat?
[43] Translation from: Soha nem találkoztam / nem foglalkoztam velük
[44] Translation from: Láttam már, vagy hallottam róluk a médiában / környezetemben
[45] Translation from: Kezeltem már drónt rövidebb ideig (pl. ismerősnél)
[46] Translation from: Rendszeresen használok drónt (pl. hobby vagy munka céljából)
[47] Familiarity.png
[48] DroneResearch

The questionnaire responses are 2.48% (2.438 vs. 2.5) under the mean of the scale.

Familiarity group

Derived from the numerical familiarity values we introduce the familiarity group concept to categorise and make observations possible. As the questionnaire familiarity group values mean is close to the possible mean value of the questionnaire options we decided to split the questionnaire participants into two categories (groups). “Less” and “More”.



Descriptive Statistics		
	Familiarity	
	Less	More
Valid	154	79
Missing	0	0
Median	2	3
Mean	1.968	3.354
Std. Deviation	0.178	0.481
MAD	0	0
Range	1	1
Minimum	1	3
Maximum	2	4

Image[49]: The interval plot of the questionnaire participants drone familiarity values categorised into 2 groups.

Table[50]: Descriptive statistics of the questionnaire participants grouping into familiarity groups by their drone familiarity scale.

Settlement type

In order to map the questionnaire participants to a settlement, we asked them to provide their postal code. With this feature in the questionnaire we still were able to anonymize the responses and have a very good understanding of the questionnaire participants' background.

Reliability analysis

TODO: How many total questionnaire submissions and how it was filtered.

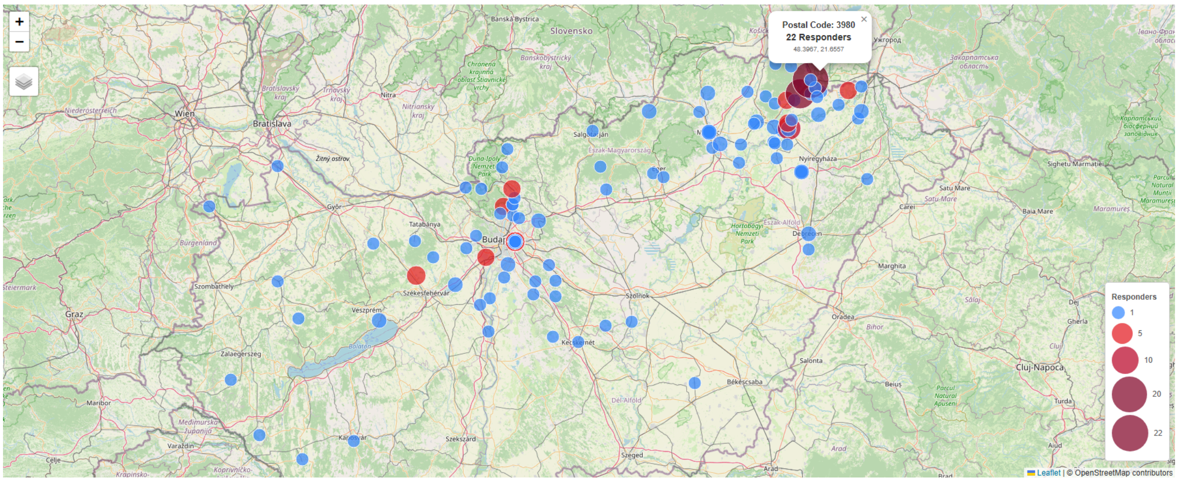
Frequentist Scale Reliability Statistics				
			95% CI	
Coefficient	Estimate	Std. Error	Lower	Upper

[49] Familiarity_group.png
[50] DroneResearch

Coefficient ω	0.75	0.02	0.70	0.79
Coefficient α	0.79	0.02	0.75	0.84
Mean	3.42	0.04	3.35	3.48
SD	0.53	0.03	0.49	0.58

Examining the questionnaire submissions consistency with Cronbach's α, we can see an acceptable reliability ($\alpha = 0.79,\ 95\%\ CI\ [0.75,\ 0.84]$).

Spatial analysis



Image[51][52]: The postal codes of the questionnaire responders displayed on the map of Hungary with counts, represented with circle size and color.

The geographical distribution of the questionnaire responders, based on postal codes, reveals a significant concentration around the University of Tokaj and the capital, Budapest. Examining the map will tell us that the southern part of Hungary is probably under-represented.

[51] Questionnaire_responses_Hungary.png
[52] https://research.artidas.hu/DroneResearch/map_v2 2026-01-30

Word cloud

Image[53]: The Hungarian word cloud of the questionnaire question “What is your greatest fear or hope concerning drones?”[54].

Image[55]: The English word cloud of the questionnaire question “What is your greatest fear or hope concerning drones?”[56].

Descriptive analysis of variables

TODO:

[53] Thesis_WordCloud_Hungarian.png
[54] Translated from: Mi a legnagyobb félelme/reménye a drónokkal kapcsolatban?
[55] Thesis_WordCloud_English.png
[56] Translated from: Mi a legnagyobb félelme/reménye a drónokkal kapcsolatban?

Hypothesis testing

TODO:

Methodology

Tested hypothesis	Statistical test	Significance measurement	Result interpretation
$H1$, $H2$, $H3$	Independent samples t-test	The t-test compares the means between two independent groups.	If $p < 0.05$, then the effect is statistically significant (reject H_0)
$H4$	Person and Spearnam correlation	Correlation measures the strength and direction of the linear relationship between two continuous variables.	If $p < 0.05$, then the effect is statistically significant (reject H_0)

Significance

Hypothesis	Statistical Test	Dependent Variable	Value	Result	Conclusion
H1: Knowledge has a positive effect on attitude	t-test	$SO\_Attitude$ (Positive attitude)	$p = 0.031$	Statistically significant ($p < 0.05$)	Confirmed: Higher knowledge is associated with a more positive perception.
H2: Women perceive greater privacy concerns than men	t-test	$WT\_Attitude$ (Negative attitude)	$p = 0.773$	Not statistically significant ($p \geq 0.05$)	Not confirmed: No significant difference between genders was found in overall threat perception.
H3: Urban population has a more positive attitude	t-test	$WT\_Attitude$ (Negative attitude)	$p = 0.002$	Statistically significant ($p < 0.05$)	Surprising inverse finding: Urban residents hold a significantly higher negative attitude toward drones than rural residents.
H4: Inverse correlation between utility and noise	Pearson and Spearman Correlation	$SO\_Attitude$ (Positive attitude) vs. W1 (Noise)	$p < 0.001$ $r = -0.208$	Statistically significant ($p < 0.05$)	Confirmed: Greater perceived utility is strongly linked to lower sensitivity to noise pollution.

Hypotheses

H1: Knowledge about drones has a positive effect on their perception

We categorized the questionnaire participants into 2 groups by their response on the "How familiar are you with drones or how often do you use them?"[57] question.

Descriptives

Group Descriptives	Group	N	Mean	SD	SE	Coefficient of Variation
SO_Attitude	Less	154	3.766	0.666	0.054	0.177
	More	79	3.962	0.624	0.070	0.158
WT_Attitude	Less	154	3.061	0.718	0.058	0.235
	More	79	2.881	0.762	0.086	0.265

Independent samples t-test (Student's t-test)

	t	df	p	Mean Difference	SE Difference
SO_Attitude	-2.171	231	0.031	-0.196	0.090
WT_Attitude	1.769	231	0.078	-0.180	0.101

Conclusion

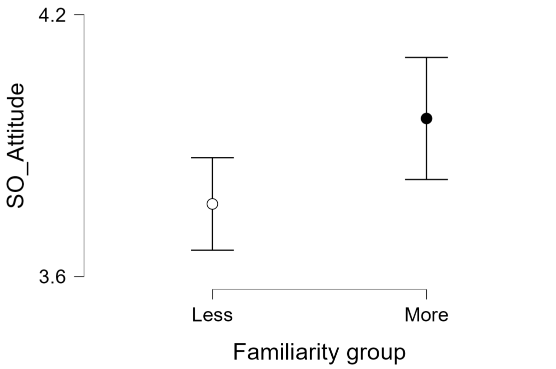
Descriptives for H1 (Knowledge positively affects drone perception) support the hypothesis by comparing attitude means between groups with Less and More drone knowledge.

Positive Attitude (SO_Attitude): The "More" knowledge group shows a higher mean (3.962 vs. 3.766) and less variation ($SD = 0.666$, $Coefficient\,of\,Variation = 0.177$), indicating a stronger, more consistent positive perception.

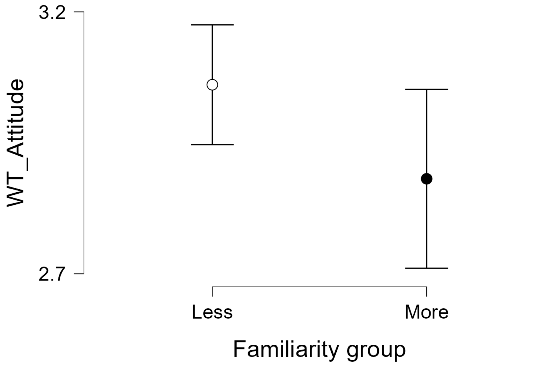
Negative Attitude (WT_Attitude): The "More" knowledge group has a lower mean (2.881 vs. 3.061), suggesting less negative concern, which also supports a more positive perception.

These descriptive patterns confirm the statistically significant H1 result ($p = 0.031$): higher drone knowledge correlates with both higher positive and lower negative attitude scores.

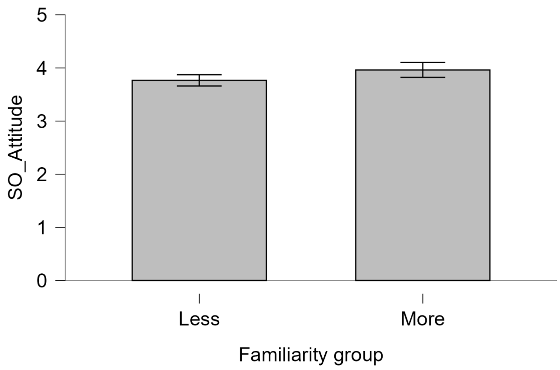
[57] Drones in Everyday Life: A SWOT Analysis of Social Perception in Hungary



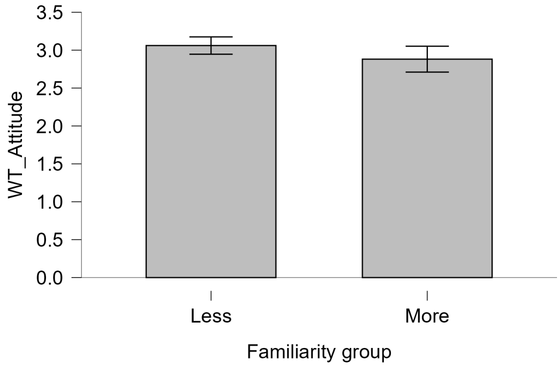
Image[58]: Positive attitude (SO_Attitude) comparison with descriptive plots between the two familiarity groups (More, Less).



Image[59]: Negative attitude (WT_Attitude) comparison with descriptive plots between the two familiarity groups (More, Less).



Image[60]: Positive attitude (SO_Attitude) comparison with bar plots between the two familiarity groups (More, Less).



Image[61]: Negative attitude (WT_Attitude) comparison with bar plots between the two familiarity groups (More, Less).

58 H1_descriptives_SO_Attitude.png
59 H1_descriptives_WT_Attitude.png
60 H1_bar_plots_SO_Attitude.png
61 H1_bar_plots_WT_Attitude.png

H2: Women perceive drones as a greater risk to their privacy than men

Descriptives

Group Descriptives	Group	N	Mean	SD	SE	Coefficient of Variation
SO_Attitude	Male	117	3.893	0.652	0.060	0.168
	Female	116	3.772	0.659	0.061	0.175
WT_Attitude	Male	117	3.014	0.771	0.071	0.256
	Female	116	2.986	0.704	0.065	0.236

Independent samples t-test (Student's t-test)

	t	df	p	Mean Difference	SE Difference
SO_Attitude	1.415	231	0.158	0.122	0.086
WT_Attitude	0.288	231	0.773	0.028	0.097

Conclusion

The analysis indicates that the null hypothesis ($H2_0$) (there is no difference in the perceived threat of drones to personal privacy between women and men) was not rejected.
This suggests that, for the measured group, gender does not play a significant role in determining the overall negative attitude toward drones (which includes privacy and threat concerns).

H3: Urban society views the presence of drones more positively

Descriptives

Group Descriptives	Group	N	Mean	SD	SE	Coefficient of Variation
SO_Attitude	Rural	65	3.812	0.664	0.082	0.174
	Urban	168	3.841	0.656	0.051	0.171
WT_Attitude	Rural	65	2.760	0.621	0.077	0.225
	Urban	168	3.093	0.758	0.058	0.245

Independent samples t-test (Student's t-test)

	t	df	p	Mean Difference	SE Difference
SO_Attitude	-0.304	231	0.761	-0.029	0.096

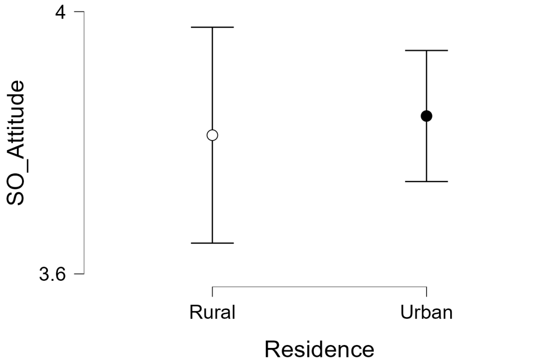
WT_Attitude	-3.158	231	0.002	-0.333	0.106

Conclusion

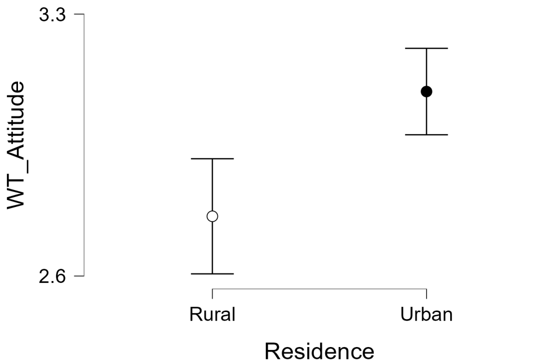
This result is a surprising inverse finding. The initial expectation, typical in innovation adoption studies, was that urban areas (with higher density, technology familiarity and greater exposure to potential smart city applications) would be more receptive.
Instead, the higher negative attitude (WT_Attitude) in urban settings suggests that city dwellers are more acutely sensitive to negative factors of drone usage.

1. Noise pollution (W1): In dense environments, the noise drones make are more likely to be perceived as disturbing.
2. Privacy concerns (T1): Higher density means drones are more likely to capture private spaces, increasing surveillance and privacy anxieties.

These findings imply that any drone implementation in urban centers (such as delivery or surveillance operations) requires strict regulation and careful service design to mitigate perceived disturbances and risks, rather than simply focusing on the technological utility. This runs counter to strategies targeting early technology adopters often found in urban hubs.

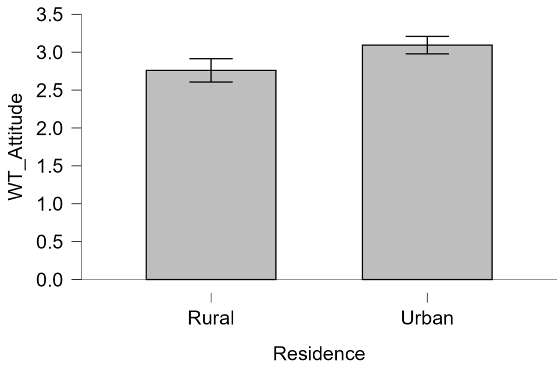


Image[62]: Positive attitude (SO_Attitude) comparison with descriptive plots between the two residency groups (Rural, Urban).



Image[63]: Negative attitude (WT_Attitude) comparison with descriptive plots between the two residency groups (Rural, Urban).

Image[64]: Positive attitude (SO_Attitude) comparison with bar plots between the two residency groups (Rural, Urban).



Image[65]: Negative attitude (WT_Attitude) comparison with bar plots between the two residency groups (Rural, Urban).

[62] H3_descriptives_SO_Attitude.png
[63] H3_descriptives_WT_Attitude.png
[64] H3_bar_plots_SO_Attitude.png
[65] H3_bar_plots_WT_Attitude.png

H4: There is a correlation between noise pollution and utility of a drone

Descriptives

	Positive attitude (SO_Attitude)				
W1 Likert	1	2	3	4	5
Valid	38	54	88	35	18
Missing	0	0	0	0	0
Median	4.125	4.000	3.875	4.000	3.313
Std. Deviation	4.105	3.794	3.831	3.861	3.326
Coefficient of variation	0.167	0.172	0.153	0.135	0.269
Variance	0.472	0.424	0.343	0.270	0.804
Range	3.500	2.750	2.750	1.875	2.750
Minimum	1.500	2.125	2.250	2.750	2.000
Maximum	5.000	4.875	5.000	4.625	4.750

Pearson and Spearman Correlation

Note: All tests are one-tailed for negative correlation.

			Pearson		Spearman		
		n	t	p	r	p	Covariance
W1	SO_Attitude	233	-0.208	<0.001	-0.176	0.004	-0.155

Conclusion

The correlation analysis performed to test H4 found a p-value of < 0.001. Since this value is well below the conventional $\alpha = 0.05$ significance threshold, the result is deemed statistically significant. The null hypothesis ($H4_0$), which stated there is no negative correlation between perceived usefulness and noise disturbance, is therefore rejected.

The strength and direction of the linear relationship were measured using the Pearson correlation coefficient (r). The coefficient is negative ($r =- 0.208$). This confirms the hypothesized inverse relationship: As the score for perceived utility (SO_Attitude) increases (more positive), the score for perceived noise disturbance (W1) decreases (less disruptive). The magnitude of the correlation ($|r| \approx 0.2$) suggest a weak, but measurable relationship.

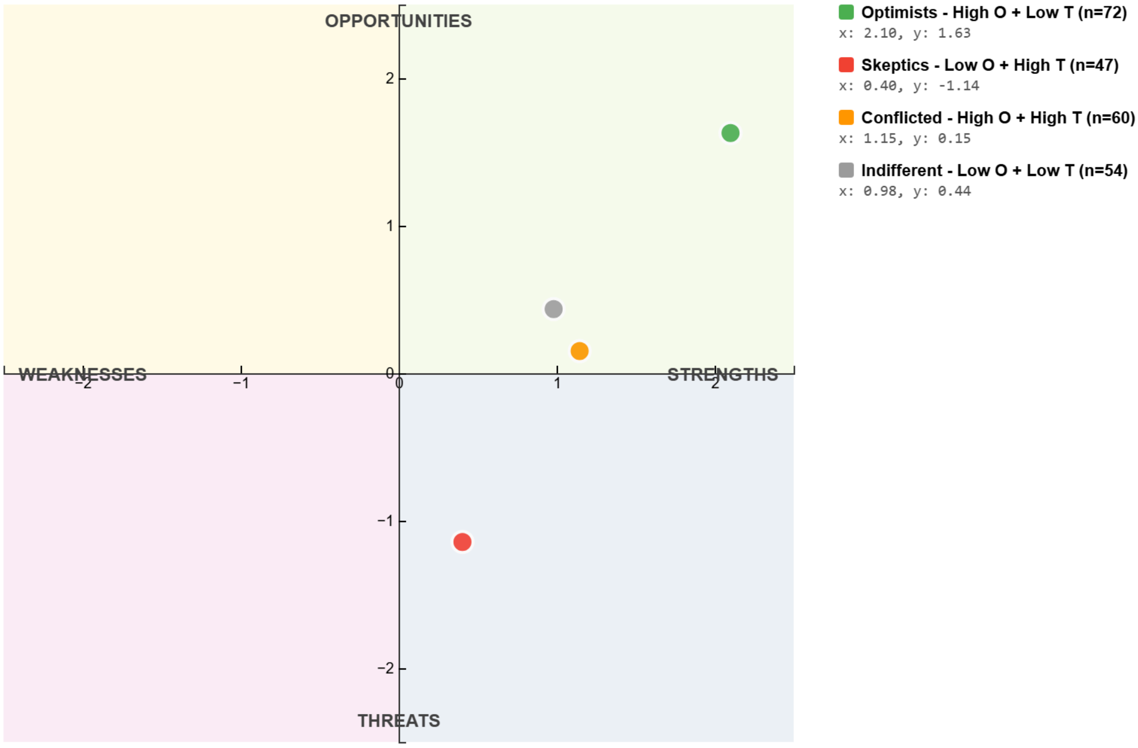
This is a critical implication for adoption strategies: Focusing on tangible benefits and positive services is more likely effective in increasing public tolerance for nuisance like noise than trying to address the noise issue in isolation.

Psychographic Clusters (Optimist vs Skeptic)

We split the questionnaire participants into 4 categories. Optimists, skeptics, conflicted and indifferent. The split will be done on the arithmetic average of the opportunity attitude (O_attitude value[66]):

$$O\_Attitude = \frac{O1+O2+O3+O4}{4}$$

The purpose of this split is to inspect how the questionnaire participants perceive drones in their everyday life.



Image[67]: Strategic Comparison (Clusters).

Cluster	Optimists	Skeptics	Conflicted	Indifferent
Profile	High opportunity (O) + low threat (T)	Low opportunity (O) + high threat (T)	High opportunity (O) + high threat (T)	Low opportunity (O) + low threat (T)
n	72	47	60	54
x	2.10	0.40	1.15	0.98
y	1.63	-1.14	0.15	0.44
% of total	30.90%	20.17%	25.75%	23.18%

66 Drones in Everyday Life: A SWOT Analysis of Social Perception in Hungary
67 SWOT_clusters_net_position.png

The "Optimists", alias "Champions"

Strong conviction. The optimists clusters x-axis value is very high (2.10). They probably believe drones are reliable, capable and barely see any weaknesses. These people do not require any convincing and can be the biggest advocates if mobilized for the popularity of drones.

The "Skeptics", alias "Resisters"

Surprisingly, the skeptics x-axis value is still positive (0.40). They probably admit the drone technology works and is necessary. We could translate this as they believe drones are not "bad junk", but "dangerous tools". Their negative y-axis $(-\ 1.14)$ shows they still see the downsides. They do not see enough value to justify the risk. These people cannot be won with strengths. We can only mitigate their opposition by addressing the threats with strict safety regulations.

The "Conflicted", alias "Swinging vote"

They are the most critical groups for policy makers and usually held back by fear. If we address the conflicted clusters' fears with regulations and safety precautions, they probably migrate to the optimist camp. If we ignore their concerns, they will slide into skepticism.

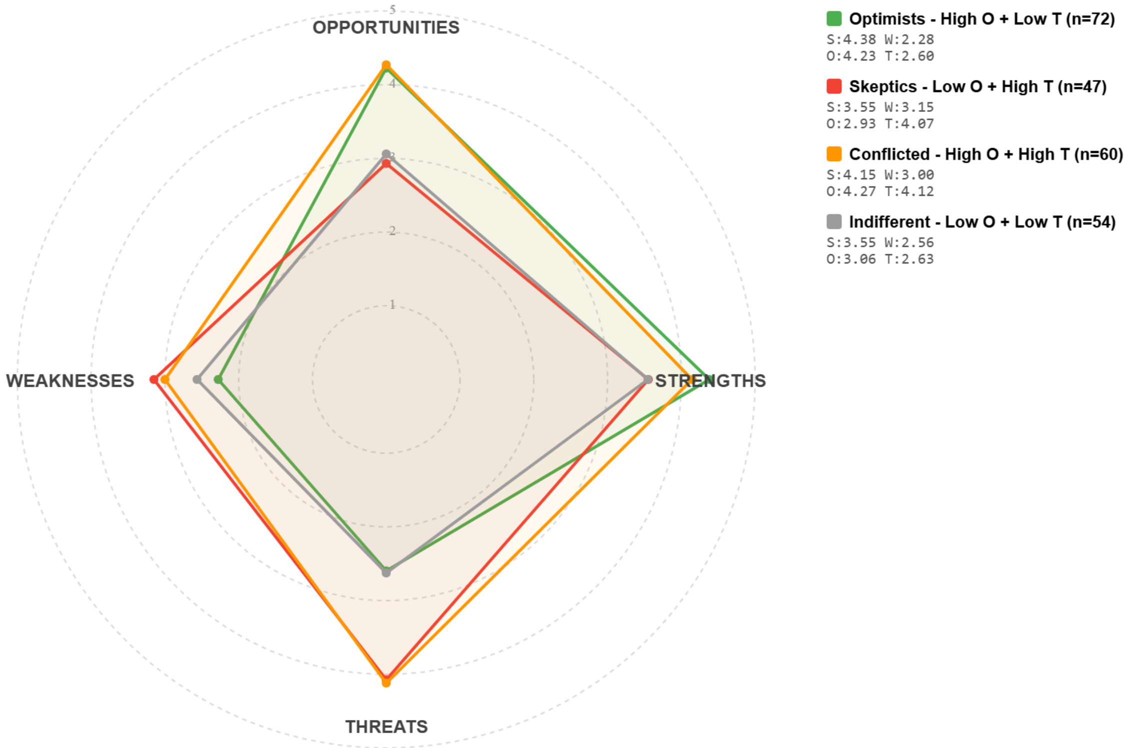
The "Indifferent", alias "Silent majority"

Their score usually found near the origo of the x and y axis. Probably, for them, the drones are just a toy. They do not see the technology as a life-changing opportunity or a civilization-ending threat. For them, drones are toys and a niche tool. Will not oppose drones around themselves, but will be unengaged.

Conclusion

This split signifies that the barrier to drone acceptance is external threats and not internal weaknesses.

1. The technology is accepted. Even the skeptics has a positive x-axis value (0.40).
2. Fear is the divider, The considerable y-axis distance (2.77) between optimists $(y = 1.63)$ and skeptics $(y =- 1.14)$ is entirely driven by how external threats (privacy, safety) are perceived.
3. There are a considerable percentage (total $n = 233$ of which 60 is conflicted (25.75%)) of people who are ready to support drones if their fears are reassured.
4. Future drone integration strategies should focus on regulatory frameworks that mitigate perceived threats instead of proving the drone technology's capability.



Image[68]: Component Comparison (Clusters).

[68] SWOT_clusters_components.png

VIII. Discussions

1. What is the best method to analyze social attitude towards a conception?
2. What are the advantages and disadvantages of a few level (e.g: 5) versus many level Likert scale (e.g: 10)?
3. An odd or even leveled Likert scale would provide more precise results for our measurements?
4. What demographic group would have the most positive attitude towards drones?
5. What demographic group would have the most negative attitude towards drones?
6. What comes to mind when they hear a drone rotor?
7. What could be the best methodology representing average for our purpose? Mean, median, mode?

IX. Conclusions

X. Future work

1. Implementing the questionnaire into our own website and solution.
2. Continuously monitor the drone perception among questionnaire participants.
3. Testing and analysing for different averages (geometric, median, mode).
4. Incorporate the same demographic splits as the Hungarian KSH website uses, for a much more comprehensive check on representation.
5. Spatial analysis of Hungary's population density compared to the questionnaire participants' postal code density.
6. Create a questionnaire to test what the generic population associates with the word: Drone.
7. Considerations on how to split the population into older and younger buckets
    - 7.1. Maybe instead of the half value of the average life expectancy at birth can be improved upon.
    - 7.2. Maybe the average age from the Hungarian KSH website[69]?

[69] https://www.ksh.hu/stadat_files/nep/en/nep0002.html 2026-02-03

XI. Attachments

Formulas and metrics

1. Arithmetic average (mean)
   1.1. $\bar{\xi} = \frac{1}{n}\sum_{i=1}^{n} \xi_i = \frac{\xi_1+\xi_2+\ldots+\xi_n}{n}$
2. Standard deviation
   2.1. $\sigma = \sqrt{\frac{\sum_{i=1}^{n}(\xi_i-\bar{\xi})^2}{n}}$
3. $SO\_Attitude$ (Positive attitude)
   3.1. This metric represents the arithmetic average (mean) Likert score related to Strengths (S) and Opportunities (O), indicating the perceived attitude towards drones. A higher $SO\_Attitude$ value signifies a more positive perception.
      3.1.1. $SO\_Attitude = \frac{S1+S2+S3+S4+O1+O2+O3+O4}{8} \Rightarrow \frac{1}{n}\sum_{i=1}^{\frac{n}{2}} (S_i + O_i)$
      3.1.2. Note: We have to carefully consider the n value as we sum the pairs of S and O values, we only have to sum half the amount someone originally would come to the incorrect conclusion looking at the original arithmetic average formula.
4. $WT\_Attitude$ (Negative attitude)
   4.1. This metric represents the arithmetic average (mean) Likert score related to Weaknesses (W) and Threats (T), indicating the perceived attitude towards drones. A lower $WT\_Attitude$ value signifies a more positive perception.
      4.1.1. $WT\_Attitude = \frac{W1+W2+W3+W4+T1+T2+T3+T4}{8}$
5. $O\_Attitude$ (Opportunity attitude)
   5.1. This metric represents the arithmetic average (mean) Likert score related to the Opportunities (O), indicating the perceived attitude towards drones. A higher $O\_Attitude$ value signifies a more opportunistic perception.
      5.1.1. $O\_Attitude = \frac{O1+O2+O3+O4}{4} \Rightarrow \frac{1}{n}\sum_{i=1}^{n} O_i$
6. $T\_Attitude$ (Threat attitude)
   6.1. This metric represents the arithmetic average (mean) Likert score related to the Threats (T), indicating the perceived attitude towards drones. A higher $T\_Attitude$ value signifies a more threatened perception.
      6.1.1. $T\_Attitude = \frac{T1+T2+T3+T4}{4} \Rightarrow \frac{1}{n}\sum_{i=1}^{n} T_i$

List of Abbreviations and Expressions

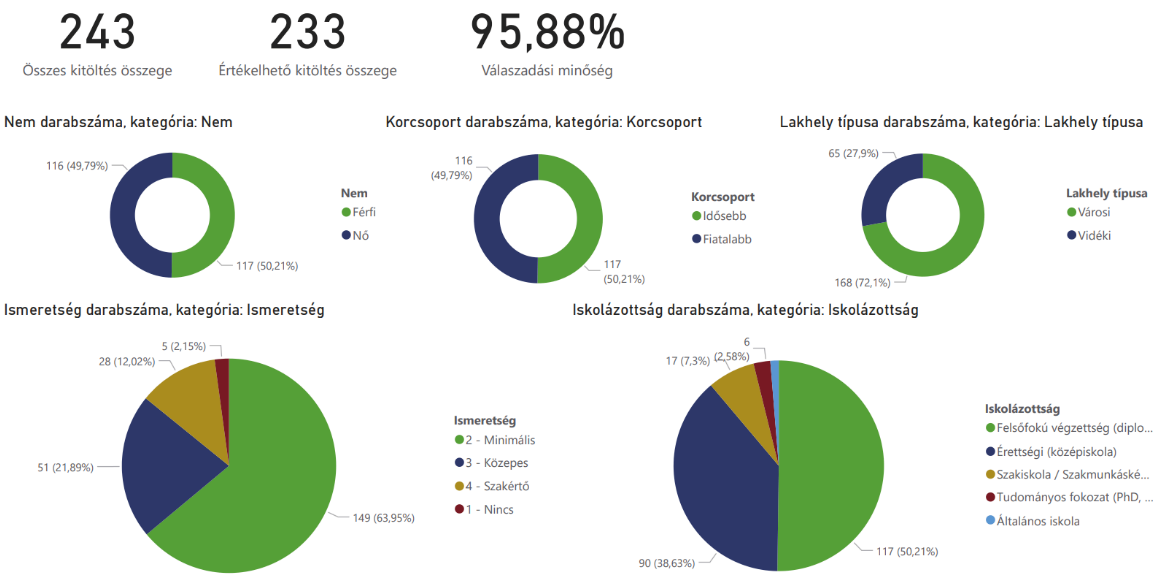
1. Metrics
   1.1. SD (Standard deviation)

- 1.2. Cronbach's α (Coefficient α)
- 1.3. SWOT analysis
  - 1.3.1. A strategic planning technique that identifies strengths (S), weaknesses (W), opportunities (O) and threats (T).
  - 1.3.2. TOWS
- 1.4. Likert scale
  - 1.4.1. A psychometric (sociology) scale used in research, named after its inventor, Rensis Likert[70].

2. AED (Automatic external defibrillator)
3. CPR (Cardiopulmonary resuscitation)
4. D2D (Drone to drone)
5. DDoS (Distributed denial-of-service)
   - 5.1. DoS (Denial-of-service)
6. Drone
   - 6.1. UAV (Unmanned aerial vehicle, Uninhabited aerial vehicles)
   - 6.2. UCAV (Unmanned combat air vehicles)
   - 6.3. UAS (Unmanned aerial system, Unmanned aircraft system)
   - 6.4. RPAS (Remotely piloted aerial system)
   - 6.5. RPV (Remotely piloted vehicle)
   - 6.6. UPS (Unpiloted system)
   - 6.7. UMS (Unmanned system)
   - 6.8. Aerial robot
7. Drones in the context of military application
   - 7.1. Uninhabited remotely controlled weapons
   - 7.2. PUR (Principle of unnecessary risk)
   - 7.3. IAW (Independent autonomous weapons)
   - 7.4. GWOT (Global war on terror)
8. Drones in the context of civilian application
   - 8.1. DO (Drone operations)
   - 8.2. DTCO (Drone-truck combined operation)
9. GPS (Global positioning system)
10. GIS (Geographic information system)
11. KSH (Központi Statisztikai Hivatal[71])
    - 11.1. (HCIS) Hungarian Central Statistical Office
12. Lidar (Light detection and ranging sensor)
13. P2P (Peer to peer)

[70] https://en.wikipedia.org/wiki/Rensis_Likert 2025-12-03
[71] https://www.ksh.hu/ 2026-01-30

Images



Image[72]: Viewing demographic composition of the questionnaire responders in PowerBI[73].

[72] PowerBI_top_level_view.png
[73] https://app.powerbi.com/ 2026-01-30