Vulnerability in Technology Cultures: A Significant Systematic Review

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ABSTRACT

Keywords:

Vulnerability; Technology; Cultures; Impact; Digitalization

In an era defined by pervasive technology integration into human life, the intersection of technology and culture is a vital area of scholarly focus. This systematic literature review comprehensively explores "Vulnerability in Technology Cultures." Our review aims to uncover, analyse, and synthesize existing knowledge in this field, recognizing its profound implications. Understanding vulnerabilities within technology cultures is essential in today's rapidly evolving technological landscape, marked by constant innovation and intricate socio-cultural dynamics. These vulnerabilities manifest across multiple dimensions, encompassing technical aspects, socio-cultural dynamics, ethical considerations, and psychological influences. Our systematic literature review employs rigorous criteria to select and scrutinize research articles, scholarly publications, and diverse sources from various disciplines, culminating in identifying and categorizing key themes and concepts. In this paper, the PRISMA approach was applied to find the primary data based on a few keywords, such as "vulnerability and technology". Based on advanced searching in SCOPUS and Web of Science, we found (n=38). Expert scholars decided to develop three themes, which are (1) Scientific Advancements and Impact, (2) Technology and Culture Interplay, and (3) Vulnerability and Resilience. In summary, a systematic literature review serves as an invaluable resource for academics, practitioners, and policymakers navigating this dynamic terrain.

1. Introduction

In the contemporary landscape of an increasingly interconnected and digitally driven world, the intersection of technology and culture has emerged as a central arena of inquiry, discourse, and concern. Within this dynamic convergence lies a profound and intricate realm called "Vulnerability in

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technology cultures", which demands meticulous exploration and analysis [1-3]. This systematic literature review endeavours to embark on this intellectual journey, unravelling the intricate threads that bind technological advancements and cultural contexts to vulnerabilities and risks. The present era is marked by a transformative technological revolution that spans the globe. Technology, in its various forms, permeates every facet of modern existence. From the internet's global reach to the proliferation of smartphones and smart cities, technology shapes how we communicate, work, govern, and interact with the world [4-6]. Simultaneously, culture's rich tapestry of traditions, values, beliefs, and behaviours continues to influence human societies profoundly. It is the crucible within which identities are forged, norms are established, and social structures evolve.

It is at the juncture of these two formidable forces, technology and culture, that vulnerabilities manifest. "Vulnerability in technology cultures" encapsulates a spectrum of challenges, risks, and consequences that arise when the relentless march of technology encounters the nuances of diverse cultural landscapes. These vulnerabilities are not confined to technical glitches or cybersecurity threats. They encompass a complex tapestry of ethical dilemmas, socio-cultural impacts, and the psychological well-being of individuals and communities [7-10]. To comprehend and systematically assess vulnerability within technology cultures is not merely an academic endeavour. It is imperative in an age where our dependence on technology is unparalleled. These vulnerabilities transcend disciplinary boundaries and hold implications for policymakers, businesses, and individuals across the globe. Their consequences ripple through society, influencing how we communicate, work, govern, and relate to one another.

This systematic literature review constitutes a comprehensive expedition into this intricate terrain. By meticulously examining and synthesizing existing research, we endeavour to illuminate the multifaceted nature of vulnerability in technology cultures and provide an exhaustive overview of this critical field of study. Our methodology is anchored in rigorous and systematic procedures for selecting, categorizing, and analysing a diverse array of academic contributions. We draw from an interdisciplinary spectrum that includes sociology, psychology, ethics, cybersecurity, anthropology, and more. This meticulous approach allows us to identify recurring themes, discern key patterns, and offer nuanced insights into the complex interplay of vulnerability within technology cultures.

2. Literature Review

In 2023, Aguilar *et al*., introduced a strategy to categorize the structural characteristics of historical buildings in earthquake-prone areas by leveraging digital tools such as Historic Building Information Modelling (HBIM) and Augmented Reality (AR). It analyses case studies in Peru and 311 Central Andes churches, forming 12 structural typologies. This research emphasizes the significance of integrating digital technologies as well as engineering analyses for facilitating seismic vulnerability assessments and structural evaluations [11]. The author identifies the impact of various technologies on medicine, highlighting their potential to bring doctors and patients closer. It also highlights the potential for misuse or misunderstanding to deepen vulnerabilities and hinder access to health systems. It emphasizes the importance of dialogued relationships for comprehensive care [12]. Numerous studies have attempted to explain why the aerospace industry is increasingly utilizing Artificial Intelligence (AI) for space applications, forced by the NewSpace economy. Nonetheless, the implementation of AI algorithms and the growing autonomy of systems in space bring about fresh weaknesses. To guarantee space safety, this article aims to establish safety protocols as well as technical standards for terrestrial uses, with a particular focus on the European context. It underscores the importance of policymakers, governance bodies, as well as technical organizations

collaborating to formulate an effective framework for tackling the novel cyber vulnerabilities brought about by AI technologies in space systems [13].

Recent evidence suggests that technology adaptation during the pandemic helped individuals cope with social distancing stress. A survey across 10 US states found that high technology use increased job retention, influenced by workplace IT usage, psychological well-being, and socioeconomic factors, despite external technology uses [14,15]. In the same year, the author examines how technology-based companies are susceptible to the impacts of COVID-19 through an approach that relies on indicators. This method highlights three aspects of vulnerability: sensitivity, exposure, as well as response capacity. Exposure refers to the risk posed by COVID-19 as a biological threat. At the same time, sensitivity encompasses various factors such as the nature of the business, job as well as its relationships with products and suppliers. Adaptive business capability is defined by resources, human capital, technological capital, and infrastructures. The framework can function as a reference guide for owners as well as managers [16]. In 2023, the author highlighted that Bhutanese traditional stone masonry architecture has been vulnerable to seismic events since 2009. The Royal Government of Bhutan collaborated with an international research project to analyse the suitability as well as appropriateness of intensifying intervention strategies. Strategies were made on purpose with local construction technologies and tested under static loads. The intervention's suitability was assessed via qualitative indicators [17].

The author identifies AI is increasingly used in space applications, including satellite constellations, relative positioning, and autonomous navigation. However, AI is vulnerable to cyber threats, making cyber security crucial for space safety. This paper aims to identify vulnerabilities in AI systems and analyse potential threats, comparing cyber-attacks in space to those targeting AI technologies. It recommends prevention and mitigation measures based on the cyber resilience of AI-based space operations. [18]. Authors have proposed This review explores the vulnerability of young people as well as children to digital technology and its impact on family dynamics. It identifies five domains of vulnerability: parental mediation and care, social networking, risky online behaviour, age and gender, as well as extensive internet use. The review highlights the lack of qualitative and quantitative studies on the role of technology in children's lives and family dynamics in the digital age [19]. The author summarized that the Internet of Things (IoT) had elevated demand for drones supplied with sensors, including technologies, for instance, Global Positioning System (GPS), Big Data, as well as Cloud Computing (CC). These drones are increasingly used in agriculture, government, and industrial sectors. However, security concerns persist. This study offers an extensive manual on protecting drones and countermeasures [20].

3. Material and Methods
3.1 Identification

The systematic review process involves three fundamental phases for selecting numerous pertinent research for this investigation. The initial phase involves identifying keywords as well as searching for related terms employing resources such as encyclopaedias, dictionaries, thesauri, including previous research. Once all relevant terms were identified, search queries were created for the Web of Science as well as Scopus databases (refer to Table 1). During the initial stage of the systematic review, a total of 835 papers were successfully retrieved from both databases as part of the current research effort.

Table 1
The search strings

Scopus	TITLE-ABS-KEY (vulnerability AND technology AND cultures) AND OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2023)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (PUBSTAGE , "final"))
WOS	vulnerability AND technology AND cultures (Topic) and 2023 or 2022 (Publication Years) and Article (Document Types) and English (Languages)

*Accessed date: 16 September 2023

3.2 Screening

In the first screening phase, it is important to ignore any duplicated papers. Moving on to the second phase, 240 publications were reviewed using specific criteria established by researchers following the exclusion of 23 papers in the initial phase. The primary criterion was prioritizing research articles as they are the primary source of valuable information. Furthermore, this research does not consider publications in the forms of reviews, systematic reviews, meta-synthesis, meta-analyses, books, chapters, book series, as well as conference proceedings. In addition, the review is limited to studies conducted in the English language exclusively. The schedule was established for a two-year period (2022-2023), which is important to remember. Alternatively, only studies performed within Malaysia have been selected in order to align with the analytical objective. Five hundred ninety-five publications overall based on predetermined criteria.

3.3 Eligibility

In the third step, referred to as the eligibility, 217 articles were initially gathered. During this stage, a comprehensive examination was conducted on the titles and essential content of all these articles to ascertain if they met the criteria for inclusion as well as aligned with the research objectives of the current study. Consequently, 179 reports were excluded since they were unrelated to the subject matter, had titles that were not relevant, or lacked abstracts that were pertinent to the study's goals. As a result, there are now 38 articles that remain for further examination.

Table 2
The selection criterion is searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2022 - 2023	< 2022
Literature type	Journal/Article	Review, Book, Conference
Publication Stage	Final	In Press

3.4 Data Abstraction and Analysis

This research utilized an integrative approach to examine as well as combine diverse research methodologies (which include quantitative, qualitative, as well as mixed methods). Expert researchers were instrumental in shaping relevant topics and subtopics. The initial stage of theme development involved gathering data. To construct the themes, the authors meticulously reviewed 38 papers for statements or information pertinent to the current research questions. In the subsequent step, the authors, in collaboration with experts, scrutinized vulnerability within technology cultures and grouped related elements in a meaningful manner. The resultant approach

yielded three principal themes: Vulnerability Disclosure and Management, Cultural Factors and Vulnerability Perception, and Ethical Dilemmas and Vulnerability.

Subsequently, the authors brought together all the themes they had developed, including any related concepts or ideas. Throughout the study, the main author worked closely with co-authors to define themes based on their discoveries. They kept a thorough record during the data analysis phase to document their analyses, insights, questions, or other pertinent aspects related to data interpretation. The authors also conducted a comparative analysis of the results to address any discrepancies that emerged during the theme-generation process. In cases of inconsistencies, the authors engaged in discussions to resolve them.

Lastly, the established themes were improved to ensure they remained coherent. To enhance the study's credibility, two specialists were consulted—one with expertise in technology and the other in the field of management sciences. The expert review phase played a crucial role in clarifying, validating, and substantiating each sub-theme through domain expertise. Adjustments were made based on the author's discretion, incorporating expert feedback and comments.
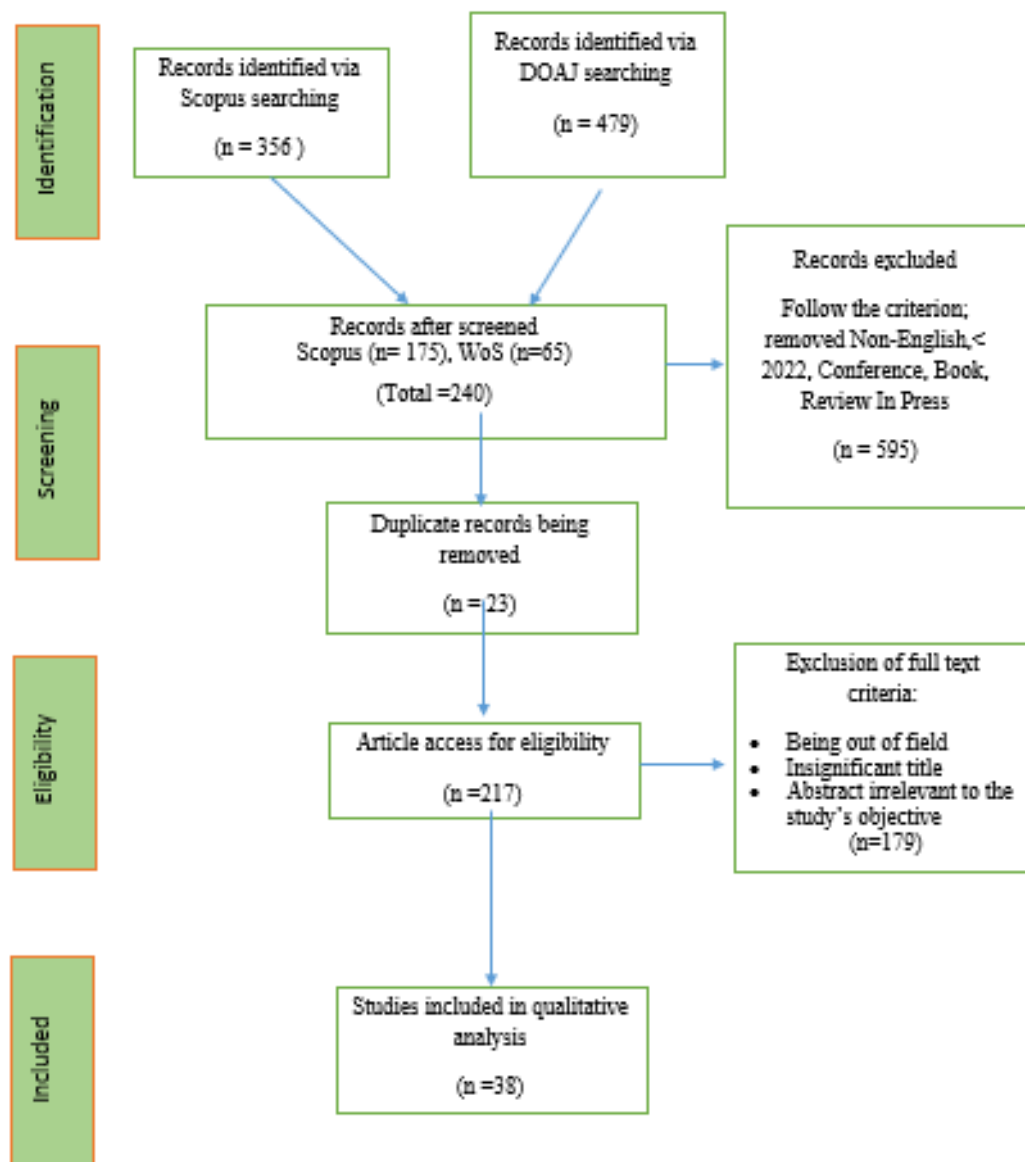

Fig. 1. Flow diagram of the suggested searching study [21]

4. Result and Findings

From the finalized search, there are three themes found, namely digital transformation in business and economy, digital health and healthcare initiatives, and digitalization in education and learning. Thus, this section will explain the findings from previous research and will be divided into three tables with different themes.

4.1 Theme 1: Scientific Advancements and Impact

Table 3
The research article's findings are based on the proposed search criterion

Authors	Title	Source Title	Methodology	Results & Findings
Radomska M. [22]	Non/living Matter, Bioscientific Imaginaries, and Feminist Techno ecologies of Bioart	Australian Feminist Studies	The article delves into the inherent connection between bio artworks and various (bio)technologies and methods of care and work. These connections give rise to distinct techno ecologies with a feminist perspective, disrupting traditional ideas in both the fields of bioscience and culture regarding the concept of embodiment as well as the interplay between nature and technology. The sculptures created by TC&A reveal life as a complex blend of living and non-living, showcasing the ongoing interweaving of organic and inorganic elements, as well as the processes of growth and decay.	The article contends that engaging in feminist techno ecologies within the realm of bio art stimulates philosophical creativity. It not only raises questions about the complex relationships between technology and biological materials, as well as between culture and the natural world, but it also encourages us to reconsider our fundamental understanding of life's existence.

Huang W.; Xiang H.; Li S. [23]	The application of augmented reality and unity 3D in interaction with intangible cultural heritage	Evolutionary Intelligence	The goal of this paper's research is to implement the self-issuance approach for the folk intangible cultural heritage centre. This approach differs from the conventional use of AR through head-mounted displays (HMDs) to directly showcase crafts. Instead, it introduces an innovative interaction method by leveraging cost-effective technologies such as AR, Unity 3D, as well as low-cost devices like smartphones and Leap motion controllers. Through the development of AR software in UNITY 3D and the utilization of HMDs and smartphones, this application enables users to seamlessly as well as comprehensively engage with intangible cultural heritage in a virtual physical environment.	The experiment's findings demonstrate the effectiveness of data transmission as well as the successful implementation of 3D interactions between individuals and exhibits. These research outcomes can be employed in the practical, interactive approach at the intangible cultural heritage centre, offering an efficient means of engaging with intangible cultural heritage through AR interactions. Consequently, visitors can develop a profound appreciation for intangible cultural heritage, where this cultural heritage can be globally disseminated.
Podobas E.I.; Gutowska-Owsiak D.; Moretti S.; Poznański J.; Kulińczak M.; Grynberg M.; Gruca A.; Bonna A.; Płonka D.; Ogg G.; Bal W. [24]	Ni2+-Assisted Hydrolysis May Affect the Human Proteome; Filaggrin Degradation Ex Vivo as an Example of Possible Consequences	Frontiers in Molecular Biosciences	In summary, the methodology involved a combination of bioinformatic analysis, ex vivo experiments on human epidermal sheets, in vitro cell culture experiments, as well as investigations into the impact on immune responses to understand the vulnerability of FLG to nickel hydrolysis and its potential implications in clinical diseases.	The findings suggest that the Ni2+-assisted cleavage of barrier proteins, which include FLG, could potentially develop medical conditions associated with exposure to nickel.
Xu J.; Yan P. [25]	GIS-Based Remote Sensing Image Information Analysis of the South Atlantic Ecological Environment and Diversity of Deep-Sea Microorganisms with Antifungal Effects	Advances in Mathematical Physics	The combined methodology involves a comprehensive approach, integrating geospatial technology for ecological assessment with microbiological sampling and analysis to provide insights into both the macro and micro aspects of the South Atlantic environment.	These outcomes offer a thorough understanding of the South Atlantic Ocean's ecological dynamics and microbial diversity. They offer valuable insights into ecological protection strategies and potential applications in the management of marine environments. The study's methodology and findings also provide a robust foundation for future research in this region and beyond.

Yang W.; Yang C.; Yang B.; Feng G. [26]	Time-Varying Research on Investors' Trading Psychology Rational and Irrational Market Sentiment Based on the Perspective of 5G Networks and Information Economics	Wireless Communications and Mobile Computing	Overall, the methodology combines quantitative analysis using the TVP-VAR model with a theoretical framework rooted in information economics as well as 5G Networks to assess the growing impacts of market sentiments on investor behaviour, particularly in the ongoing pandemic context.	In summary, the research investigates the impact of irrational as well as rational market sentiments on investor behaviour, especially in the context of 5G technologies and the COVID-19 pandemic. It illuminates aspects of herd behaviour, investor psychology, as well as overconfidence dynamics, offering important implications for market participants and regulatory authorities.
Hu M.; Lei X.Y.; Larson J.D.; McAlonis M.; Ford K.; McDonald D.; Mach K.; Rusert J.M.; Wechsler-Reya R.J.; Mali P. [27]	Integrated genome and tissue engineering enables screening of cancer vulnerabilities in physiologically relevant perfusable ex vivo cultures	Biomaterials	In summary, the methodology involves the development of perfusable tissue constructs using bio fabrication techniques, the ex vivo culture of patient-derived xenografts, as well as the application of CRISPR-Cas genome engineering for large-scale genetic screens. The results obtained from these experiments offer valuable insights into cancer vulnerabilities and have implications for potential therapeutic targets.	In summary, the findings underscore the significance of the integrated approach, as it bridges the gap between in vivo and in vitro cancer models. By successfully facilitating genetic screenings within ex vivo cancer tissue models that closely mimic physiological conditions, this research contributes to our understanding of cancer biology and has the potential to inform targeted therapies and treatment strategies for individual patients.
Madanan M.; Hussain N.; Khaliq A.A. [28]	A study of the digitization process to preserve the culture and heritage of a civilization using natural language processing and its impact on the social, economic, and scientific aspects	Journal of Theoretical and Applied Information Technology	Overall, the methodology involves systematically converting physical manuscripts and documents into digital formats, followed by organizing, indexing, and preserving the digitized content. Natural language processing techniques are used to enhance the digitization process, and the methodology is geared toward enhancing a nation's cultural heritage through digitizing valuable artifacts and documents.	In summary, the findings underscore the transformative role of digitization in preserving cultural heritage and artifacts. By using advanced technology, such as natural language processing and indexing, digitization can overcome the limitations of traditional preservation methods and ensure the accessibility and accuracy of valuable cultural documents and manuscripts for generations to come.

Pérez Agúndez J.A.; Yimam E.; Raux P.; Rey-Valette H.; Girard S. [29]	Modelling economic vulnerability: As applied to microbiological contamination on the Thau Lagoon shellfish farming industry	Marine Policy	In summary, the methodology involves a comprehensive vulnerability analysis of the shellfish farming industry in the context of bacteriologic pollution. It utilizes a quantitative approach, including the development of indicators and data collection through field surveys, to assess the vulnerability of different agents within the industry and identify strategies for mitigating economic impacts.	Findings highlight the nuanced nature of vulnerability within the shellfish farming sector and emphasize the need for tailored strategies to support the industry's sustainability and resilience in the face of bacteriologic pollution and related challenges.
Okami M.; Kato Y.; Kobayashi N.; Yamagishi J. [30]	Agronomic performance of an IR64 introgression line with large leaves derived from New Plant Type rice in aerobic culture	European Journal of Agronomy	The methodology involves a series of field experiments, data collection, and statistical analysis to evaluate the performance of YTH323, a rice variety with modified aboveground architecture, in various cultivation conditions. This study aims to determine how these modifications impact rice yield and growth characteristics.	The study concludes that genetic modification of the aboveground architecture with regard to IR64, a common tropical lowland rice cultivar, reducing the number of tillers and leaves enhances its adaptation to aerobic culture. This finding suggests that such genetic modifications can contribute to improved rice cultivation practices in water-saving aerobic systems.
Singh S. [31]	The COVID-19 Pandemic and the Formal Sector Crisis in IT and ITeS	Economic and Political Weekly	The methodology involves a multi-pronged approach that combines secondary data from media reports with primary data collected through an online survey and telephonic interviews. The research aims to uncover and document the social and work-related aspects of India's IT and ITeS sector, particularly in light of the challenges affected by the COVID-19 pandemic.	In summary, the findings and implications drawn from the abstract point to a sector marked by opacity, potential vulnerabilities in permanent employment, and a need for more effective employee protections. The study also recognizes the transformative impact of the COVID-19 pandemic on work arrangements within the sector, which has necessitated a closer examination of its workforce dynamics.
Qadikolaei M.R.; Zali N.; Soltani A. [32]	Spatiotemporal investigation of the digital divide, the case study of Iranian Provinces	Environment, Development and Sustainability	In summary, the methodology involves collecting and analysing statistical and economic data spanning a ten-year period to investigate disparities in ICT access and usage across 31 Iranian provinces. The research focuses on temporal and spatial variations, identifies influencing factors, and offers policy recommendations to address the digital divide and promote inclusivity.	In summary, the research underscores the existence of a digital divide in Iran, driven by factors such as family income and the presence of R&D centres. It emphasizes the dynamic nature of this divide, which fluctuates over time and across regions. The study calls for targeted policy measures to bridge the digital gap and promote inclusivity, particularly for disadvantaged socioeconomic groups.

| Suryadevara N.; Shiakolas A.R.; VanBlargan L.A.; Binshtein E.; Chen R.E.; Case J.B.; Kramer K.J.; Armstrong E.C.; Myers L.; Trivette A.; Gainza C.; Nargi R.S.; Selverian C.N.; Davidson E.; Doranz B.J.; Diaz S.M.; Handal L.S.; Carnahan R.H.; Diamond M.S.; Georgiev I.S.; Crowe J.E., Jr. [33] | An antibody targeting the N-terminal domain of SARS-CoV-2 disrupts the spike trimer | Journal of Clinical Investigation | In summary, the methodology involves the use of LIBRA-Seq technology to isolate and characterize a panel of NTD-reactive and neutralizing antibodies from an individual who is cured of COVID-19. Genetic analysis, functional studies, and the identification of a rare antibody (COV2-3434) are central to the research, providing insights into potential sites of vulnerability on the SARS-CoV-2 S protein and their implications for antibody-based immunity. | In summary, the study's results focus on identifying antibody targets on the SARS-CoV-2 S protein, having a particular emphasis on the NTD and the discovery of a rare antibody (COV2-3434) with unique functional properties. The study's findings have implications for our understanding of the immune response to SARS-CoV-2 as well as the potential development of antibody-based therapeutics or vaccines. |
| Kraft T.S.; Seabright E.; Alami S.; Jenness S.M.; Hooper P.; Beheim B.; Davis H.; Cummings D.K.; Rodriguez D.E.; Cayuba M.G.; Miner E.; de Lamballerie X.; Inchauste L.; Priet S.; Trumble B.C.; Stieglitz J.; Kaplan H.; Gurven M.D. [34] | Metapopulation dynamics of SARS-CoV-2 transmission in a small-scale Amazonian society | PLoS biology | The methodology combines mathematical modelling, data collection, simulation, and empirical validation to assess vulnerability and intervention strategies related to SARS-CoV-2 infection in small-scale Indigenous populations. It aims to thoroughly understand disease dynamics in these communities as well as inform public health policy. | In summary, the study combines the use of mathematical modelling, empirical data collection, and simulation to assess the vulnerability of Indigenous populations to SARS-CoV-2 infection. It also evaluates the effectiveness of intervention strategies, focusing on collective isolation. The research contributes to our understanding of disease dynamics in such populations and highlights the importance of tailored control measures. |

| Buckland B.; Boulanger R.; Fino M.; Srivastava I.; Holtz K.; Khramtsov N.; McPherson C.; Meghrous J.; Kubera P.; Cox M.M.J. [35] | Technology transfer and scale-up of the Flublok® recombinant hemagglutinin (HA) influenza vaccine manufacturing process | Vaccine | In summary, the methodology involves the large-scale production of HA protein antigens for influenza vaccines using a unique and adaptable manufacturing process. The technology's ability to rapidly produce vaccines for various influenza strains and its resilience to mutations make it a promising option for pandemic preparedness and vaccine production. | In summary, while specific numerical results are not provided in the abstract, the findings highlight HA protein antigens' successful production and adaptability for influenza vaccines using a scalable and versatile manufacturing process. The technology's potential implications for pandemic preparedness and vaccine production are also emphasized. |

4.2 Theme 2: Technology and Culture Interplay

Table 4
The research article's findings are based on the proposed search criterion

Authors	Title	Source Title	Methodology	Results & Findings
Campione J.R.; Mardon R.E.; McDonald K.M. [36]	Patient Safety Culture, Health Information Technology Implementation, and Medical Office Problems That Could Lead to Diagnostic Error	Journal of Patient Safety	This study employed a cross-sectional design to examine the connection between health information technology (IT) implementation, patient safety culture, as well as the frequency of problems that may result in diagnostic errors in the medical office environment.	The study's findings highlight the influence of patient safety culture as well as health IT implementation on the frequency of breakdowns in care processes within medical offices. These findings shed light on possible vulnerabilities that may enhance the risk of diagnostic errors in healthcare settings.
Romo-Avilés N.; García-Carpintero M.Á.; Pavón-Benítez L. [37]	Not without my mobile phone: alcohol binge drinking, gender violence, and technology in the Spanish culture of intoxication	Drugs: Education, Prevention, and Policy	this qualitative study utilized in-depth interviews with a sample of young individuals in two cities in Spain to explore the culture of binge drinking, its association with mobile phone technology and social networks, and the resulting gender violence and risky behaviours. The findings call for targeted prevention strategies and interventions to address these emerging issues among youth.	The study's findings indicate the presence of gender violence in contexts where intensive alcohol consumption occurs. This violence is associated with mobile phone usage in interpersonal or couple relationships. The abstract suggests that women primarily bear the brunt of this violence, experiencing sexual violations as well as harassment concerning their public image via ICT.

Watkins M.E. [38]	Designing an Effective Organizational Culture to Guard Against the Cyber Risks of Emerging Technologies	Journal of Healthcare Management	The methodology employed in this essay revolves around the development of a healthcare cyber resiliency model. This model is constructed relying on an extensive review of pertinent literature, expert consultations, iterative development, and a philosophy that emphasizes the role of both human and technical factors in safeguarding healthcare information technology. While it does not involve traditional data collection or statistical analysis, the methodology aims to provide healthcare administrators with a conceptual framework to enhance cybersecurity in the evolving healthcare landscape.	It proposes a proactive approach to cybersecurity that involves continuous improvement and a balance between technical solutions and human factors. While specific empirical findings are not provided in the abstract, the focus is on raising awareness about the importance of cybersecurity in the healthcare sector and suggesting a model to address these concerns.
Becker R.E. [39]	Two modern science and technology cultures: For safety and validity, does medicine have to update?	Journal of Patient Safety	It presents a discussion of contrasting scientific cultures within modern medicine and suggests the need for systemwide programming and leadership in patient safety.	The passage underscores the importance of recognizing and addressing vulnerabilities and errors in medical research as well as patient care. It supports a shift toward a culture in medicine that prioritizes standardized practices, systemwide programming, and leadership in patient safety to minimize errors as well as enhance the overall healthcare quality.
Acero A.; Ramírez Cajiao M.C. [40]	Analysing Sustainable Practices in Engineering Projects: A Systemic Approach	Sustainability (Switzerland)	In summary, the methodology described in the abstract involves a combination of literature review, systems thinking using causal loop diagrams, and qualitative analysis to address the gap in engineering education regarding sustainability. The research seeks to promote a sustainable mindset within the engineering community by identifying and leveraging key causal relationships within engineering systems of practice.	In summary, the findings from this abstract highlight the need to bridge the engineering education gap when considering environmental and cultural factors. The proposed approach of using causal loop diagrams seeks to instil a sustainability-oriented perspective among engineering students. It accomplishes this by examining the makeup and attributes of engineering systems in practice as well as identifying leverage points for sustainable development.

Mohd Isa W.A.R.W.; Hakim Suhaimi A.I.; Noordin N.; Mohd Safiq M.S.	The influence of Islamic Culture on information privacy: Case of Malaysia's computer professionals	Indonesian Journal of Electrical Engineering and Computer Science	The study mentions adapting research frameworks from previous works. This suggests that the research is built upon existing theoretical and methodological foundations, likely related to cultural influences on privacy and self-regulatory efficacy.	The research findings are expected to reveal the extent to which Islamic cultural factors impact computer professionals' self-regulatory efficacy. This may include their ability and motivation to protect personal information privacy in the context of rapidly evolving technologies.
Raúl C.M.; Carlos R.V.; María G.C.; Carolina Q.M. [41]	Innovation and Educational Technology in the current Latin American context; [Innovación y tecnología educativa en el contexto actual latinoamericano]	Revista de Ciencias Sociales	The study employs a descriptive-documentary study approach, suggesting that it relies on existing documents, literature, and data to analyse the topic. It does not involve original data collection but rather synthesizes and analyses existing information.	In conclusion, the research findings suggest that Latin America faced significant challenges in adopting and utilizing educational technology, particularly in response to the COVID-19 pandemic. However, despite these challenges, adapting to digital culture and consolidating distance learning allowed Latin American educational systems to continue functioning and meet academic objectives.
Coeckelbergh M. [42]	The Art of Living with ICTs: The Ethics–Aesthetics of Vulnerability Coping and Its Implications for Understanding and Evaluating ICT Cultures	Foundations of Science	The methodology described in this passage is more about the approach to understanding and addressing the issues related to human vulnerability in a philosophical and conceptual manner rather than a specific research methodology involving data collection, analysis, or empirical investigation.	In summary, the passage argues for an integrated perspective that combines ethics and aesthetics in addressing technology-mediated human vulnerability. It suggests that this integration involves ethical considerations and creative, artistic, and cultural dimensions. Additionally, it calls for a re-evaluation of our approaches to coping with vulnerability and a more thoughtful exploration of suitable technologies for this purpose.
Waelbers K.; Briggle A. [43]	Three schools of Thought on freedom in liberal, technological societies	Techne: Research in Philosophy and Technology	In summary, the methodology in this passage is characterized by philosophical analysis, comparative evaluation of theoretical perspectives, and the synthesis of insights from different scholars to address the question of human agency in a technological culture.	The findings on philosophical insights and conclusions drawn from the synthesis and evaluation of different perspectives on the role of technology and human agency. It emphasizes the complexity of the issue and the need to consider multiple perspectives to gain a comprehensive understanding of the topic.

Sutherland C.; Henderson A.; Trotter A.J.; Giosio D.; Smith G. [44]	Assessing sensing techniques for detecting markers of approaching ecdysis in juvenile tropical rock lobsters, Panulirus ornatus	Aquacultural Engineering	The methodology likely involves the data analysis gathered from the imaging and sensing techniques. This analysis may include comparing the effectiveness of each marker, assessing variability between individuals, and determining the potential utility of each technique in characterizing pre-ecdysis.	In summary, the passage presents findings related to potential markers for pre-ecdysis in spiny lobsters and the suitability of different imaging and sensing techniques. It emphasizes the potential of ultrasonic investigation as a cost-effective and promising method for detecting new integument growth in lobsters during the pre-ecdysis stage.
Pinsky D. [45]	Digitally mediated communication and school-based sex education in the USA	Sex Education	The study conducted interviews involving 110 high schools, including college students in the Northeastern USA. These interviews were likely qualitative in nature, aiming to gather insights and perspectives from adolescents.	In summary, the research highlights the significance of digital technology in adolescent flirtation practices and relationships. It also underscores the need for educators and sex education programs to recognize and adapt to the evolving digital landscape in adolescents' lives to provide effective guidance and support.
Schmidt J.I.; Hausner V.H.; Monz C. [2]	Building adaptive capacity in a changing arctic by use of technology	Ecology and Society	The passage mentions the use of Q-sort methodologies. Q-sort is a research technique involving participants sorting items (statements or concepts) into predefined categories or arranging them along a continuum according to their perspectives. This technique was likely used to examine the attitudes of participants toward technology and climate change adaptation.	In summary, the research highlights the dual role of technology in Indigenous communities in northwest Arctic Alaska. While technology can enhance specific capacities to address climate-related challenges, it also comes with downsides and potential drawbacks. The study underscores the need for a holistic approach to climate adaptation policies, taking into account both non-climatic as well as climatic stressors influencing the vulnerability with respect to these Indigenous communities.
Markellou M. [46]	Cultural Heritage Accessibility in the Digital Era and the Greek Legal Framework	International Journal for the Semiotics of Law	In summary, the methodology for this research involves legal analysis, literature review, stakeholder engagement, comparative analysis, and the development of policy recommendations or a revised legal framework to address the issues related to the use of digital technologies for cultural heritage in Greece. The specific steps and details of the methodology would likely be outlined in the full research paper or report.	In summary, the findings from this abstract underscore the need for a modernized legal framework in Greece to facilitate open access to digitized cultural heritage. This should also involve aiding cultural heritage organizations in their transition to the digital era and ensuring the long-term preservation of cultural assets.

Fernández A.M. [47]	Paradoxes of global and local development in the film verónico cruz. la deuda interna: A hybrid discussion group in Spanish for specific purposes	Hispania	In summary, the abstract methodology involves using the film as inspiration for a workshop on advanced Spanish for Specific Purposes, incorporating principles of andragogy and suggestopedy, and introducing the concept of "minori'ethage" to examine social inequality. However, the abstract lacks detailed information regarding the workshop's specific results or conclusions.	The abstract lacks precise details regarding the workshop's results or findings. Nevertheless, the abstract suggests that the workshop intends to sensitize participants to global economic development as well as its impact on the Qulla culture in Jujuy, Argentina. The abstract does not detail the effectiveness of achieving this aim and any specific results or insights gained by participants.
Kato Y.; Okami M. [48]	Root growth dynamics and stomatal behavior of rice (Oryza sativa L.) grown under aerobic and flooded conditions	Field Crops Research	The primary aim of the research is to investigate the various ways in which rice cultivars react to root growth and stomatal behaviour when grown in both flooded (traditional) and aerobic (water-saving) conditions. The study compared four rice cultivars under two different cultivation conditions: aerobic culture as well as flooded culture. The aerobic culture was able to keep the soil moisture level at a depth of 20cm within the range of -15 to -30 kPa.	The study suggests that the success of aerobic rice culture, which aims to reduce water use, is influenced by root growth characteristics and stomatal behaviour. Vigorous root growth, particularly in the subsurface layer, serves a vital role in soil water uptake as well as maintaining transpiration in aerobic rice culture. The findings highlight the importance of understanding root behaviour in developing more resilient and water-efficient rice cultivation practices.
Hermann V. [49]	From Agent to Subject: Panoptic and Post-Panoptic Surveillance in Contemporary Eastern European Television Series	Studies in Eastern European Cinema	The paper focuses on television series of high quality from Eastern Europe that were created in the past ten years. It establishes these series as addressing contemporary issues by drawing parallels with the region's history, particularly the era of state socialist regimes. The methodology involves in-depth analysis of selected series and contextualizing them within the broader landscape of Eastern European quality television.	The findings would likely include insights and interpretations derived from the analysis of the selected television series "1983" and "Hackerville," as well as the broader examination of the themes and concepts discussed.

4.3 Theme 3: Vulnerability and Resilience

Table 5
The research article's findings are based on the proposed search criterion

Authors	Title	Source Title	Methodology	Results & Findings
Congram M.; Bell P. [50]	Laying the groundwork for the successful deployment of communication interception technology (CIT) in modern policing	Journal of Policing, Intelligence, and Counter-Terrorism	In summary, the methodology employed in this abstract involves a literature review and analysis with a specific focus on the practical implementation of Communication Interception Technologies in the fight against transnational organized crime, ultimately aiming to provide recommendations for improving their effectiveness in law enforcement efforts.	The findings support the notion that CIT serves as a crucial tool for gathering intelligence, and it holds a significant role in today's law enforcement landscape. It underscores that CIT is most beneficial when employed within a proactive, intelligence-driven approach. The study also suggests that to make this approach effective, Australian authorities, as well as law enforcement agencies, need to reconsider and rectify the existing legal and operational limitations imposed on CIT usage and the prevailing intelligence culture in policing.
Malik A.Z.; Paswan A. [51]	Language-related Stereotype Threat, customers' well-being and its outcome	Journal of Services Marketing	The scientists utilized a research method that involved both surveys as well as experimental investigations. Simultaneously, they gathered data from individuals in the USA who are not native English speakers but have it as their second language. They employed structural equation modelling to assess the proposed connections.	The research revealed that non-native customers who feel they are being stigmatized due to language in an ICSE setting tend to experience intergroup anxiety and a feeling of not fitting in. This intergroup anxiety negatively impacts their ease of communication with service providers, shaping their subsequent purchasing choices. As a result, they tend to avoid direct interactions with service providers and opt for automated or smart services instead.

Georgiadou A.; Mouzakitis S.; Askounis D. [3]	Assessing mitre attack risk using a cyber-security culture framework	Sensors	Overall, the methodology likely encompasses data collection, integration, analysis, and interpretation to explore the relationship between cultural factors and security vulnerabilities within the MITRE ATT&CK Framework, emphasizing practical applications in cybersecurity.	In this study, we present the findings of our research, which examines the connection between a wide range of organizational and individual cultural elements, as outlined in our newly established cyber-security culture framework, as well as security vulnerabilities linked to specific adversary actions and patterns using the MITRE ATT&CK framework. This approach leverages the potential of MITRE ATT&CK in a novel and previously unexplored scientific direction, focusing on security evaluation as well as defensive planning before its conventional application. It is important to note that the proposed cyber-security culture framework was initially crafted with the intent of addressing crucial infrastructures, particularly within the energy sector.
Alessa L.N.; Kliskey A.A.; Williams P. [52]	Forgetting freshwater: Technology, values, and distancing in remote arctic communities	Society and Natural Resources	The study involved conducting interviews with individuals living in remote, resource-dependent communities in Alaska. These interviews probably consisted of a set of inquiries aimed at evaluating the beliefs as well as the significance that these individuals attach to freshwater.	In summary, the study's findings highlight a shift in values related to freshwater in remote, resource-dependent communities in Alaska as they modernize, with younger generations placing less emphasis on traditional-subsistence values and more emphasis on convenience as well as recreational values. The presence or absence of municipal water systems also appears to influence these values. The study suggests that this transformation in values may have implications for the relationship between communities and their environment, characterizing it as a result of technology-driven environmental changes.
Pollini A.; Callari T.C.; Tedeschi A.; Ruscio D.; Save L.; Chiarugi F.; Guerri D. [1]	Leveraging human factors in cybersecurity: an integrated methodological approach	Cognition, Technology and Work	The methodology integrates both qualitative and quantitative research methods to assess the level of maturity of the pilot healthcare organizations concerning their ability to address cybersecurity risks.	In conclusion, this research employs a holistic/Human Factors approach to assess the cybersecurity maturity of pilot healthcare organizations, considering both technical and human factors. The study finds that better cybersecurity culture doesn't always result in rule-compliant behaviour and emphasizes the importance of integrating non-technical countermeasures, like user awareness, into cybersecurity management.

| Calvo R.; Amigo C.; Billi M.; Fleischmann M.; Urquiza A.; Álamos N.; Navea J. [53] | Territorial Energy Vulnerability Assessment to Enhance Just Energy Transition of Cities | Frontiers in Sustainable Cities | In summary, the methodology employed in this research primarily revolves around the development and application of the Territorial Energy Vulnerability (TEV) framework. It includes conceptual framework development, indicator-based assessment, data collection, analysis, and the application of the framework to specific case studies to understand and quantify territorial energy vulnerability. The results of this methodology can then be used to inform energy policy and guidelines, particularly in the context of a just energy transition. | In summary, the research presented in the abstract focuses on developing a framework to assess Territorial Energy Vulnerability (TEV) by considering the sensitivity and resilience characteristics of socio-techno-ecological systems. The framework is applied to three case studies in Chilean cities, and the findings suggest that it can be a valuable tool for informing policies related to energy poverty and equitable access to energy services in the context of a just energy transition. |
| Pieters W.; Consoli L. [54] | Vulnerabilities and responsibilities: Dealing with monsters in computer security | Journal of Information, Communication and Ethics in Society | In summary, the methodology used in this research paper involves a philosophical and anthropological approach to analysing information security vulnerabilities through the lens of cultural categories and virtue ethics. The findings suggest that this approach can inform proactive measures to address security vulnerabilities and reshape security practices. | The paper concludes that this approach can serve as a foundation for proactively addressing unknown future vulnerabilities in information security. By exploring the cultural and ethical dimensions of security vulnerabilities, it offers a new perspective on understanding and preventing these vulnerabilities. |

| Fazzi E.; Galassi S.; Misseri G.; Rovero L. [55] | Seismic vulnerability assessment of the benedictine basilica typology in central Italy | Journal of Building Engineering | In summary, the methodology presented in the abstract involves a multi-disciplinary, multi-scale approach to assess the seismic vulnerability of historic basilica churches. It combines various types of data and information, including historical, environmental, geometrical, and mechanical factors, to evaluate the churches' vulnerability to seismic events. The methodology aims to provide a comprehensive understanding of the seismic behaviour of these structures and identify potential weaknesses. | The results of the study on Benedictine basilica churches show that while these churches share common geometry and proportions, variations exist in scale and building technology based on church importance and available resources during construction, leading to differences in brickwork or stone masonry. Smaller, locally significant churches follow construction rules, maintaining modest dimensions and proportions, although they often use lower-quality materials and technology, resulting in homogeneity in masonry quality and connections. In contrast, more prominent places of worship exhibit larger dimensions and frequent stylistic reworks, particularly in the apse and façade, often with less precise connections. Vulnerability assessments indicate that apse and façade macro-elements are more susceptible. A correlation exists between the Masonry Quality Index and expected acceleration demand for stone masonry churches with small dimensions, while brickwork churches show higher masonry quality but do not follow this trend. Wall-to-wall connection accuracy correlates with masonry quality for local churches but not for larger ones, and it inversely relates to façade slenderness. Incorporating frictional restraining forces in kinematic analysis can improve macro-element response modelling, with their relevance varying with church size, requiring careful minimization procedures. |

5. Discussion and Conclusion

The results' discussion begins with the first theme about the Scientific Advancements and Impact. Several significant contributions emerge from distinct domains in this comprehensive synthesis of diverse research findings. Beginning with the feminist perspective in bioart, it is elucidated that the fusion of feminist technoecologies and bioart incites philosophical innovation, challenging the entrenched intersections of technology with biomatter and culture with nature, thereby prompting a profound reconsideration of the very ontology of life. Transitioning to the realm of cultural heritage, the research underscores the efficacy of data transmission and three-dimensional interaction, with potential applications in intangible cultural heritage preservation, facilitating global dissemination and fostering a deeper cultural appreciation by shifting to the sphere of environmental health. Findings point to the potential health implications of Ni^{2+}-assisted cleavage of barrier proteins, shedding light on the clinical consequences associated with nickel exposure. Furthermore, ecological dynamics within the South Atlantic Ocean are illuminated, offering valuable insights for the preservation of marine environments and biodiversity. The study investigating investor behaviour, particularly in the context with regards to 5G technologies as well as the COVID-19 pandemic, supports understanding market psychology, herd behaviour, and overconfidence, thus informing investment strategies and regulatory policies. In the domain of cancer research, an integrated approach combining mathematical modelling and ex vivo cancer tissue models demonstrate promise for advancing our comprehension of cancer biology, thereby informing tailored therapies for individual patients. Moreover, digitization emerges as a transformative tool for cultural heritage preservation, harnessing advanced technology to enhance accessibility and precision in preserving cultural artifacts. Vulnerabilities within the shellfish farming sector underscore the necessity of tailored strategies to ensure sustainability in the face of bacteriologic pollution. Genetic modifications for rice cultivation reveal potential pathways for enhancing water-saving aerobic systems. Workforce dynamics within a specific sector are characterized by vulnerabilities in permanent employment and the transformative influence of the COVID-19 pandemic. Addressing digital disparities in Iran, the research advocates for targeted policies to bridge the digital divide and promote inclusivity. Antibody targets on the SARS-CoV-2 S protein and the discovery of a unique antibody suggest potential therapeutic and vaccine applications, contributing to our understanding of immune responses to the virus. Lastly, the research assessing vulnerability to SARS-CoV-2 in Indigenous populations underscores the importance of tailored control measures and collective isolation strategies. Collectively, these studies offer diverse perspectives and insights across various disciplines, enriching our understanding of critical topics in academia and beyond.

Next, the technology and culture interplay themes discuss the influence of patient safety culture and health information technology on care process breakdowns in medical offices, particularly in the context of diagnostic errors, which has been emphasized. By transitioning to interpersonal dynamics, the research reveals a correlation between gender violence and intensive alcohol consumption, often involving mobile phones, disproportionately affecting women through technology-mediated harassment. It advocates a proactive approach to cybersecurity, underscoring the importance of continuous improvement and balancing technical solutions with human factors within healthcare. By addressing medical research and patient care, the passage underscores the significance of standardized practices, systemwide programming, and leadership in patient safety to mitigate errors and enhance healthcare quality. Shifting to engineering education, it emphasizes the imperative of integrating environmental and cultural factors, using causal loop diagrams to instil sustainability perspectives in engineering students. By exploring Islamic cultural factors, the study aims to illuminate their impact on computer professionals' self-regulatory efficacy, particularly in

safeguarding personal information privacy amid technological advancements. Amid educational challenges in Latin America, the research notes the successful adaptation to digital culture and distance learning amid the COVID-19 pandemic, guaranteeing the continuity of academic objectives. Advancing to the realm of ethics and aesthetics, it calls for an integrated approach to address human vulnerability mediated by technology, advocating reevaluated coping strategies as well as suitable technological solutions. The multifaceted relationship between technology and human agency emerges as a central theme, emphasizing the complexity necessitating diverse perspectives for comprehensive understanding. Bridging into marine biology, potential markers for pre-ecdysis in lobsters are highlighted, along with imaging and sensing techniques for integument growth detection. In the context of adolescent relationships, the study underlines digital technology's pivotal role and the need for adaptive sex education programs. Indigenous communities in northwest Arctic Alaska face complex implications of technology, warranting holistic climate adaptation policies. The passage underscores the modernization of legal frameworks to facilitate open access to digitized cultural heritage while preserving cultural assets. Lastly, it previews a workshop aiming to sensitize participants to global economic development's influence on the Qulla culture in Argentina, awaiting detailed results. The study accentuates root growth characteristics and stomatal behaviour's pivotal role in enhancing water-efficient aerobic rice culture in agricultural science. Concluding with media analysis, the passage suggests forthcoming insights and interpretations derived from the study of the television series "1983" and "Hackerville," contributing to broader thematic discussions. These findings collectively offer a nuanced understanding of contemporary issues across diverse academic domains, emphasizing the value of interdisciplinary perspectives.

Finally, the Vulnerability and Resilience theme represents a diverse range of research methodologies and fields of study. Some showed the methodology involves a literature review and analysis focused on the practical implementation of Communication Interception Technologies (CIT) in combating transnational organized crime, with the aim of offering recommendations for enhancing law enforcement effectiveness. There is another survey-based research, experimental studies, and structural equation modelling to explore the experiences of non-native speakers in the USA who discern language-related stigmatization in service encounters, influencing their buying behaviour. The third abstract likely entails data collection, integration, analysis, and interpretation to investigate the relationship between cultural factors and security vulnerabilities within the context of the MITRE ATTACK Framework in cybersecurity. The qualitative study involves interviews to assess shifting values related to freshwater in remote, resource-dependent communities in Alaska as they modernize, with implications for community-environment relationships. The other studies employ a holistic approach, integrating quantitative as well as qualitative research methods to evaluate the cybersecurity maturity of healthcare organizations, emphasizing the importance of non-technical countermeasures like user awareness and highlighting the focus on the development and application of the Territorial Energy Vulnerability (TEV) framework, encompassing conceptual framework development, indicator-based assessment, data collection, analysis, and case study application to inform energy policy and guidelines. The philosophical and anthropological approach is employed to analyze information security vulnerabilities through cultural categories and virtue ethics, with the aim of informing proactive measures in computer security. Lastly, a multi-disciplinary, multi-scale approach to evaluate the seismic vulnerability of historic basilica churches in central Italy, integrating historical, environmental, geometrical, and mechanical factors, has been applied to evaluate vulnerability and identify weaknesses. These past studies collectively reflect the rich diversity of research methodologies and topics across various academic disciplines.

Acknowledgement

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