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THE IEEE GLOBAL INITIATIVE ON ETHICS OF EXTENDED REALITY (XR) REPORT

BUSINESS, FINANCE, AND ECONOMICS

Authored by

Michael Middleton

Chapter Leader

IEEE

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Samira Khodaei

Mark McGill

The Institute of Electrical and Electronics Engineers, Inc. 3 Park Avenue, New York, NY 10016-5997, USA

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THE IEEE GLOBAL INITIATIVE ON ETHICS OF EXTENDED REALITY (XR) REPORT

BUSINESS, FINANCE, AND ECONOMICS

ABSTRACT

This report is the result of work within the IEEE Global Initiative on Ethics of Extended Reality (XR), a multidiscipline group of industry practitioners, ethicists, academics, researchers, educators, and technology enthusiasts. It has been written to focus on a wide range of ethical issues related to XR within the medicine domain. This report builds on work outlined in the "Extended Reality" chapter of the IEEE's seminal ethics-focused publication *Ethically Aligned Design*. XR is a term used to broadly refer to a suite of immersive technologies including virtual reality, augmented reality, and spatial computing. The scope of this report is the exploration of ethics-related issues in XR business models, and the aim is to initiate expert-driven, multidiscipline analysis of the evolving XR Ethics requirements, with a vision to propose solutions, technologies, and standards in future updates. The set of recommendations within this report will hopefully contribute to industry conceptualization of socio-technological issues, highlight concreted recommendations, and lay the groundwork for future technical-standardization activities.

MONIQUE J. MORROW & MATHANA

CHAIR & VICE CHAIR

IEEE GLOBAL INITIATIVE FOR ETHICAL EXTENDED REALTY

1. INTRODUCTION

Recommendations on XR ethics in business models,[1] economics, and finance cannot be communicated soon enough. There is already ambiguity in the ethical roles of individuals, corporations, and governments in cybersecurity and the right to privacy. The same tech giants who are feared for their level of power and past/present unethical behavior have successfully resisted any legislative, monetary, or cultural impetus to change their business models or behavior [1].

Certain dangers are obvious, such as the ongoing theft of data for exploitation, blackmail, humiliation, political maneuvering, industrial sabotage, etc. But less obviously, and as is often done with social media, XR consumers will regularly make life-altering data available to corporations in exchange for brief experiences that could be obtained elsewhere for free or relatively little cost. For example, an unsuspecting consumer who has signed a Terms & Conditions form allowing for their data to be sold to third parties, may not understand that their decision to play a Virtual Reality game can result in something like being denied life insurance coverage in future by a seemingly unrelated company.

Business models and the domains of economics/finance have this in common: money is the oxygen that keeps them alive, and a successful injection of XR ethics into one will affect the other. (Likewise, a failure in one will carry over to the other.) This paper will examine some of the most pressing XR ethical issues in these spaces and propose an initial set of policy considerations and recommendations. Some proposals will be top-level, others will address more specific needs of their respective spaces. Governments and businesses can and should consider implementing additional proposals as fit the nature of their domains. Time is not on the side of ethics when it comes to building international standards in these spaces, but the proposed recommendations can provide a framework by which industry groups and businesses may start to adopt practical standards for themselves and their ecosystems.

[1]The term *business model* has faced several different definitions since the 1990s (Afuah, 2004, Osterwalder et al, 2005, Stewart & Zhao, 2000, Morris et al, 2005, Seelos & Mair, 2007, Brousseau & Penard, 2006, Magretta, 2002). The main function from the company perspective, as described by Novikova *et al.*, is "creating and capturing value". Specifically, three questions are asked: Who is your customer? What does your customer value? How do you make money in this business? In the context of XR, it is important for us to look beyond the concept of an immersive experience provided to an audience. These experiences, and their connected value to a person, can be personal and subjective. Serious questions will need to be answered as to XR ethics, and only some of these will be on the level of specific business models. For example, is there an experience pyramid in which some experiences need not be paid for? Are negative experiences allowable or ethical in XR? Should certain experiences be forbidden, including those with analogs to real-world forbidden experiences? Which experiences should be available to authorities and/or competent institutions, such as the sciences, but not to the public?

2. BUSINESS AND INDUSTRY MODELS, GOVERNANCE AND STRUCTURES

Emerging technologies spread unevenly around the world and through industry segments, often due to serious cost and infrastructure obstacles. Mobile devices require only basic internet connectivity. XR requires access to decent (or better) internet capabilities and appropriate interface devices (VR headsets, smartphones, tablets). Until recently, this has limited advanced applications to industries such as medicine that could bear the high cost.

But the highest level of overall XR adoption today comes in the consumer-facing world of entertainment and media, with gaming standing out as the world's top XR industry [2]. Not surprising, perhaps, given that the most famous example of augmented reality in public adoption is probably the 2016 *Pokémon® Go* [3] phenomenon as well as the selfie filters on social media sites that have introduced XR through a lens of trusted platforms and quick novelty applications. [2]

Key Hypothetical Example

The *World Economic Forum* published an article with a hypothetical case study of a problem this can cause. In this scenario, a young man named Riley played a startup company's VR headset game with his friends for approximately twenty minutes. Unknown to him, the company captured two million points of data about his body during this time, and later sold this information to third-party firms. Later, Riley—young and in perfect health—was turned down for life insurance because his movement patterns mirrored those of someone who might be in the very early stages of dementia. Because dementia runs in families, his sister is also unable to get life or long-term care insurance [4]. This 20-minute game will affect both of their financial futures, as well as the lives and wellbeing of their families.

In *The Possibility of Ethical Business*, Napoleon M. Mabaquiao, Jr., says, "The principle of respect for persons states that one's act is morally good if it does not use persons merely as means but also treats them as ends at the same time…One concrete way to find out whether Person A respects Person B in dealing with Person B is if Person B *voluntarily and knowingly* gives her *consent* to person A to perform such act towards her" [5]. This case demonstrates that neither the development company nor the insurance company fully understood or

[2] Pokémon is a registered trademark of Nintendo of America Inc.

respected the person providing the data; nor did that person understand the value they brought to these other parties; nor did they provide ethical consent in the transaction. Even if they were aware that their data might be generally connected, it is questionable that they gave knowing consent as to the depth of its applications and the impact it would have on their life.

The broad-scale impact of decisions like this can affect the wellbeing of entire segments of the population in ways that may not be transparent to them. And if this is true for the developed world, the implications for underdeveloped countries may be more dire still. What of the significant portion of the world where smart phones, social media, and even XR have preceded access to basic or competitive banking, financial products, and modern insurance programs? XR could make available information about these people that could significantly delay or reduce companies' willingness to offer services in the area. The consequences of XR are already beginning to play out; ethical standards must follow with all possible speed. The first three recommendations apply to all stakeholders in the XR space.

Recommendation #1	Stakeholders of all types should study how to make available free, publicly-available XR tools and spaces that do not require identification or collect personal data. These would be the equivalent of public parks—free to use without documentation or registration.

Recommendation #2	Stakeholders should define, and defend, high standards for experiences that should be accessible to all people in line with the protection given to other experiences, such as national parks or local parks, public art, etc. Grants should be made available to those seeking to provide these experiences for the public good.

Recommendation #3	Stakeholders should work together to promote and adapt technology standards that facilitate the widest-possible participation in, and transparency of, XR experiences. These standards should allow participants their choice of providers and platforms.

Recommendation #4	These and other broad-scale programs should employ differential privacy, or a similarly protective stance, to ensure the privacy rights of those who participate.

2.1. INDUSTRY BEHAVIOR

A major battlefront for XR ethics will be at the industry level. Global competition and industry pressure make it unreasonable to expect (for example) Tech Giant A to express a high level of ethical behavior, and to sit by and watch as Tech Giant B rejects this behavior and creates an insurmountable competitive lead. A significant win could come through industries as a whole adopting their own standards, even if their rationale is simply avoiding interference from legislative or regulatory bodies. Public, private, and political pressure may need to be applied in order to create such a model, but it is not without precedent.

In the United States, for example, the term *self-regulatory organization* is well-known. The Financial Industry Regulatory Authority (FINRA), the Municipal Securities Rulemaking Board (MSRB), the National Association of Realtors (NAR), and the American Medical Association (AMA) are just some of the major SROs with significant clout in their respective industries.

Recommendation #5	Self-regulatory organizations (SROs) should be called upon to review, adopt, and enforce specific standards of XR ethics pertinent to their industry.

This focus on SROs is not intended to serve as a run-around to legislation or regulation; it is purely a matter of speed and agility and allows industry members the opportunity to set an early stake in the ground as to how they feel XR should be governed. This is of special importance because it may be the quickest pathway for the passage of a set of XR ethical standards that company boards/management can vote to adopt, as opposed to having to create their own guidelines from scratch.

Legislation, regulation, and regional/global cooperative agreements and standards should follow with more formal sets of guidelines, rules, and/or laws to address each space. Even before the release of fully developed bodies of law, these organizations can release guidelines, interpretive letters, and other information to help shape the movement of XR's growth in an ethical manner.

Recommendation #6	Regulators, law-making bodies, and global cooperative standard-making bodies should begin issuing guidelines and interpretive statements, while moving towards the research, and passage into law, of appropriate XR ethical standards.

Industry players may feel (or claim to feel) caught between business potential and the limitations imposed by XR ethical guidelines. In these cases, incentives may be required (or demanded). Governments, foundations, and other grant-making bodies are able to influence the direction of XR ethics, especially among businesses and universities that rely on these bodies for financial support and incentives.

Recommendation #7	Governments, foundations, and other tax-levying or grant-making bodies should integrate XR ethical standards into requirements for potential tax breaks, research grants, bonds, etc. Differential privacy and/or other high levels of individual user privacy should be prerequisites for these awards wherever possible.

2.1.1. BUSINESS GOVERNANCE AND OPERATIONS

Legislation, regulation, and structural financial incentives will be a major boon for XR ethics adoption, but a bottom-up approach should also be pursued. (This level of cooperation will be required for SROs to enact meaningful change anyway.) A natural place for this bottom-up approach to begin is the corporate boardroom/governance sphere, as well as at the hands of those who own public companies.

Recommendation #8	Company owners and/or Boards of Directors should pass resolutions supporting and adopting XR ethical standards of conduct from SROs or other competent authorities, where available, or their own standards if no others are available. They should also encourage their industry's SROs and regulatory bodies to provide structured guidance.

Recommendation #9	Stockholders, limited partners, or other company owners outside the governance structure should push for these same actions for companies in which they hold an interest.

The previous recommendations focus on corporate governance, but opportunities may be found also in the day-to-day workings of an enterprise. For example, the vendor/supplier due diligence process is a critical element of company operations through which XR ethics may be enforced. It is already common

for companies to put in place screens for vendor/supplier behavior in their requests for proposals (RFPs) on topics related to ethical operations, governance, etc. XR ethics should be inserted into this process as an additional screen. Even a basic set of questions would require bidding companies to begin to consider their position on XR ethics.

Recommendation #10	Businesses should integrate XR ethical guidelines and/or requirements into their vendor and supplier due diligence and selection processes.

2.1.2. CUSTOMERS

The recommendations presented are meant to inspire positive ethical pressure within the business and B2B (business-to-business) ecosystems. The B2C (business-to-consumer) channel will be equally critical in terms of XR ethical adoption. It is not yet clear how XR ethical matters will play out in the public eye, but two timely examples may illustrate the possibilities.

2.1.2.1 EXAMPLE ONE—CONSUMER DATA PRIVACY

Public understanding and acknowledgment of consumer privacy issues come following decades of inattention and severe damage. Wide swaths of data are now available, and the sale of this data between third parties is a commonplace part of widespread business models. Major legal efforts to opt out of, or reverse, this ecosystem proceed slowly and without clarity as to their efficacy or adoption. Consumer data privacy is so intimately tied to the ethical problems of XR that it will get its own special treatment in 2.2 this report. It can even be said that many of the most specific XR ethical questions will hinge on this topic. The question will be whether the technology moves to mass adoption before ethical questions are even roughly considered, as with social media; or if the growth of privacy concerns resulting from past issues cause a severe limitation in the uptake of XR beyond already-accepted levels.

The European Union already has data privacy regulations in place, such as the General Data Protection Regulation (GDPR), which protects the processing of personal data within the EU. Through this regulation, companies, entities, and organizations processing any form of personal data are accountable for their protection and must provide customers with the opportunity to give informed consent (which may be revoked at any time). The penalties can be up to €10 million, or up to 2% of the annual worldwide turnover in cases if a breach of data protection can be proven. For businesses and developers, this has

proven extremely problematic. Personal data was used to train algorithms (i.e., face detection), and cannot be removed from the data set or production of these algorithms. Furthermore, when developers use an application programming interface (API) or software development kit (SDK), the data issues may not be transparent to them.

Privacy has its own treatment in this report, and a review of the concept of differential privacy and other systems for better protecting individuals is encouraged.

2.1.2.2 EXAMPLE TWO—ENVIRONMENTAL, SOCIAL, GOVERNANCE (ESG) IN FINANCIAL SERVICES

ESG sensitivities in investments have now gone mainstream, despite confusion by some participants as to how the terms may be measured or whether they are effective. As Russell Reynolds Associates observes, "the massive pools of capital building up around the world that are dedicated to sustainable investment strategies are overwhelming and causing a severe supply/demand imbalance that will force financial services firms…to deliver credible and scalable ESG strategies…ESG is forcing a fundamental rethink in corporate strategy."[6].

ESG benefitted from a growing sense of consciousness among consumers and businesses as to sustainability and social topics that fall into the broad category of ESG. XR ethical efforts could benefit from ensuring that consumers understand the connection between seemingly new technologies and experiences, and existing concerns and values they already possess. While questions of social good and environmental sustainability are not limited to the financial services industry, they are having a specific series of impacts that is expected to continue and sharpen over time. These are driven not only by increased public consciousness over the problems being addressed, but also by the reality of generational wealth. The largest transfer of wealth in history is expected to begin with the current older generations dying off and leaving their wealth to younger generations with a different set of values. This has forced financial product manufacturers—and their sales forces—to be at the front of the ESG question as a matter of marketing (at least) and self-preservation (at most).

If a major XR provider or experience can operate competitively with a high standard of publicized and verifiable ethical standards, it could create strong industry pressure to match the standards, at the risk of being on the wrong side of the capital flowing into the industry.

Recommendation #11	A major XR technology and/or experience provider with first-mover advantage should publicly take a position of transparent and ethical XR standards to create public education and set a high bar for future entrants.

2.1.3. THE ROLE OF CONSUMER ADVOCACY GROUPS

The ESG example illustrates the importance of consumer behavior and action in the coming battle for XR ethics. Consumer Advocacy Groups, also known as National Consumer Organizations, or simply Consumer Organizations, can have tremendous influence on the shape of consumer spending and business operations. They may be one of the most important stakeholder types for XR ethics advocacy due to the fact that they exist (in some form) in most countries and are often valued by consumers for their independent assessments of a business' operations and products. This can be especially true for local advocacy groups that enjoy high levels of community trust and engagement.

The obvious "top-level" target here is Consumers International, which has 250 member organizations in 120 countries [7]. This group hosts World Consumer Rights Day and assigns a theme each year to focus consumer efforts. Past themes addressed telephone rights; removing antibiotics from processed foods; and improving consumer diets. More recent trends show a focus on digital trust and fairness (including three years in a row from 2017–2019), which bodes well for the potential inclusion of XR themes. Similar thematic opportunities are to be found in other international, country-specific, and regional groups.

There is also the influence of general advocacy groups or special interest groups that have the ear of segments of the population. For example, the AARP (with members aged fifty or greater) is a major lobbying force in the United States of America thanks to nearly forty million members; it even boasts the two largest circulation-publications in the US [8]. Organizations like AARP enjoy significant levels of trust among their members and can be a critical resource for pushing and framing public debate.

Recommendation #12	Consumers International and other advocacy groups should demonstrate their commitment to the space by championing high privacy standards, while declaring XR ethics as the theme for future days/months, and for other targeted awareness campaigns.

Recommendation #13	Individual stakeholders in the XR ethics space should target their relevant advocacy groups for attention to this topic, including by submitting articles, participating in boards, etc.

2.2. ISSUES BY TOPIC

2.2.1. DATA

In addition to the broad thoughts on data discussed earlier, there are additional layers of data that demand immediate XR attention.

2.2.1.1 LOCATION DATA

XR technologies are routinely location-specific, with activations/applications making extensive use of geofencing, global positioning systems (GPS), and other digital markers of physical spaces. This type of data can be used to determine intimate details about a person's life, the people with whom they associate, their schedule/routine, etc. This data may also be used to infer potential illegal or illicit activities, such as whether someone could have made a particular trip while going only the speed limit or slower. Likewise, it might be used by an authoritarian government to determine if a user attended a pro-democracy rally or by a government that bans religion to evaluate who might be attending religious worship. This can be particularly dangerous in emerging markets for which there is no choice of internet service, outside of a government-controlled utility.

Recommendation #14	A specific focus must be made on the ethics of XR location data collection, evaluation, and sharing, especially in cases where XR technologies are experienced through core technologies, such as smartphones.

2.2.1.2 POKÉMON GO, OVRLANDS, AND IMPLICATIONS FOR BUSINESS

Pokémon Go provided a serious public introduction to widespread AR adoption and the legal/ethical issues that might result. In addition to the injuries commonly sustained by players, there were issues such as frequent trespass on private property. Players seemed to forget that they needed to "prioritize real world rules over in-game concerns." [9] There were even concerns in the US that the game could be used to violate election law [10].

Pokémon Go is free to play; it offers in-app purchases, but these do not interfere with the ability to experience the core mechanics of the game. This is a common model, also used by *Harry Potter: Wizards Unite*, which generated 15 million installs within a month of its release [11]. These apps can compete favorably on price against VR experiences distributed via platform stores and expensive equipment; a key trade-off is their likely need to use data as a form of revenue stream. This may expose children and young adults, as well as economically-disadvantaged communities, to practices that result in a long-term price they do not fully understand they are paying.

Now consider the case of OVRLands, which has divided the world into 1.6 trillion specific hexagons that users can buy, auction, trade, rent, and control [12]. As of publication, a key focus of this company is to allow live events to be broadcast into a user's home in real-time XR, allowing for "a new way to party." But another key component of the system is that a user can buy a specific hexagon that corresponds to a real-world location and have a customized AR experience that someone will encounter when they travel there physically. Advertisers can promote themselves on the land, earning money for the landowner while also earning OVR tokens themselves [12].

Of course, the ability to divide this world has nothing unique about it; Omniscape (billed as "the first location-based XR platform designed for content, community, and monetization") also lets you stake a digital claim to real locations and insert experiences into those spaces [13]. But if one or more of these services is attached to a major provider, and becomes a major force, then those with limited means may come to find that the virtual version of their land is owned by outsiders before they ever get a chance to purchase it. This represents just one of many questions that will arise as to the rights of owners and investors of physical properties and experiences, and the accompanying XR equivalents. (For example, will a hyper-realistic XR version of a tour of Egypt's pyramids result in a ruinous decline in tourist traffic to the real location?)

Recommendation #15	XR stakeholders must interrogate their technologies, experiences, and activations to understand the real-world effects on ownership, investment, personal agency, and the law that they may provide—especially in terms of the XR equivalency of real-world private assets, unique locations, etc.

2.2.1.3 SERVICE DATA AND OWNERSHIP OF CONTENT/EXPERIENCES

This paper has emphasized the business model that offers free access in exchange for data, but this is not the only revenue-generating model used by modern technology businesses. For example, some models now exist in which an individual is purchasing access to a game, movie, or experience, but will lose this access once a subscription or other recurring fee is not paid. *Playstation® Plus* is a platform-based service that provides access to an expanding library of game titles that are "yours to play as long as you are a member." [14][3] A different approach still is found in *Apex Legends*, a game that uses the "freemium" model, in which a user may play the game for free, but would have access to a significantly enhanced experience in exchange for in-game payments/micropayments [15].

These three models represent a significant departure from early home entertainment models. Whether it was via a VHS player or a Nintendo Entertainment System™ (NES), the platform and any games—once purchased—could be played indefinitely at no additional cost outside of normal wear and tear.[4] By contrast, user costs are now for access/licensing, and once access to the account or service ends, the user loses not only the service itself, but access to any additional packages purchased through the service.

These models are not limited to the video game industry. Netflix® charges a monthly access fee but—unlike many video game platforms—regularly drops content it no longer licenses, causing even paying users to lose access.[5] Even free sites such as YouTube (ad-driven) are pushing towards raising revenue through premium services; meanwhile, creators may gain $0.10 to $0.30 per view [16] enough to reward the most popular creators, but not enough to provide a sustainable income for the vast majority of others creating content for the site.

It is reasonable to assume that XR experiences will follow these more developed, pro-business models; consumers are likely to have access to experiences and activations that require ongoing subscriptions to maintain access. Unlike with those early home entertainment systems, however, users will also be contributing extensive quantities of personal data that will help these companies adjust and target experiences back to them designed to increase the revenue they pay to these companies. This question of ownership of received data and experiences, and of the value imbalance at play, will be a critical question for the world of XR ethics and business models.

[3] Playstation is a registered trademark of Sony Interactive Entertainment Inc.
[4] NINTENDO ENTERTAINMENT SYSTEM is a trademark of Nintendo of America Inc.
[5] Netflix is a registered trademark of Netflix, Inc.

Recommendation #16	The public must demand and reward business models that provide a clear understanding of rights, price, value, and ownership of XR data and experiences, in line with the contributions made by those funding them.

2.2.2. SOCIAL MEDIA

As mentioned previously, the misalignment in value exchange has been clearly visible in the social media space for some time. Most prominent social media business models currently finance themselves with customer data and targeted advertising; this is necessary in part because consumers have historically proven hesitant to pay for content online—not only social media, but also news and other content [17]. Over time, it has become clear that the depth of user data analysis, storage, and usage is beyond what could have been reasonably expected by those participating in the social media platforms.

For example, Facebook is purported to maintain approximately 52,000 analytics on each user [18]. GDPR in Europe, and other innovations in consumer privacy law, focus on making it possible for a user to withdraw consent when it comes to personal data. In addition, growing awareness of the use/abuse of personal data may cause a shift towards a cultural decision point in which the experiences being offered are not worth the data being provided. The growth of XR may serve as a catalyst to this shift and help bring context and structure to attempts to improve the equity and agency of provider/user in XR experiences.

Social media is already a key entry point for XR experiences and is likely to remain a core stakeholder in XR rollout and adoption. XR stakeholders should seek to create and support cross-platform capabilities that allow user identities and controls to transcend specific providers, and which enforce standards that allow stakeholders to align with ethical providers and platforms without compromising their ability to connect, communicate, and build audiences/identities/businesses. For an example of such a movement in social media, the *Fediverse* consortium of servers may be used. Users may create identities that cross the boundaries of specific offerings and communication protocols [19], such as is possible with the *Mastodon* open-source software service [20].

Recommendation #17	XR ethics advocates should align closely with privacy/ethical advocates that focus on other, related spheres, such as the social media space, to improve the chances for a comprehensive and efficient movement towards real XR ethical outcomes. Included in this alignment is the support for efforts within those spheres to promote user independence and control.

3. ECONOMY, FINANCIAL SERVICES, BANKING, CRYPTOCURRENCY

The economy, banking, and financial services are such broad topics that anything attached to them gains critical importance by association. As with business models, the impact of XR ethics behavior in these areas will bleed into every sphere of human life and behavior.

3.1. ECONOMY

3.1.1. GOVERNMENT AND INTERNATIONAL ORGANIZATIONS

Broad governmental and international economic organizations may seem out of scope for this paper's domain, but special attention should be paid to their various working groups as these can be critical points of dialogue for topics related to XR ethics. A good example may be found in the 2019 report *Waking Up to a New Reality* [21], published by Accenture, in collaboration with the G20 Young Entrepreneurs' Alliance. This paper highlights the following six specific risks:

- Misuse of personal data
- Fake experiences and false information
- Cybersecurity and identity theft
- Technology addiction
- Antisocial behavior
- Digitally divided worlds (haves/have nots)

It is critical that these conversations begin taking place now in large economically focused bodies; this paper supports the production and sharing of reports of this kind, especially when they can be refined into specific action-driven next-steps.

Recommendation #18	Working groups within major global and regional economics organizations should be targeted for awareness of, and taking of positions on, XR ethics as applies to their members and domains.

3.1.2. CURRENCIES

The world of virtual currencies, including fiat digital currencies operated under the control of a government, is still emerging at the time of this report. As such, specific recommendations are not available at this time, outside of those implied throughout this section (and the larger report) with regards to fairness of access; transparency; and the ability for the government or other entities to track and analyze individual spending, types of experiences selected, etc.

3.1.3. RAW MATERIALS, MANUFACTURING, TRADE

In May 2021, United Nations Secretary General António Guterres spoke at the *Global Roundtable on Transforming Extractive Industries for Sustainable Development*, noting that mineral and raw material extraction have an "essential role to play in advancing sustainability and equity" [22]. It is certainly expected that global economic organizations (and some governments) will push for more environmentally sound and sustainable practices in both raw materials and manufacturing, and that XR's capabilities will be critical in helping drive towards these ends.

On the surface, there are immense positives to the adoption of XR in these industries, especially in cases where an industry is highly dangerous; critical to the economy of a developing nation and its people; and can be rendered safer and more sustainable if low-cost training is available. The 2021 report *An Imperative: Developing Standards for Safety and Security in XR Environments* [23] referenced VR training as able to deliver "high-performance outcomes at a fraction of the cost," and referenced an earlier PwC study that shows that VR is four times quicker than classroom training, and creates users who are four times more focused on their e-learning while nearly three times more confident to apply skills after training.

Despite these benefits, significant challenges are posed by the potential of XR in these industries. In

2019, the European Parliamentary Research Service predicted that artificial intelligence (AI) front-runners could develop into a have or have not ecosystem similar to that of the giant technological firms that operate today [24]. The same can be assumed of XR front-runners, which are more likely to come from wealthier and more technologically advanced societies. A swift rise in XR integration of raw materials and manufacturing could lead to efficiencies that reduce employment opportunities for those in developing nations, while simultaneously eroding what agency those countries currently have in the development of their natural resources and the operations of their manufacturing sectors.

Recommendation #19	XR integration into the raw materials, manufacturing, and trade sectors of developing economies should be designed to ensure that the respective nations, and their people, have access to, and agency with regards to, the benefits that can be realized in their industries.

3.2. FINANCIAL SERVICES AND BANKING

Financial services and banking are massive global industries; as with the economy, they only lend themselves to so much generalization. A host of recommendations can be formed for sectors and sub-sectors; however, this paper's focus is on certain broad themes that fit its ethics problems and recommendations.

3.2.1. BANKING AND LOAN SERVICES

Banking and loan services are considered a key dividing line in terms of access to upward mobility. Mobile technology and digital banking present the most significant potential remedy to this problem in history, even as they also affect the alternative banking systems that arose to deal with peoples' needs for these services. Change is happening quickly; the number of unbanked individuals fell to 1.7 billion in 2017, from 2.5 billion a year before [25]. No doubt these numbers have continued to change dramatically, offering large segments of the population their first opportunity at safe, secure investing via savings and checking accounts, as well as access to loans for personal or business reasons. Concerns about XR in this space have been addressed previously in this paper.

3.2.2. ALTERNATIVE FINANCIAL SERVICES/MONEY SYSTEMS

The term *alternative financial services* can have a number of meanings [26]. For the scope of this report, the focus is on financial service ecosystems, such as *hawala* (or similar), that usually feature the following characteristics:

- Cash-based systems for transferring value, usually in low transaction amounts.
- Often used for sending money across borders, and as such a common tool for money laundering and terrorist financing.
- Community-based, with face-to-face interaction and a sufficient system of records (usually paper-based).
- Communicate limited information about the transaction and participants, with a focus only on what information is required [27].

These systems were used to move more than $500 billion in money in 2013, and can have a massive economic impact in some countries (for example, in Turkmenistan that year, this type of system accounted for 48% of the GDP) [28].

The rise of digital systems, as well as major improvements in anti-money laundering (AML) and terrorist financing globally, have already put systems like these on notice. But because most users are low-income individuals, there are serious implications if systems such as this collapse or go digital before their core users can learn and adopt a replacement system and its accompanying technologies. There are also political concerns that could rise from tighter scrutiny and regulation of *hawala*-type systems in a virtual environment, including the inability of dissidents to convey financial support to their families; the requirement to show your face and identity to use the system, under the guise of know your customer (KYC) laws; etc. This problem represents a similar issue as to the one first raised in this paper, regarding the young man who lost out on life insurance. As disruptive technologies are instituted, there must be training and context made available to users so that they can understand the full set of trade-offs they are making by discarding an old system in favor of a new one.

Recommendation #20	Private firms, governments, and advocacy groups should consider the ethical concerns and dangers of implementing products and services that may undermine critical alternative financial systems, especially if there is a possibility a new system will lack important features of the old. Training and context should be provided to ensure informed consent.

3.2.3. INSURANCE

XR is already well in place in the industry. For example, claims adjusters and underwriters can build comprehensive environments to study the environments to which insurance will apply, and to even inspect physical damage from offsite locations; likewise, virtual reality training environments have become increasingly common, as has VR-based physical therapy for work injuries [29]. The insurance example that opened this paper represents just one dimension of the ethical considerations for XR in the insurance industry. Insurance comes in many forms, including life, health, car, home, workman's comp, etc., and each of these areas has unique dimensions from an XR point-of-view. For this paper, the focus is on the three dimensions that cross most types of insurance:

1. The use and abuse of data that may determine eligibility and/or claim payout.
2. The need for work-related insurance coverage to include protection from accidents or injuries that can arise through the learning or use of XR in a work environment.
3. The need for new types of insurance that may govern specific and unique areas of the XR ecosystem and metaverse.

The first recommendation relates to the problem of data use and abuse, as illustrated in the opening section of this paper.

Recommendation #21	Insurance providers and financial services companies should have clear limits on their ability to use data (not collected by them) for insurance underwriting and claims payment services; and transparent, open processes must exist for individuals to determine what data, and from what providers, was used to determine their viability.

A swift increase in the mandatory adoption and use of XR technologies in the workplace will also mean a rise in the number of workplace accidents related to the technology. The most familiar example to VR headset users might be the danger of falling, running into objects, or hitting/kicking someone while a user's vision is entirely obscured. But there is also the problem of injuries such as muscle strain, carpal tunnel syndrome, stiff shoulders, headaches, and eye strain from device wearing [30]. These issues will need to be expressly understood and specified as elements of a potential worker's health and compensation needs if they accompany mandatory device use.

Recommendation #22	Workers required to use and adapt to new devices and methodologies must have ergonomic considerations and coverage for XR-related injuries that arise during adjusting to, and using, XR and its associated platforms.

With a focus on top-level issues, the third recommendation is presented more for the consideration of ethics as it applies to rights, ownership, public and private spaces, and other similar matters in an XR environment. As people and corporations stake a claim to the XR space, and as human identity becomes intertwined with XR, it is imperative that insurance coverage emerges and adjusts to account for problems of risk and loss associated with the affairs of these virtual environments. How this insurance might operate will take shape over time, but could include coverage for loss of identity/avatar representation, loss of access to environments of a therapeutic or privileged nature, etc.

Recommendation #23	As human work, play, and identity enter a metaverse in which they become entwined, insurance coverage must emerge to protect for risk, damage, and loss of assets, properties, and other elements of this metaverse.

3.2.4. PERSONAL INVESTING

XR's capabilities as a training tool bode well for opportunities to increase financial wellness education for retail investors. Likewise, XR will be able to offer individuals in difficult locations access to the experience of a live, in-person bank or personal financial advisor, and this physical flexibility would make it easier for advisors to serve more clients in a single day. This could be a positive step in reducing the haves and have nots of financial advice by giving firms the capability to serve underbanked or under-educated individuals who might normally have no physical access to a personal financial advisor.

The atmosphere of the in-person meeting will no doubt be adjusted to make the best use of XR's capabilities for simultaneous video and data visualization [31]. This could be overwhelming to some individuals, and it is possible that unethical firms or salespeople could make use of atmospheric effects (such as light, noise, distraction); virtual effects such as highlighting certain text, or using eye movement tracking to keep positive data in the clients' line of sight while downplaying negative data; etc. The various moral concerns shared in this paper will apply especially to situations in which an individual is placed in an environment outside of their control and asked to make difficult financial decisions.

The XR ethics space must be prepared to imagine, and account for, the issues that will arise in this space and to seek their oversight by appropriate means. In some cases, these issues will be beyond the limits of the XR or its device; for example, financial advisers interacting with a senior citizen via an XR device will have reduced capacity to observe their living environment's sanitary upkeep, or the presence of potential elder abuse from others, who may be exerting financial force or bullying on them. It will be up to these industries to work with XR providers on potential solutions to problems "outside of the metaverse" that still apply to conditions within it.

Recommendation #24	Individuals offering financial advice and/or products must have clear rules and limitations as to what effects they may produce with XR to influence the decision of a customer. They must likewise seek to understand extra-metaverse factors that may be affecting behavior without being apparent in the metaverse.

3.2.5. ANTI-MONEY LAUNDERING, TERRORIST FINANCING, FRAUD, REGULATION

Know your customer (KYC) stands as one of the foundations of modern fraud prevention. The decline of in-person services has brought considerable challenges, but KYC has overcome them with a host of security measures that are now widespread. If anything, one could imagine that a rise in XR technology might make it more viable for businesses to know customers again, especially with easy and widespread video. Likewise, XR might bring KYC capabilities to those who traditionally have struggled with them, such as people with no or limited mobility.

As has been illustrated in prior examples, KYC capabilities must evolve to serve the legitimate public interest while also attending to individual rights. KYC stakeholders will need to navigate the concerns raised previously as to individual agency, the protection of identity from third parties, the safety of participants, etc. These stop short of requiring a specific recommendation, but merited mention here.

3.3. CRYPTOCURRENCY, VIRTUAL ASSETS/NFTS, AND BLOCKCHAIN APPLICATIONS

3.3.1. CRYPTOCURRENCIES AND NFTS

It did not take long for cryptocurrency to become the product type by which blockchain (and other distributed ledger technologies) are known and judged in the public eye—and for good reason. In one recent example, a coin launched on a Monday took all of two days to achieve a $45 billion [32] market cap; putting it in a similar valuation to the hotel chain Marriott International, or the financial company Bank of New York Mellon. Fraud has been rampant, and the decentralized nature of the technology has made it highly attractive for those involved in money laundering, terrorist financing, and other types of financial crime.

Likewise, non-fungible tokens (NFTs) have come recently to prominence, offering blockchain-based opportunities to buy and sell elements outside of virtual spaces, such as a particular highlight from a professional basketball game [33] or a band's new album release [34]. The rapper MF Doom released augmented reality masks that were superimposed over the faces of iconic celebrities and historical figures [35].

With distributed ledger technologies coming into such quick use and adoption, there will be a whole series of specific XR ethical concerns to be analyzed. This will be especially true in cases where XR activations are "sold" to users for cryptocurrencies or NFTs, in exchange for data that may be of far greater value. This paper stops short of specific recommendations in this space, short of the ones already made that apply to this space.

3.3.2. BROADER DISTRIBUTED LEDGER APPLICATIONS

As with the previous technologies, there needs to be a tight coordinating effort between XR stakeholders and distributed ledger stakeholders to ensure the evolution of ethical considerations. The Pokémon example illustrated a sliver of the problems that arise when XR adoption meets elements of human life outside the metaverse. Serious and troubling questions should be asked about how disparate elements of these technologies might be brought together into profoundly dangerous and unethical ways that are exploited further by the anonymity and lack of central control that distributed ledgers provide.

What if, for example, a bad actor was able to use public data to successfully pinpoint a user's personal mobile device; and then to use this pinpoint to offer XR experiences that involved that person, such as the ability to buy their home address or telephone number? Or to use a NFT to sell access to their physical "space" to the highest bidder? This is but one example. What was once a dystopian thought experiment is now theoretically possible with the combination of technologies described in this paper; it will be incumbent on stakeholders of all types to prevent this type of use and abuse, including cutting off its data and infrastructure flow before it can emerge or gain common acceptance.

4. CONCLUSIONS

Business models, financial services, and global economics illustrate a common thread: the very nature of these institutions as systems of competition stands as a major threat to the development and adoption of a thorough set of XR ethics. Early entrants stand poised to dominate fields that directly govern the goodwill of citizenries, the future of governments, and the opportunity to be the next global corporate behemoth—an opportunity that, if not taken, will more than likely simply go to another party.

Stakeholders can also separate themselves from the consequences of their decisions on an unprecedented level, just as a social media firm might tout its benefits to society while determining that downstream effects are the fault of broader forces, not of its own specific actions. This represents a moral hazard generally, and a great dilemma for companies and countries that are dedicated to pursuing ethical approaches to XR. These like-minded entities need to find one another, organize with each other, and act quickly to navigate the tumultuous waters to come. Their success or failure will impact every area of human life explored in this paper.

5. REFERENCES

The following sources have either been referenced within this paper or may be useful for additional reading:

[1] M. Scott, "Stealth political ads flourish on Facebook," *Politico.com*, 2020. https://www.politico.com/news/2020/03/06/stealth-political-ads-flourish-on-facebook-122539.

[2] "EXTENDED REALITY (XR) MARKET - GROWTH, TRENDS, COVID-19 IMPACT, AND FORECASTS," *MordorIntelligence.com*, 2021. https://www.mordorintelligence.com/industry-reports/extended-reality-xr-market#:~:text=Given its enormous potential%2C XR,gaming and healthcare to manufacturing.

[3] Wikipedia, "Pokémon Go," *wikipedia.org*, 2016. https://en.wikipedia.org/wiki/Pokémon_Go#References.

[4] S. P. Jessica Outlaw, "Industry review boards are needed to protect VR user privacy," *weforum.org*. https://www.weforum.org/agenda/2019/08/the-hidden-risk-of-virtual-reality-and-what-to-do-about-it/.

[5] N. M. Mabaquiao, "The possibility of ethical business," *J. Dharma*, 2020.

[6] K. B. Harrison, "The Transformation of Financial Services," *Russell Reynolds Associates*. https://www.russellreynolds.com/insights/thought-leadership/esg-2020-the-transformation-of-financial-services.

[7] "Consumers International," *ConsumersInternational.org*, 2021. https://www.consumersinternational.org/members.

[8] C. L. Day, *AARP: America's Largest Interest Group and Its Impact*. ABC-CLIO, 2017.

[9] "Pokemon Go Players Are Finding Imaginary Monsters, Along With Real Legal Issues," *AshtonandPrice.com*. https://www.ashtonandprice.com/pokemon-go-legal-issues/.

[10] A. Petteys, "The Surprising Legal Issues Related to Pokémon Go," *Patch.com*. https://patch.com/michigan/royaloak/surprising-legal-issues-related-pokmon-go.

[11] M. Forde, "Harry Potter: Wizards Unite is already in sharp decline," *Pocketgamer.biz*, 2019. https://www.pocketgamer.biz/news/72068/harry-potter-wizards-unite-sharp-decline/#:~:text=Downloads number aren't good,during the last four months.

[12] "Is Augmented Reality (AR) Blockchain's Killer App?," *Ovr.ai*. https://www.ovr.ai/blog/is-augmented-reality-ar-blockchains-killer-app/.

[13] "The First Location-based XR Platform Designed for Content, Community, and Monetization," *omniscape.com*. https://www.omniscape.com.

[14] "PlayStation," *PlayStation.com*. https://www.playstation.com/en-us/ps-plus/.

[15] "EA Games," *EA.com*. https://www.ea.com/games/apex-legends.

[16] W. Geyser, "How Much do YouTubers Make? – A YouTuber's Pocket Guide," *YouTube.Com*, 2021. https://influencermarketinghub.com/how-much-do-youtubers-make/.

[17] M. Masnick, "The Paywall Conundrum: Even Those Who Like Paying For News Don't Pay For Much News," *techdirt.com*, 2019. https://www.techdirt.com/articles/20190615/01285842407/paywall-conundrum-even-those-who-like-paying-news-dont-pay-much-news.shtml.

[18] A.Green, "Facebook's 52,000 data points on each person reveal something shocking about its future," *Komando.com*. https://www.komando.com/social-media/facebooks-52000-data-points-on-each-person-reveal-something-shocking-about-its-future/489188/.

[19] J. Holloway, "What on Earth is the fediverse and why does it matter?," *NewAtlas.com*, 2018. https://newatlas.com/what-is-the-fediverse/56385/.

[20] E. Rochko, "Welcome to Mastodon," *2017*. https://web.archive.org/web/20180912080249if_/https://hackernoon.com/welcome-to-mastodon-111d9227e56a.

[21] L. Morvan, "Waking up to a new reality," *Accenture.com*, 2019. https://www.accenture.com/_acnmedia/Accenture/Redesign-Assets/DotCom/Documents/Global/1/Accenture-G20-YEA-report.pdf#zoom=50.

[22] U. News, "Share gains from extracting precious raw materials more equitably, guard against pitfalls: UN chief," *News.un.org*, 2021. https://news.un.org/en/story/2021/05/1092692.

[23] N. Morris, "An Imperative Developing Standards for Safety and Security in XR Environments," *xrsi.org*, 2021. https://xrsi.org/wp-content/uploads/2021/02/An-Imperative-Emteq-XRSI-Whitepaper-on-Standards-for-safety-and-Security.pdf.

[24] M. Szczepański, "Economic impacts of artificial intelligence (AI)," *EPRS: European Parliamentary Research Service*, 2019. https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/637967/EPRS_BRI(2019)637967_EN.pdf.

[25] "DRIVING FINANCIAL INCLUSION FOR THE UNBANKED," *Unbankded.com*. https://unbanked.com/resources/banking/driving-financial-inclusion-for-the-unbanked/.

[26] C. Bradley, S. Burhouse, H. Gratton, and R.-A. Miller, "Alternative financial services: A primer," *FDIC Q.*, vol. 3, no. 1, pp. 39–47, 2009.

[27] F. A. T. Force, "The role of Hawala and other similar service providers in money laundering and terrorist financing," *Paris.* https://www.fatf-gafi.org/media/fatf/documents/reports/Role-of-hawala-and-similar-in-ml-tf.pdf *(letzter Abruf 15.05. 2018)*, 2013.

[28] A. Mayyasi, "Hawala: The Working Man's Bitcoin," *Priceonomics, Febr.*, vol. 7, 2014.

[29] "Extended Reality (XR) – Seizing opportunity in Insurance during COVID 19," *Coforgetech.com*, 2020. https://www.coforgetech.com/resource-library/point-view/extended-reality-xr-seizing-opportunity-insurance-during-covid-19.

[30] "Pioneering the Extended Reality Frontier in Insurance," *Accenture Insurance*, 2018. https://insuranceblog.accenture.com/pioneering-the-extended-reality-frontier-in-insurance.

[31] O. S. University, "Virtual reality, real injuries: How to reduce physical risk in VR," *ScienceDaily.com*. https://www.sciencedaily.com/releases/2020/01/200108092448.htm .

[32] "Two-day-old cryptocurrency surges to US$45B market value," *BNNBloomberg.ca*, 2021. https://www.bnnbloomberg.ca/cryptocurrency-s-value-surges-to-45-billion-one-day-after-its-debut-1.1602436.

[33] J. Young, "People have spent more than $230 million buying and trading digital collectibles of NBA highlights," *Cnbc.com*, 2021. https://www.cnbc.com/2021/02/28/230-million-dollars-spent-on-nba-top-shot.html.

[34] D. Ripert, "Augmented Reality NFTs: Benefits and How to Create Them," *poplar.studio*, 2021. https://poplar.studio/blog/augmented-reality-nfts/.

[35] A. Ardichvili, J. A. Mitchell, and D. Jondle, "Characteristics of ethical business cultures," *J. Bus. ethics*, vol. 85, no. 4, pp. 445–451, 2009.

[36] M. Komorowski and S. Delaere, "Online media business models: Lessons from the video game sector," *Westminster Pap. Commun. Cult.*, vol. 11, no. 1, pp. 103–123, 2016.

[37] S. McPhillips and O. Merlo, "Media convergence and the evolving media business model: An overview and strategic opportunities," *Mark. Rev.*, vol. 8, no. 3, pp. 237–253, 2008.

[38] O. Novikova, "The New Media Business Model: When Customer Controls the Data," *J. Bus. Model*, 2019.

[39] A. Salamzadeh, H. Kawamorita Kesim, and M. Karami, "Media business models: A holistic approach," 2019.

[40] S. Angova and I. Valchanov, "New online media business models," *God. na UNSS*, vol. 1, pp. 287–306, 2018.

[41] J. Windscheid, B. Gossel, and A. Will, "Media entrepreneurship: The role of emerging technologies for media business models," 2019.

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