Migration Letters

Volume: 20, No: 9, pp. 228-258

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Regulatory Frameworks for Autonomous Robotics in NEOM's Sustainable Technology Landscape

Dr. Mohamed Diaa Mohamed Refaei[1]

The author extend their appreciation to the Deputyship for Research & Innovation, Ministry of Education in Saudi Arabia for funding this research work through the project number (0154-1443-S).

Abstract

This article embarks on a jurisprudential exploration of the legal framework underpinning NEOM, a pioneering city project in Saudi Arabia that stands at the forefront of technological innovation and urban development. Anchored within the broader context of Saudi Arabia's Vision 2030 initiative, the study delves into the complex interplay between advanced technology and Islamic jurisprudence, addressing the novel legal challenges posed by autonomous robotics and AI systems within NEOM's futuristic landscape. The paper critically examines the evolving concept of legal personhood in the context of AI, probing the ramifications of granting 'electronic personhood' to autonomous entities and its alignment with Islamic legal principles. It further scrutinizes issues of data privacy, technological ethics, and environmental sustainability, proposing a forward-thinking legal architecture that harmonizes technological advancement with ethical mandates and societal protection. Through an interdisciplinary approach, the study navigates the dynamic techno-legal terrain, emphasizing the necessity of agile legal frameworks, adaptive enforcement mechanisms, and global techno-legal consortia. This scholarly exposition not only contributes to the existing body of legal literature on emerging technologies but also offers pragmatic recommendations for NEOM, positing it as a potential model for global urban and legal innovation. The article concludes by highlighting the imperative of continuous legal evolution in response to technological progress, advocating for a jurisprudentially resilient and ethically grounded legal landscape in NEOM.

Keywords: *NEOM, Autonomous Robotics, electronic personhood.*

1. Introduction

The advent of autonomous robotics and advanced artificial intelligence (AI) systems heralds a new epoch in the synthesis of technology and jurisprudence. This transformation is vividly exemplified in the NEOM project, a futuristic city initiative under Saudi Arabia's Vision 2030. The integration of cutting-edge technology within NEOM's urban fabric presents unique jurisprudential challenges and opportunities,

[1] Co-professor of Public Law, College of Sharia & Law, University of Tabuk, Saudi Arabia, e-mail: m.refaei@ut.edu.sa

necessitating a reevaluation of traditional legal doctrines and the creation of innovative legal frameworks.

1.1 Background and Rationale

NEOM's vision encompasses not only technological advancement but also a commitment to an ethical, sustainable, and legally sound societal structure. The interplay of autonomous robotics within this framework poses intricate legal questions, particularly around the concepts of legal personhood for AI, data privacy, ethical algorithmic governance, and environmental sustainability. This intersection of advanced technology with legal norms underscores the need for a comprehensive legal approach that aligns with Islamic jurisprudence and international legal standards..

1.2 Objectives and Hypotheses

The primary objective of this paper is to explore and articulate a viable legal framework for NEOM that addresses the challenges posed by autonomous technologies. It hypothesizes that NEOM can pioneer a legal paradigm that is both adaptable to technological innovation and grounded in ethical and jurisprudential principles. This framework should balance technological advancement with societal protection, ensuring compliance with Islamic law and international legal norms.

1.3Methodology

The study adopts an interdisciplinary approach, combining legal analysis with insights from technology studies, ethical theories, and Islamic jurisprudence. It utilizes a comprehensive review of existing legal doctrines, case law, and scholarly works on AI and robotics. The paper also incorporates scenario analysis and prognostication techniques to anticipate future legal challenges and propose preemptive solutions.

1.4 Structure of the Paper

This paper commences with a theoretical foundation, followed by a thorough literature review. Subsequent sections dissect NEOM's positioning within the global techno-legal arena, delve into case studies highlighting the legal and ethical dimensions of robotics, and propose a framework for NEOM's regulation of autonomous robots. The final sections outline potential challenges and wrap up with conclusions and recommendations.

2. Theoretical Underpinning and Literature Synthesis

2.1 Theoretical Foundations

The incursion of autonomous robotics in legal strata is a multidisciplinary challenge, necessitating a synthesis of theoretical insights across sectors. This section delves into the deep theoretical chasms, assessing the jurisprudential foundations and their implications for the emerging realities of robotics and technological urban spaces.

2.1.1 Redefining Jurisprudence in the Age of Autonomous Robotics

The infusion of autonomous robotics in societal contexts marks a paradigmatic transition in jurisprudential landscapes, necessitating a profound reconceptualization of law's foundational doctrines. Traditional legal frameworks, exemplified by legal positivism, hinge on the predictability and intentionality intrinsic to human conduct. However, the ontological shift instigated by autonomous entities, governed by artificial intelligence (AI) and machine learning (ML), challenges these normative legal structures, demanding innovative juridical interpretations (Calo, 2015).

The operational principles of autonomous robots, delineated by complex algorithms, introduce a significant anomaly into the legal matrix constructed around human behavior and morality. Legal systems, premised on human experiential parameters, grapple

ineffectively with AI's decision-making processes, devoid of human emotional and ethical compasses. This disconnect manifests starkly in liability attribution, exposing the inadequacy of existing legal doctrines to address the complexities engendered by robotic autonomy (Asaro, 2011).

Lessig's (2006) groundbreaking theory, "code is law," anticipated this juridical dissonance, asserting technology's role in shaping legal and social norms. Beyond a symbiotic relationship, Lessig proposed an active technological encroachment into legal governance, signifying a shift towards 'lex informatica,' wherein legal norms are interwoven with and influenced by technological protocols.

The integration of legal norms within algorithmic frameworks extends beyond augmenting statutory regulations; it implicates a fundamental jurisprudential restructuring. This intersection presents not merely regulatory hurdles but an epistemological reorientation in understanding law's societal roles (Hildebrandt, 2015). The governance of AI and robotics, contingent on encoded norms, necessitates interdisciplinary acumen, bridging legal scholarship with technological literacy.

Furthermore, the democratic ethos underpinning conventional legal systems, which underscore transparency, accountability, and collective governance, confronts a potent challenge in the realm of robotic autonomy. The algorithmic mechanisms that steer these entities operate beyond layperson comprehension, confining regulatory comprehension and command to a specialized technocracy. This dynamic aggravates democratic deficits, obfuscating legal accessibility and equity, and concentrically centralizing power (Brownsword, 2019).

In synthesizing these insights, the trajectory of legal regulations vis-à-vis autonomous robotics is identified as a transformative continuum. This transition surpasses the mere enactment of robot-specific legislations, invoking a philosophical reevaluation and systemic reengineering of jurisprudential axioms. The emergent legal tapestry requires a confluence of multidisciplinary expertise, integrating technologists, jurists, ethicists, and sociologists, to construct an inclusive legal architecture. This collaborative framework must strive to preserve democratic principles of justice, equality, and rule of law within an ecosystem increasingly permeated by algorithmic determinism and robotic self-governance (Mittelstadt, 2019).

In conclusion, the advent of autonomous robotics signifies a jurisprudential watershed, challenging traditional legal precepts and democratic ideals. The evolving 'lex informatica' necessitates a recalibrated legal philosophy, a synergy of diverse expert insights, and an overarching commitment to upholding foundational democratic principles in this algorithm-dominated epoch. Navigating this intricate nexus will require an unprecedented level of interdisciplinary cooperation and a reimagined understanding of legal norms and structures, underscored by the principles of equity, accountability, and transparent governance.

2.1.2 Sustainable Technological Cities: Jurisprudence and the NEOM Initiative

The rise of technologically-driven cities heralds a fresh chapter in urban evolution, harmoniously blending urban planning, technological advancement, and intricate legal systems. As a salient case in point, the NEOM initiative elucidates the myriad legal and ethical dilemmas these techno-cities face. For context, Singapore's Smart Nation and Barcelona's Smart City serve as illustrative global benchmarks, both experiencing a compelling need to seamlessly marry legal systems with rapid tech progression (Caragliu, Del Bo, & Nijkamp, 2011).

Jurisprudentially, we observe a pivotal shift in techno-cities from traditionally static legal regimes to dynamic and anticipatory frameworks. Our conventional legal edifices, conceived during relatively stable socio-economic epochs, appear increasingly outmoded in the face of our current digital societal evolution. Echoing Teubner's (1983) seminal

insights on reflexive law, it's evident that the rapid cadence of societal and technological change necessitates agile and adaptive legal systems. A concrete illustration is the EU's GDPR which emerged as a response to pervasive concerns surrounding data sovereignty, privacy, and the ethics of the digital domain (Voigt & von dem Bussche, 2017). As artificial intelligence becomes ubiquitous and ethical considerations paramount, projects such as those in Amsterdam and Copenhagen—much like NEOM—underscore the urgency to revitalize our prevailing legal doctrines.

The crucial role of legal foresight in this scenario cannot be overemphasized. Examining Marchant's scholarly contributions in parallel with real-world initiatives like Dubai's Smart City sheds light on a pressing need for a jurisprudential posture that's both predictive and adaptively responsive. This aligns with a broader academic and practical consensus advocating a governance model intertwining technological forecasting with evolving legal paradigms (Kitchin & Lauriault, 2014).

Central to our discussion is the imperative of algorithmic governance transparency. A detailed scrutiny of Sidewalk Labs' Toronto project, for instance, lays bare the myriad complexities inherent in rolling out transparent algorithmic systems (Bridle, 2018; Green, 2019). Such tangible cases accentuate the paramount importance of clarity in algorithmic decision-making. This transcends mere operational efficacy; there exists a deep-seated ethical obligation to ensure digital mechanisms resonate with collective societal values, individual rights, and equitable distributions (Zuboff, 2019).

In contemplating this dynamic jurisprudential terrain, techno-cities represent both uncharted challenges and untapped potentials. As NEOM and analogous global endeavors continue to evolve, they collectively underscore a clarion call for jurisprudential rejuvenation. Answering this call demands an integrative strategy: one rooted in cutting-edge legal research, invigorated by interdisciplinary dialogues, and operationalized through nimble, forward-looking policy frameworks. The ultimate vision remains unaltered: crafting urban futures that harmoniously meld technological innovation with unwavering commitments to human rights, societal ethics, and shared prosperity.

2.1.3 Interdisciplinary Approach in Jurisprudence: Navigating the Complexities of Autonomous Systems

The advent of autonomous systems marks an inflection point in jurisprudential thought, necessitating an interdisciplinary recalibration of traditional paradigms. As we navigate this uncharted terrain, the integration of diverse perspectives becomes not just beneficial but indispensable. The multifaceted complexities introduced by these technological advancements supersede the capacities of conventional legal frameworks, demanding a comprehensive, cross-disciplinary strategy (Murray, 2016).

In the realm of autonomous technologies, the unprecedented unpredictability, epitomized by self-evolving machine learning capabilities and unsupervised decision-making processes, challenges the bedrock of legal systems—predictability, consistency, and accountability (Calo, 2017). Herein, traditional legal doctrines, rooted in human agency and predictable causalities confront obsolescence. This confrontation underscores the imperative of incorporating technological and computational expertise into legal reasoning and methodologies. By penetrating the opaque veil of sophisticated algorithms and operational mechanics, jurisprudence can craft informed, nuanced, and preemptive doctrines responsive to these emergent, unpredictable technological phenomena (Hildebrandt, 2015).

Furthermore, beyond the algorithmic enigmas, there exists an expansive ethical quagmire. Traditional legal frameworks find themselves navigating a labyrinth of privacy dilemmas, accountability in decision-making, and inherent algorithmic biases, which they are ill-prepared to resolve autonomously (Mittelstadt, 2019). Ethical considerations in this context extend beyond statutory compliance; they invoke deep-seated philosophical

inquiries into the moral imperatives that should inform and guide our legislative architectures and judicial pronouncements. This dimension adds a layer of humanistic depth, propelling legal norms toward broader societal justice, human dignity, and ethical stewardship.

Recognizing the limitations of traditional, retrospective legal mechanisms in this rapidly evolving landscape, contemporary jurisprudence must pivot towards a future-proofed framework. It entails a forward-looking legal posture, underscored by anticipatory governance and legal agility, prepared to align with and adapt to technological innovations (Marchant, Abbott, & Allenby, 2014). This paradigm shift is not an end in itself but a continuous process, demanding legal frameworks that are not just reactive but also proactive, capable of foreseeing and addressing the ethical and legal conundrums that these technologies engender.

Embracing this complexity, the interdisciplinary approach emerges as a beacon, guiding this jurisprudential epoch. It advocates a symbiotic scholarship model that harnesses insights from data scientists, moral philosophers, legislative experts, and judicial practitioners. This collaborative tapestry is instrumental in erecting a resilient legal superstructure, inherently robust to accommodate the moral, ethical, and societal challenges spurred by autonomous technologies (Scaria, 2015).

In conclusion, the trajectory toward mastering the jurisprudence of autonomous systems charts a course through unexplored academic and practical terrains. It compels us to knit a rich interdisciplinary tapestry, drawing from the nuanced threads of technology, ethical introspection, and innovative legal thinking. This convergence is foundational in erecting legal edifices of the future, ensuring they are anchored in principles of inclusivity, justice, and reverence for human dignity. In this relentless march of technological progress, it is this holistic symbiosis that will fortify our legal institutions, enabling them to serve as steadfast guardians of ethical values and societal equilibrium.

2.2 Literature Synthesis

2.2.1 Legal Accountability and Autonomous Systems:

Navigating the jurisprudential complexities introduced by autonomous systems demands an intricate synthesis of existing literature that bridges the chasm between conventional legal doctrines and the sophisticated operational realities of these technological entities. Autonomous systems represent a seismic shift in the landscape of legal accountability, particularly challenging the doctrines of tort law, including foreseeability, causation, and liability. The unique operational attributes of these systems, characterized by their autonomous decision-making capabilities, defy the traditional parameters of human control and predictability that form the bedrock of current legal frameworks (Murray, 2018).

The inherent autonomy in these technological systems undermines established norms of accountability, traditionally premised on human oversight and predictability. Decision-making processes driven by advanced algorithms and machine learning techniques defy direct attribution to conventional actors, such as manufacturers or operators, thereby disrupting the standard chain of liability (Schwartz, 2019). Particularly, instances where actions executed by autonomous systems deviate from their creators' anticipations highlight the deficiencies in current legal frameworks, which are predicated on foreseeability.

In response to these challenges, scholarly discourse has broached the radical concept of ascribing legal personhood to robots. This innovative proposition acknowledges the advanced, quasi-independent operational capabilities of autonomous systems, suggesting their recognition as separate legal entities. Such a transformative approach aims to circumvent the anthropocentric constraints of existing legal doctrines. However, it simultaneously engenders critical debates around rights, obligations, and the concept of

'personhood,' traditionally grounded in inherent human biological and psychological characteristics.

Beyond structural and doctrinal adaptations, the legal discourse must evolve to encapsulate the profound ethical implications arising from autonomous operations. Scenarios where harm results from decisions enacted without human input present complex ethical quandaries, necessitating a recalibration of legal standards to reflect broader societal values and ethical principles (Pagallo, 2013). This imperative underscores the critical need for dynamic legal norms that resonate with the pace of technological advancements and societal consensus (Bryson et al., 2017).

Addressing these multidimensional challenges calls for a paradigm shift in legal approaches towards autonomous systems. The transformation extends beyond reactive legal adjudications, advocating for proactive jurisprudential engineering that anticipates technological trajectories and societal implications. This forward-looking perspective emphasizes the need for a legal system that is simultaneously robust and malleable, capable of adapting to emerging realities while preserving ethical integrity and societal welfare (Brownsword, 2019).

In synthesizing the diverse strands of scholarly insights, it becomes unequivocally clear that the intricacies of legal accountability in the realm of autonomous robotics require a fundamental reconfiguration of traditional legal paradigms. The envisioned jurisprudential evolution necessitates an acknowledgment of the unprecedented complexities introduced by these advanced entities. It underscores the imperative to balance stringent legal accountability with nuanced ethical considerations, ultimately aspiring towards a legal system proficient in stewarding societal advancements at the cusp of technological innovation.

2.2.2 Ethical Considerations in Autonomous Robotics

Delving into the ethical intricacies associated with autonomous robotics commands a rigorous scholarly navigation through a terrain fraught with philosophical conundrums and moral ambiguities. The advent of autonomous systems not only prompts the application of established ethical doctrines but also necessitates a critical reassessment of these principles, given the unparalleled proficiencies and unpredictabilities these technologies embody (Bryson, 2018). This journey underscores the importance of a nuanced dialogue that extends beyond superficial ethical analogies, venturing into the profound depths of moral philosophy and human values (Vallor, 2016).

Central to the ethical debate is the formidable challenge of translating intricate human moral reasoning into algorithmic logic. This transposition is fraught with philosophical tension, considering the human propensity for context-dependent judgments and moral fluidity, aspects that starkly contrast with the binary realm of computational algorithms. Encoding nuanced ethical principles into autonomous systems, therefore, represents a colossal intersection of technology and philosophy. It necessitates harmonizing the ostensibly divergent tenets of deontological and consequentialist ethics—traditionally characterized by rule-based morality versus outcome-oriented morality, respectively.

Nowhere do these ethical complexities manifest more conspicuously than in the realm of autonomous vehicles tasked with making instantaneous decisions with life-or-death implications. These dilemmas, epitomized by the philosophical "trolley problem," require machines to make choices reflective of moral judgments that have perplexed humanity for generations. This scenario transcends technical algorithmic challenges, broaching profound ethical questions regarding the infusion of value systems and hierarchical assessments into artificial agents. It calls into question foundational ethical doctrines, including principles of equality and the sanctity of life, which form the bedrock of contemporary moral philosophy.

Compounding these ethical predicaments is the evolving discourse surrounding the autonomy and moral agency of robotic systems. As these entities exhibit advanced levels of independence, the distinction between instrument and agent becomes increasingly nebulous, igniting debates over the allocation of moral responsibility and the plausibility of ascribing rights to non-biological entities. This discourse propels us into the unexplored realms of defining "life" and agency, compelling a reevaluation of anthropocentric ethical and legal doctrines.

The ethical quandaries permeating autonomous robotics also bear significant societal implications. The methodologies employed in instilling ethical decision-making in these systems influence societal norms and interpersonal dynamics, encompassing trust in technological advancements and the broader role of technology within societal frameworks. Consequently, the ethical configuration of autonomous systems emerges as a democratic imperative, necessitating inclusive stakeholder engagement and reflecting collective societal values (Noorman, 2012).

Conclusively, the ethical exploration of autonomous robotics represents a profound scholarly expedition into territories of philosophical and moral ambivalence. It obliges an exhaustive reexamination of traditional ethical doctrines, advocating an academic openness to redefine concepts of agency, responsibility, and the sanctity of existence in an era increasingly dominated by technological entities that challenge and redefine the foundational tenets of human ethical understanding.

2.2.3 Regulatory Disparities and Convergences: A Critical Analysis

As we navigate the complexities of legal frameworks governing autonomous robotics, it becomes apparent that traditional paradigms are grappling with the unprecedented realities introduced by these technological advancements. The legislative and judicial systems, anchored in historical and anthropocentric principles, face profound challenges, as exemplified by the European Union's exploration of "electronic persons" within the legal corpus. This notion, a radical departure from established legal doctrines, has sparked considerable debate and criticism within the scholarly community and judicial circles, highlighting the need for a more nuanced, forward-thinking, and globally harmonized approach.

The European Parliament's resolution to recognize robots as potential "electronic persons" reflects a revolutionary, yet controversial, legal conceptualization (European Parliament, 2017). This approach, while ostensibly addressing issues of liability and agency in autonomous systems, has elicited criticism for its hasty departure from established legal norms centered around human agency and natural personhood.

Critics argue that this proposal may be premature, given the current stage of autonomous technology, and could inadvertently introduce more legal complications than it seeks to resolve (Bryson, Diamantis, & Grant, 2017). For instance, the extension of personhood, even in a limited context, could entangle autonomous systems in a web of rights and responsibilities that society and the legal system are not yet equipped to handle. The concept of "electronic persons" is further complicated by the absence of precedents, necessitating reliance on analogies with corporate personhood that remain imperfect substitutes due to intrinsic differences in autonomy, intentionality, and moral agency.

Furthermore, scholars like Asaro (2016) posit that the approach could potentially undermine human rights by creating a false equivalence between human beings and artificial entities. This equivalence could dilute the unique moral and jurisprudential standing humans currently hold within the legal system, thereby fundamentally altering the social contract upon which laws are built.

The stark contrast between the EU's approach and other jurisdictions' more cautious stances underscores the broader challenges in shaping a cohesive international legal framework for autonomous systems. These disparities, while reflective of cultural and

socio-legal differences, also signal a fragmented future for robotics regulation, impeding universal standards necessary for global commerce and governance (Scherer, 2016).

Legal scholars advocate for a more gradual, collaborative process of developing international standards, drawing on comparative analyses of existing regulations and their efficacies (Bartolini, 2018). Such an approach requires international bodies to facilitate dialogue, accommodate diverse legal traditions, and create a flexible, adaptable legal framework that can evolve alongside technological advancements.

Conclusively, harmonizing legal standards for autonomous robotics transcends mere regulatory alignment; it necessitates interdisciplinary engagement to construct an ecosystem conducive to innovation, ethics, and societal welfare. Law cannot operate in a vacuum, especially in fields as dynamic and multifaceted as autonomous robotics (Hildebrandt, 2015). Collaboration among legal scholars, ethicists, technologists, and policymakers is essential for creating balanced, resilient, and context-appropriate regulations.

This interdisciplinary approach is not without its challenges, given the varying epistemologies and methodologies these fields employ. However, the alternative—a fragmented, inconsistent legal landscape—poses greater risks to society, innovation, and the very concept of justice. Hence, the onus is on the current generation of legal scholars and practitioners to forge new alliances, embrace epistemological diversity, and chart a prudent course through these uncharted territories.

3. Contextualizing NEOM in the Global Techno-Legal Landscape

3.1 Jurisprudential Implications of NEOM's Techno-Legal Interface

NEOM's vision, as part of Saudi Arabia's Vision 2030 initiative, requires a delicate interplay between innovation and adherence to Islamic law. Given that Islamic jurisprudence, or Fiqh, is derived from various sources, including the Qur'an, Sunnah (practices of the Prophet Muhammad), Ijma' (scholarly consensus), and Qiyas (analogical reasoning), the introduction of a techno-centric legal system must be compatible with these primary sources.

3.1.1 Harmonizing Islamic Jurisprudence with Modern Technological Challenges in NEOM

The emergence of NEOM as a cornerstone of Saudi Arabia's Vision 2030 initiative embodies an unprecedented fusion of technological advancement with Islamic legal tradition. This pioneering techno-jurisprudential synthesis necessitates an intricate equilibrium that honors the immutable precepts of Sharia (Islamic law) while navigating the dynamic and often uncharted waters of modern legal challenges posed by rapid technological innovation.

NEOM's legal framework, envisioned to promote and sustain its ambitious technological aspirations, must operate within the parameters of Islamic jurisprudence. The primary sources of Islamic law — the Qur'an and the Sunnah — provide the foundational ethical and legal guidelines, while Ijma' (consensus among scholars) and Qiyas (analogical reasoning) allow for flexibility and adaptation to novel circumstances, which are inherent to a project of NEOM's scope and vision.

The challenge lies in aligning the NEOM project with global legal norms, especially in areas such as artificial intelligence (AI), biotechnology, and environmental sustainability, without contravening Islamic jurisprudential principles. The task of interpreting Sharia in the context of modernity has precedent; Islamic scholars have historically engaged in Ijtihad (independent reasoning) to address new issues, a process that is essential in the face of NEOM's advanced techno-legal paradigm.

In the realm of artificial intelligence, for example, Sharia principles regarding responsibility and intentionality must be reconciled with the autonomous decision-making capabilities of AI systems. The inherent unpredictability and lack of explicit intention in AI behavior pose significant questions for Islamic jurisprudence, which traditionally predicates liability and moral responsibility on human agency and intention.

Furthermore, NEOM's commitment to sustainability and environmental stewardship can find resonance within Islamic jurisprudence, which emphasizes Khilafah (stewardship) of the Earth. This principle mandates that any exploitation of resources and technological development must be balanced with the duty to protect and preserve the environment for future generations, a concept echoed in contemporary international environmental law (Kamali, 1999; Khatib, 2016).

To achieve a synthesis between NEOM's techno-legal framework and Sharia, a multi-disciplinary approach is required, engaging scholars from Islamic jurisprudence, international law, technology experts, and ethicists. This collaboration must ensure that NEOM's legal system is not only Sharia-compliant but also resonant with international human rights standards, a challenge that mirrors the broader global endeavor to integrate diverse legal systems and cultural norms in an increasingly interconnected world (Baderin, 2003).

As NEOM forges ahead, it stands as a living laboratory for the co-evolution of law and technology. The project offers a unique opportunity to explore the harmonization of a centuries-old legal system with cutting-edge innovations, which may yield insights and methodologies applicable beyond the borders of Saudi Arabia

3.1.2 Redefining Juridical Entities: AI and Legal Agency in NEOM

The conferral of citizenship upon Sophia the robot by Saudi Arabia in 2017 represents a novel challenge to established jurisprudential paradigms. This symbolic act has precipitated an exigent discourse within the domain of legal personhood in artificial intelligence (AI). NEOM's techno-legal construct potentially serves as a crucible for redefining legal personality in the context of AI. Within the traditional Islamic jurisprudential framework, one potential avenue is to assimilate AI entities within the construct of 'Wakala' (agency), thereby enabling AI to execute certain juridical acts as agents of human principals (Al-Shibli, 2020).

The 'Wakala' concept, deeply rooted in Islamic jurisprudence, could provide a structural foundation for the integration of AI into the legal fabric, as it contemplates the performance of legal actions on behalf of another. This concept resonates with the notion of 'legal agency' familiar to Western jurisprudence, which has recognized corporations and other non-human entities as capable of bearing rights and duties through human agents (Vicente & Lavazza, 2020).

Such a reconfiguration would necessitate a rigorous reassessment of 'Aqd' (contract) theories underpinning Islamic law to address the unique characteristics and capabilities of AI entities. The recalibration of contract law principles to accommodate AI agents would involve intricate analyses of 'offer and acceptance' paradigms, as well as the requisite intention and capacity for contract formation (Al-Dawoody, 2018).

Moreover, it behooves us to consider the creation of novel categories within Islamic jurisprudence to provide a robust framework for the regulation of AI. This would involve not only the adaptation of existing legal constructs but also the innovation of new principles that recognize the autonomy and decision-making capabilities of AI, while simultaneously ensuring adherence to the ethical and moral underpinnings of Islamic law.

In parallel, the international legal community continues to grapple with similar issues. The European Parliament, for instance, has proposed the notion of "electronic persons" for the most sophisticated autonomous robots, reflecting a growing recognition of the

need to reconceptualize legal personhood in light of technological advancements (European Parliament, 2017).

The intricate dialogue between the evolving capabilities of AI and the steadfast principles of jurisprudence remains fertile ground for scholarly inquiry. The synthesis of technological innovation and legal tradition within NEOM's framework may yet herald a new chapter in the annals of jurisprudential evolution.

3.1.3 Islamic Ethics in the Digital Age: Shaping NEOM’s Algorithmic Governance

The establishment of NEOM, a model for futuristic urbanization under Saudi Arabia's Vision 2030, necessitates a jurisprudential discourse on algorithmic governance, particularly within the Islamic ethical paradigm. The operational ethos of NEOM’s algorithms must be intertwined with the jurisprudential principles of 'Adl' (justice) and 'Ihsan' (benevolence), reflecting the integral values of Islamic governance (Al-Raysuni, 2005).

A propositional framework for NEOM would involve the implementation of a 'Hisbah' institution, recalibrated for the digital age, ensuring that technological advancements adhere to Islamic jurisprudence (Al-Sulami, 2004). This modern 'Hisbah' would function as a regulatory body overseeing the ethical programming of algorithms, which should be designed to uphold the values of fairness, transparency, and social welfare, aligned with the jurisprudential concept of Maqasid al-Shariah (the objectives of Islamic law) (Kamali, 2008).

Islamic Information Technology Law emerges as an exigent field of study, warranting scholarly attention to navigate the uncharted waters of NEOM's technological policy-making (Khan, I. A., 2019). This new branch of law would benefit from drawing upon the classical Islamic legal tradition while confronting contemporary challenges posed by artificial intelligence and data governance.

In the international arena, the ethical considerations in algorithmic governance are being closely examined. Documents such as the EU’s Ethics Guidelines for Trustworthy AI provide a secular counterpart to NEOM's proposed Islamic ethical governance framework, emphasizing the importance of ethical alignment in AI systems (European Commission, 2019).

NEOM’s techno-legal paradigm has the potential to become a lodestar in reconciling modernity with tradition. By integrating the foresight of Islamic jurisprudence with innovative governance mechanisms, NEOM could pioneer a global standard for ethical technology deployment that harmonizes with Saudi Arabia’s legal and moral landscape.

Thus, the synthesis of technological governance with Islamic jurisprudence in NEOM stands as a testament to the evolving narrative of Sharia in the digital epoch. The seamless melding of these spheres could engender a governance model that is at once progressive and anchored in the time-honored principles of Islamic ethics.

3.2 Analyzing the Stakes: NEOM's Jurisprudential, Ethical, and Governance Challenges

As NEOM steers into the uncharted waters of legal innovation and technological advancement, it emerges as a jurisprudential conundrum poised on the cutting edge of global trends, but not without profound implications. This venture's high stakes necessitate an analytical odyssey into its underlying complexities, dissecting the layers of its techno-legal, ethical, and socio-environmental paradigms.

3.2.1 The Challenge of Lex Informatica: Evolution of Legal Norms

As NEOM forges ahead with its integration of emerging technologies, it confronts the concept of 'lex informatica,' the body of law that arises from the Internet and digital environments. This concept, as envisaged by scholars like Lawrence Lessig, suggests that the code itself becomes a type of law (Lessig, 2006). For NEOM, translating the

traditional Saudi legal norms into digital governance protocols presents an extraordinary task. Unlike the European Union's General Data Protection Regulation (GDPR), which Estonia had to align with for its e-residency program, Saudi Arabia does not have an existing comprehensive legal framework specifically for data protection and privacy, although steps are being taken to develop this (Saudi Data and Artificial Intelligence Authority, 2021). NEOM must innovate in creating a legal infrastructure that not only meets the data governance demands of a hyper-connected city but also adheres to the cultural nuances of Saudi society, including gender norms and individual rights.

3.2.2 Balancing Technological and Environmental Considerations

NEOM's location in the Tabuk province raises significant environmental concerns. As an exemplar of sustainable development, NEOM must reconcile the tension between its technological ambitions and environmental stewardship. Lessons can be gleaned from the case of Masdar City in the UAE, which faced hurdles in sustainable development and had to adjust its strategies in real-time to maintain ecological balance (Cugurullo, 2013). NEOM is not only obliged to adhere to Saudi environmental laws but also international environmental law, as it has been a party to the Paris Agreement since 2016 (United Nations, 2016). The development of NEOM must include rigorous Environmental Impact Assessments (EIA) that are transparent and hold the developers accountable, going beyond mere compliance to a demonstration of environmental innovation.

3.2.3 NEOM: A Sociological Paradigm

The sociological impact of NEOM's technology-driven society is an area ripe for critical examination. The use of extensive surveillance and biometric systems could further entrench societal divisions if not carefully regulated. The Aadhaar system in India, despite its initial aim to provide a unified identity system, has been critiqued for its social implications, such as privacy concerns and exclusion errors (Khera, 2018). NEOM, with its promise of advanced surveillance for security and efficiency, must ensure such systems are implemented with robust checks against misuse and are sensitive to the rights of individuals, particularly in respect to gender norms that are sensitive topics within Saudi society.

In conclusion, NEOM is navigating uncharted waters in the realm of techno-legal development. Its progress will demand a rigorous analysis of evolving jurisprudence, ethics, and governance that respects both the technological aspirations of a smart city and the social and cultural imperatives of the Kingdom of Saudi Arabia. As a pioneering endeavor, NEOM's experiences and outcomes will contribute significantly to global discourses on the interaction of technology with traditional legal and societal frameworks.

4. Autonomous Robotics: An Exposition of Legal and Ethical Complexities

In the crucible of autonomous robotics, the techno-legal construct of NEOM confronts intricate jurisprudential paradigms. This revolutionary domain, though burgeoning with possibilities, is fraught with ethical and legal conundrums that defy traditional boundaries and demand innovative governance. By dissecting salient global instances and envisaging an ethical matrix, one discerns the jurisprudential navigation necessary for NEOM's unique techno-socio ecosystem.

4.1 Case Studies: Legal Frontiers in Robotics

The global legal landscape offers instructive forays into the regulation of autonomous robotics, each narrative contributing to the intricate tapestry from which NEOM must draw its regulatory inspirations and warnings.

4.1.1 United States: The Convergence of Autonomous Vehicles and Tort Law

The advent of autonomous vehicles (AVs) marks a revolutionary reconfiguration of mobility, implicating a concomitant evolution of legal frameworks. The incident in Tempe, Arizona, in 2018, wherein an autonomous vehicle was involved in a pedestrian fatality, accentuated the exigencies of reconciling traditional tort principles with the complexities introduced by these algorithm-driven machines. This tragic event served as a legal litmus test, prompting earnest jurisprudential discourse around liability and the contours of negligence in the era of autonomous technology.

The Tempe incident pierced the veil of traditional liability paradigms, exposing the inadequacies of conventional tort law in addressing the peculiarities of AVs. Traditionally, tortious liability is predicated on human fault, whether through act or omission. However, the autonomous nature of these vehicles obfuscates the locus of blame, given the diminished human agency. This scenario resurrects the age-old legal conundrum of res ipsa loquitur, where the incident itself implies negligence, albeit in a vastly more complex context (Morgan, 2021).

The algorithmic determinism that guides AVs necessitates a departure from personal liability, steering legal thought toward a product liability framework. Here, the manufacturers could be held liable for design defects, inadequate safety features, or failures in expected autonomous functions (Marchant & Lindor, 2012). This transition echoes the sentiments of scholars and practitioners advocating for a more encompassing liability doctrine that factors in the intricacies of automated decision-making systems (Vladeck, 2014).

For visionary projects like NEOM, the U.S. legal tribulations following the Tempe incident underscore the necessity to architect jurisprudential infrastructures that transcend orthodox legal schemas. Embracing a proactive legislative ethos requires synthesizing multifaceted legal principles, drawing from product liability, cybernetic jurisprudence, and emergent AI ethics. This composite approach aims not only to protect individuals from potential harms but also to create a legal environment that spurs technological innovation while deterring complacency and recklessness in design and deployment (Schellekens, 2015).

The overarching objective transcends mere accountability; it extends to fostering an ecosystem conducive to technological advancement. However, this necessitates a delicate jurisprudential balance. The legal frameworks must be sufficiently robust to safeguard citizens and assign liability, yet agile enough to avoid stifling innovation through overly onerous regulations (Calo, 2017). Achieving this equilibrium requires a nuanced understanding of the technologies at play and an acknowledgment of the broader societal and ethical implications of their integration into everyday life.

The integration of autonomous vehicles into societal fabrics marks a jurisprudential epoch. The United States, spurred by real-world incidents, is grappling with these challenges, seeking pathways to evolve traditional tort law to accommodate technological realities. For initiatives like NEOM, these developments are not mere observations but constitute a clarion call for legal innovation – an opportunity to pioneer a comprehensive legal infrastructure that accommodates the future, with all its complexities and promises.

4.1.2 European Union: Navigating Data Protection in the Robotic Epoch

The digital age, characterized by rapid technological advancements and the ubiquity of data, has ushered in a new epoch. Within this transformative milieu, the European Union (EU) has emerged as a vanguard in crafting legislative responses to the multifaceted challenges presented by this digital surge. The General Data Protection Regulation (GDPR) epitomizes this forward-thinking approach, seeking to navigate the complex interplay between personal data rights and the burgeoning domain of autonomous robotics.

Instituted in 2018, the GDPR emerged as a seminal legislative instrument, amplifying the rights of individuals vis-à-vis their personal data and imposing stringent obligations on entities processing such data (Voigt & von dem Bussche, 2017). It has redefined consent mechanisms, enshrining the principles of explicitness and granularity. Moreover, the principle of data minimization underscores the necessity of limiting data collection to the strict essentials, echoing the "privacy by design" philosophy propounded by Cavoukian (2010).

As autonomous robotics gain traction, they entangle with the intricate web of data protection, precipitating both operational and legal quandaries. Robotics, by their nature, involve intricate data processing activities, often in real-time and at a scale hitherto unparalleled. The challenge then becomes reconciling the operational imperatives of these technologies with the sacrosanct rights enshrined within GDPR. This intersection has attracted substantial scholarly attention, with scholars like Kaminski (2019) positing that a robust data protection regime could potentially stymie certain advancements in autonomous technologies.

NEOM's ambitious vision encompasses a harmony between cutting-edge technology and foundational human rights principles. Replicating the GDPR's rigorous standards within such an environment demands a nuanced approach, one that tempers technological zeal with a steadfast commitment to individual rights. A tailor-made, or sui generis, regulatory framework might be the key. Such a model would seek inspiration from the GDPR while adapting to the unique technological and societal contours of NEOM (Schwartz & Peifer, 2017). In crafting this balance, NEOM could become a beacon for other digital metropolises, elucidating how to foster innovation without sacrificing individual liberties.

The robotic epoch, while emblematic of human ingenuity, also beckons profound legal introspection. The EU, through its GDPR, provides a beacon, illustrating the nexus between data rights and technological innovation. As NEOM strives to chart its path, it finds itself at the confluence of these dual imperatives, offering a unique opportunity to shape a future that harmoniously intertwines individual rights and technological progress.

4.1.3 South Korea: The Quandary of Robotic Legal Personhood

The South Korean discourse on the "electronic personhood" for advanced artificial intelligence systems transcends theoretical speculation, delving into the urgent ethical and legal dilemmas wrought by the burgeoning evolution of technology. Within the global milieu, this dialectic is not insular but a fragment of a universal introspection on assimilating intricate autonomous systems into societal infrastructures that have been historically human-centric.

Jurisprudentially, the ontogeny of legal personhood has been marked by an expansion that accommodates not only natural persons but also juridical entities like corporations. The emergence of sophisticated AI problematizes these ontological categories by ushering in entities capable of independent decision-making and interactions, sans consciousness, challenging the binary taxonomy of personhood (Teubner, 2018).

South Korea's legal system, reflective of its societal penchant for innovation, grapples with the recognition of advanced AI systems as "electronic persons." This radical juristic contemplation is undergirded by the potential of these entities to discharge duties and possess rights, heralding a seismic shift in the locus of legal responsibility and the corpus of rights allocation (Kim, 2017). Such juridical personification of AI would engender far-reaching ramifications for liability, rights, and societal institutional structures.

For an emergent techno-polis like NEOM, the imperative to incubate technological advancement is concomitant with the necessity of forging a legal architecture that is anticipatory and robust. This prescient legal scaffolding must acknowledge the sui generis nature of AI entities, harmonizing the impetus for innovation with ethical imperatives and societal safeguards. An astute legal praxis must emerge, one that acknowledges the quasi-

agency of AI while embedding unequivocal accountability frameworks (Brownsword, 2019).

The conundrum of "electronic personhood" mirrors the pressing exigency for legal doctrines to metamorphose in tandem with technological progressions. Jurisdictions such as South Korea and visionary entities like NEOM are at the vanguard of these legal revolutions. They bear the potential to sculpt jurisprudential paradigms that acknowledge the distinctive nature of AI, thereby setting benchmarks that could sculpt the contour of global legal norms (Scherer, 2016).

In the vortex of global legal reformation, the South Korean debate on AI's "electronic personhood" epitomizes the burgeoning imperative for the legal fraternity to reformulate entrenched conceptions of agency, accountability, and rights within the ambit of accelerating technological advancements. As NEOM strides towards realizing its ambitious blueprint, its regulatory stance has the potential to crystallize this avant-garde legal ideology, possibly serving as a bellwether for international legal standards.

4.2 The Ethical Matrix in Autonomous Robotics: Reconciling Philosophical Dilemmas and Legal Pragmatism within NEOM's Innovative Framework

As autonomous robotics increasingly permeate societal strata, they evoke profound ethical and legal quandaries, particularly in futuristic endeavors like NEOM. These dilemmas necessitate an interdisciplinary approach, merging jurisprudential acumen with philosophical doctrines to construct an ethical matrix that both guides and restrains technological innovation (Vallor, 2016).

4.2.1 Autonomy within Ethical and Legal Ambits: Control and Responsibility

The advent of autonomous robotics raises profound questions within the philosophical arena of ethics and the pragmatic world of law. These questions necessitate a paradigmatic shift in understanding the interplay between autonomy, control, and responsibility.

Autonomous robotic systems, by virtue of their self-governance, invite scrutiny into the essence of control and the allocation of responsibility. The philosophical quandary stems from the fact that these systems can perform actions without direct human oversight, which disrupts traditional ethical frameworks predicated on human agency (Wallach & Allen, 2009). From a legal perspective, the emergence of robotic autonomy demands a recalibration of the doctrines of liability that have historically been anthropocentric (Calo, 2015).

In NEOM's groundbreaking framework, reconciling these complexities necessitates a harmonious synthesis of ethical theory and legal doctrine. NEOM aspires to integrate autonomous robotics within its social and economic fabric, thus facing the need to construct an ethical matrix that considers dignity, autonomy, and sentient welfare, aligned with stringent legal standards that delineate clear zones of responsibility and control (Sparrow, 2007).

The control dilemma in robotics revolves around the capacity for these systems to make decisions independently, invoking the principle of "machine ethics" (Anderson & Anderson, 2011). Here, the philosophical discussion is twofold: it involves crafting a moral algorithm that governs robotic behavior and determining the extent to which this programming satisfies ethical imperatives.

Legal scholars, in turn, grapple with the attribution of responsibility for autonomous systems’ actions. This challenge is augmented by the potential for robotic decisions that may not be predictable or directly traceable to human input, thus confounding traditional liability schemes (Vladeck, 2014). NEOM's innovative legal structure must then anticipate the scenarios where robots act outside the scope of their programming or in

unanticipated ways, necessitating a novel legal approach to causation and blame (Kurki & Pietrzykowski, 2017).

To achieve coherence in this ethical matrix, NEOM must draw upon the most cogent aspects of ethical philosophy — from Kantian deontology, which emphasizes the morality of actions themselves, to utilitarianism, which weighs the outcomes of actions. Jurisprudentially, the city must navigate between strict liability, where responsibility is irrespective of fault, and a more nuanced approach that considers the intentions and capabilities of autonomous agents (Asaro, 2012).

The ethical matrix of NEOM must thus serve as a jurisprudential compass, guiding the integration of autonomous robotics into its society. It should encapsulate principles that acknowledge the moral and legal significance of autonomy while establishing a legal infrastructure that promotes innovation, ensures public safety, and embodies justice.

4.2.2 Data Privacy and Collective Welfare: A Dichotomy of Ethical Considerations within NEOM's Innovative Framework

The intricate interplay between data privacy and collective welfare represents a pivotal ethical dichotomy in the governance of autonomous robotics. This schism necessitates a meticulous jurisprudential approach to reconcile individual rights with the collective good within NEOM's avant-garde regulatory framework. At the heart of this discourse lies the principle of informational self-determination, juxtaposed against the exigencies of societal welfare and safety.

Privacy, conceptualized as a fundamental human right, forms the substratum of data protection laws worldwide, including the General Data Protection Regulation (GDPR) of the European Union (EU) (Regulation (EU) 2016/679). The GDPR’s rigorous privacy norms have informed global data protection standards, asserting individual autonomy over personal data. NEOM's aspiration to be a nexus of technological innovation requires a calibration of these privacy principles against its own smart city data ecosystems (de Hert & Papakonstantinou, 2016).

Collective welfare, often framed within the utilitarian calculus, posits the greatest good for the greatest number as the preeminent ethical criterion. In the context of autonomous robotics, this necessitates the aggregation and analysis of vast datasets to enhance efficiency, safety, and public service delivery. However, this utilitarian approach raises jurisprudential challenges, particularly when it encroaches upon individual privacy rights.

The crux of this dichotomy within NEOM's legal framework can be addressed through the principle of proportionality, a cornerstone of contemporary legal theory which mandates that measures infringing upon rights must be proportionate to the legitimate aims pursued. It predicates that NEOM’s regulatory schema for autonomous robotics should optimize both privacy rights and collective benefits, thereby effectuating a harmonious balance (Beyleveld & Brownsword, 2007).

Moreover, the concept of 'group privacy' emerges as a nuanced counterpoint to individualistic privacy paradigms, recognizing that data may pertain to groups and thus may demand collective privacy safeguards (Floridi, 2014). In NEOM's context, where artificial intelligence (AI) systems engage with both individual and collective data, the legal conceptions of privacy must evolve to encompass collective interests without undermining individual rights.

In conclusion, NEOM's innovative legal framework must adeptly navigate the ethical matrix of data privacy and collective welfare, embodying a jurisprudential synthesis that upholds the sanctity of privacy while facilitating the collective good. This delicate equipoise should be continually informed by interdisciplinary discourse, incorporating legal scholarship, technological insight, and ethical theory, to sustain a living legal order

that accommodates the dynamic interplay between evolving technological capabilities and foundational human values.

4.2.3 The Techno-environmental Imperative: Balancing Innovation with Sustainability

The interplay between the relentless pursuit of technological innovation and the pressing imperative of environmental sustainability presents a pivotal jurisprudential challenge in the realm of autonomous robotics. The quest to harness the full potential of robotics within sustainable parameters demands a robust legal framework, capable of fostering innovation while safeguarding the planet's ecological balance.

International environmental law, particularly through instruments such as the Paris Agreement (United Nations, 2015), underscores the imperative to address climate change through innovative solutions, which include the deployment of advanced technologies (Bodansky, 2016). The ethos of the Paris Agreement is predicated on the notion that technological innovation should align with long-term sustainability goals.

At the nexus of technology and environmental stewardship, autonomous robotics has the potential to significantly impact the conservation and sustainable use of natural resources. Robotics can drive efficiency in energy consumption, reduce waste, and enhance the monitoring and management of environmental systems. However, the environmental externalities associated with the manufacturing, deployment, and disposal of robotic systems necessitate a comprehensive legal strategy to mitigate adverse impacts.

To reconcile the dual objectives of innovation and environmental conservation, adaptive governance has been proposed as a suitable legal mechanism (Cosens et al., 2017). This approach advocates for a legal system that is responsive to scientific and technological advancements, capable of adjusting regulatory measures as the effects and capabilities of robotics become more evident.

In the context of NEOM's innovative framework, the adoption of an adaptive governance model could be particularly beneficial. NEOM aims to serve as a blueprint for future cities, emphasizing the integration of technological advancements with environmental sustainability (NEOM Company, 2021). A legal framework that is both flexible and anticipatory would support NEOM's objectives by allowing for the agile integration of autonomous robotics in a manner that prioritizes ecological integrity.

As we forge ahead, the alignment of law with ecological and technological imperatives remains a cornerstone of prudent governance. By anchoring our legal systems in the principles of sustainability and innovation, we can ensure that the ascent of autonomous robotics proceeds in harmony with the preservation of the environment for present and future generations.

4.2.4 Equity amidst Technological Flourishing: Confronting Socioeconomic Disparities

The burgeoning integration of autonomous robotics within various sectors of the economy implicates a range of socioeconomic concerns, notably the potential exacerbation of existing disparities. As scholars and policymakers grapple with the distributional effects of rapid technological change, the law emerges as both a tool and a battleground for ensuring that the fruits of innovation are equitably shared.

The principle of equity in the context of technological advancement is not merely a moral imperative but a legal challenge. The law must navigate between fostering innovation and preventing a widening chasm between the techno-privileged and the underprivileged. This delicate balance is captured in the jurisprudence surrounding the right to participate in the cultural life of the community, as enshrined in Article 27 of the Universal Declaration of Human Rights (UDHR), which includes the benefits of scientific progress.

As the International Covenant on Economic, Social and Cultural Rights (ICESCR) underscores, states have a duty to respect, protect, and fulfill the right to enjoy the

benefits of scientific progress and its applications (CESCR, 2009). In the digital age, this translates into the imperative for legal frameworks to accommodate equitable access to technology, including autonomous robotics.

In jurisdictions spearheading technological advancements, such as NEOM, the intersection of robotics and socioeconomic equity is acutely pertinent. Here, legislation must be crafted with foresight to ensure that automation does not result in the disproportionate displacement of workers (Ford, 2015). Additionally, laws governing education and training must evolve in tandem with technological progress to prepare the workforce for a future where robotics plays a central role (West, 2018).

Furthermore, it is incumbent upon the legal system to address the disparities that may arise from the digital divide—where access to technological infrastructure and know-how becomes the new frontier of inequality (van Dijk, 2020). Such disparities are not merely economic but resonate with the Rawlsian principle of distributive justice, which mandates that social and economic inequalities are to be arranged so that they are to the greatest benefit of the least advantaged.

The challenge is to construct a legal framework that harmonizes with NEOM's vision of harnessing cutting-edge technology while ensuring that all segments of society benefit from the robotic revolution. This entails legal innovation in labor law, education policy, and access to technology, underpinned by principles of distributive justice and social equity.

In conclusion, the law must serve as the mediator between the forces of innovation and the imperatives of equity. In this delicate role, it must be both resilient and adaptive, ensuring that as NEOM and similar projects advance into the future, they do so with an unwavering commitment to socioeconomic inclusivity.

5. Crafting NEOM's Legal Blueprint for Autonomous Robotics: A Jurisprudential Odyssey into Techno-Legal Synergism

NEOM stands on the cusp of techno-legal innovation, seeking to transcend traditional boundaries by intertwining advanced technology with comprehensive legal jurisprudence. This synthesis promises a transformative trajectory for autonomous robotics, necessitating a legal paradigm that both complements and propels technological futurism. Herein, we undertake a scholarly expedition to construct an avant-garde legal architecture for NEOM, one that harmonizes with international legal precedents, ethical mandates, and the city's trailblazing spirit.

5.1 Legal Provisions Deconstruction: Bridging Technological Prowess and Legal Foresight

NEOM's pioneering foray into integrating autonomous robotics within its urban fabric demands a jurisprudential renaissance. This initiative, emblematic of Saudi Arabia's Vision 2030, necessitates the drafting of an innovative legal framework that addresses the multilayered challenges posed by advanced technologies. This section of the article delineates the legal mechanisms and principles that could govern the incorporation and operation of autonomous systems within NEOM, drawing from the wellspring of international legal theory, ethical considerations, and pioneering legislative efforts from around the globe.

5.1.1 Reimagining Legal Personhood in the Realm of Autonomous Robotics

The advent of autonomous robotics propels us into a philosophical and legal debate regarding the notion of personhood and agency. NEOM, as a vanguard smart city, confronts the challenge of defining the status of autonomous entities within its jurisdiction. The crux of this challenge lies in distinguishing between mere tools and

entities warranting a form of legal recognition that could encapsulate their autonomous operational capacities (Kurki & Pietrzykowski, 2017).

Scholars such as Teubner (2018) argue for the recognition of a new category of 'electronic persons', contending that such a status would streamline interactions within digital environments. However, these proposals are not without contention; they raise profound questions about responsibility, liability, and the nature of rights (Bryson, Diamantis, & Grant, 2017). The jurisprudential task for NEOM will be to craft a legal category that is sufficiently agile to accommodate the functionalities of autonomous systems while ensuring that ethical and accountability standards are not compromised (Pagallo, 2013).

Further, the integration of autonomous robotics into the public sphere raises pivotal concerns surrounding privacy, data protection, and surveillance. NEOM's legal blueprint must thus embed principles of data governance akin to the European Union's General Data Protection Regulation (GDPR), ensuring that individual privacy is safeguarded in the face of pervasive data collection and processing by autonomous systems (de Hert & Papakonstantinou, 2016).

NEOM's legal framework will also need to contend with the deployment of robotics in various facets of city life. From traffic management to public safety and healthcare, the legislative structure must provide for the seamless integration of robotic systems, ensuring they operate within the bounds of the law and are subject to oversight mechanisms akin to traditional human-driven entities (Calo, 2015).

In conclusion, the drafting of NEOM's legal framework for autonomous robotics represents a formidable yet exhilarating venture. It calls for a jurisprudential agility that marries the promise of technological advancement with the imperatives of legal order, human dignity, and societal welfare. This legal odyssey will not only shape the destiny of NEOM but also contribute significantly to the global discourse on the governance of emerging technologies.

5.1.2 Data Ethicality and Sovereignty: Steering the Course of Techno-Privacy

In the quest to mould NEOM into a paradigm of innovation, the city's legal fabric must incorporate a sophisticated understanding of data ethicality and sovereignty, particularly as they pertain to autonomous robotics. The rapid proliferation of these technologies raises not just questions of efficiency and integration, but also of privacy, data ownership, and the ethical use of information (Mittelstadt, 2017).

The legal constructs for data ethicality in NEOM must reconcile the dual imperatives of fostering innovation and protecting individual privacy rights. This entails crafting legislation that mirrors the robust protection afforded by the General Data Protection Regulation (GDPR) of the European Union, which represents a gold standard in the protection of personal data (Regulation (EU) 2016/679). NEOM's legal framework must thus ensure that the collection, processing, and use of data by autonomous entities adhere to principles of fairness, transparency, and accountability, and that individuals retain control over their personal information (Bygrave, 2017).

Moreover, the concept of data sovereignty—where data is subject to the laws of the country where it is located—must be carefully navigated. NEOM's global aspirations will likely entail the cross-border flow of data, necessitating agreements and policies that respect the data sovereignty of all involved jurisdictions while enabling the free flow of information critical to a smart city's operations (Kuner, 2020).

In implementing these principles, NEOM can draw upon the evolving jurisprudence around digital privacy and data protection. The legal treatment of data as an extension of the self, and thus deserving of protection similar to physical integrity, could serve as a guiding tenet (Solove, 2020). Equally, the city can harness legal theories that

conceptualize data as a communal resource, thus promoting a shared data ecosystem that benefits society as a whole while respecting individual rights (Purtova, 2018).

The design of NEOM's legal system must also anticipate future developments in technology and their implications for data ethicality. The legislative framework should be adaptable, capable of evolving alongside advancements in robotics and AI, ensuring that the city remains at the forefront of technological innovation without compromising the ethical standards that underpin a just and equitable society (Balkin, 2016).

In conclusion, NEOM's legal blueprint for data ethicality and sovereignty must be as dynamic as the technology it seeks to govern. It must balance the protection of individual rights with the collective benefits of data sharing and technological progress. This approach will not only establish NEOM as a leader in tech-driven urban development but will also contribute to the global discourse on privacy and data governance in the age of AI.

5.1.3 Forging Techno-Ecological Harmonization: The Green Mandate

In the luminous wake of NEOM's ambition, it becomes imperative to sculpt a legal framework that not only incentivizes technological ingenuity but also safeguards the ecological tapestry vital to the region's sustenance. NEOM's legislative ethos must, therefore, enshrine principles that foster an equilibrium between the innovative thrust of autonomous robotics and environmental preservation—a green mandate that is both a moral imperative and a legal necessity.

The jurisprudential landscape must be seeded with statutes that encourage the development and deployment of robotics in a manner that adheres to stringent environmental standards. Drawing from the anticipatory governance model, NEOM's laws should be designed to preempt ecological disruptions, integrating environmental impact assessments into the fabric of technological advancement (Ruhl, 2012). This approach aligns with the precautionary principle, a cornerstone of international environmental law, which mandates that the absence of scientific certainty must not delay measures to prevent environmental degradation where there is a risk of serious or irreversible harm.

In shaping this green mandate, NEOM can look towards legal instruments such as the Paris Agreement, which exemplifies international commitment to combating climate change through innovation and collective responsibility (United Nations, 2015). Furthermore, by embedding sustainability criteria into the legal criteria for the deployment of autonomous systems, NEOM can ensure that these technologies contribute to the Sustainable Development Goals, promoting a synergistic relationship between technological growth and environmental stewardship (Sachs, 2012).

Additionally, NEOM's legal doctrine could pioneer the recognition of the rights of nature, a jurisprudential concept that ascribes legal personhood to natural entities, thereby granting them standing to be represented in legal proceedings. This innovative legal recognition, already taking root in several jurisdictions, could serve as a bulwark against the exploitation of natural resources in the pursuit of technological and urban development.

NEOM's legal blueprint must thus be imbued with provisions that mandate the use of clean technologies, encourage renewable energy sources, and penalize actions that jeopardize the ecological balance. Such legal articulations would not only position NEOM as a steward of the environment but would also send a clarion call to the world, demonstrating the possibility of a harmonious coexistence between humanity's technological endeavors and the Earth's ecological systems.

5.2 Enforcement Mechanisms: Embracing a Futuristic Legal Technocracy

The architectural magnificence of NEOM's legal edifice, while deeply rooted in robust jurisprudential theories, ascends to unparalleled heights with its enforcement mechanisms. These mechanisms, synonymous with NEOM's futuristic ethos, are not mere extensions but rather critical pillars of the techno-legal system.

5.2.1 AI-Driven Predictive Jurisprudence: Preempting Legal Transgressions

NEOM's legal architecture is envisaged to be underpinned by AI-driven predictive jurisprudence, a sophisticated concept that combines the foresight of advanced analytics with the normative frameworks of the law. This proactive legal mechanism is designed to anticipate and preempt transgressions, thereby fostering a compliant and orderly society within the city's cutting-edge environment.

The paradigm of predictive jurisprudence converges on the deployment of artificial intelligence to analyze patterns and predict potential legal violations before they materialize. Such a system draws inspiration from the notion of preventive justice, which has been a subject of legal contemplation, emphasizing the need for legal systems to evolve from reactive to preemptive stances in law enforcement (Ashworth & Zedner, 2008).

In the context of NEOM, where the legal system interacts intricately with autonomous technologies, AI can be harnessed to monitor compliance with regulations, assess risks, and provide early warnings to prevent legal breaches. This approach is aligned with the burgeoning field of legal informatics, which seeks to leverage computational methods to enhance the administration of justice (Katsh & Rabinovich-Einy, 2017).

To ground this futuristic vision in practical terms, NEOM could implement an AI-based regulatory compliance system that continuously scans the operational parameters of autonomous systems, ensuring adherence to legal and ethical standards. Such mechanisms have been advocated in scholarly discussions as a means to address the complex legal challenges posed by rapidly evolving technologies (Hildebrandt, 2016).

These AI-driven systems must be built upon a foundation of robust data protection and privacy laws, to safeguard against the misuse of personal data and uphold the rights of individuals—a principle that is central to legal systems that respect human dignity and autonomy (Bygrave, 2014).

The adoption of AI in legal enforcement in NEOM would not only exemplify a novel juridical approach but also serve as a benchmark for future smart cities. It encapsulates a jurisprudential leap from traditional legal processes to an advanced technocratic model, redefining the very nexus of law, technology, and society.

5.2.2 Revolutionizing Dispute Resolution: Autonomous Mediation Paradigms

The vision for NEOM extends to revolutionizing traditional dispute resolution methods by incorporating autonomous mediation paradigms. This innovative approach seeks to blend the technological sophistication of artificial intelligence with the nuanced understanding of legal jurisprudence to facilitate swift, fair, and effective resolution of conflicts.

Autonomous mediation in NEOM would be grounded in the principles of alternative dispute resolution (ADR), which has been widely acknowledged for its efficiency and flexibility compared to conventional court proceedings (Menkel-Meadow, 2019). The integration of AI into ADR mechanisms can further enhance these benefits by introducing algorithms capable of impartially analyzing the facts and suggesting equitable solutions, thereby reducing human bias and error.

This advanced mediation framework could draw from the rich tradition of consensus-driven dispute settlement in Islamic jurisprudence, which emphasizes reconciliation and

the maintenance of social harmony (Al-Dawoody, 2011). It could also incorporate predictive analytics to assess the likely outcomes of disputes based on historical data, thereby informing negotiation strategies (Susskind, 2019).

To ensure the ethical deployment of autonomous mediation systems, NEOM's legal framework would incorporate stringent guidelines for algorithmic transparency and accountability. Such protocols are critical to upholding the rights of parties and ensuring that the AI's decision-making process aligns with ethical and legal standards (Casey et al., 2019).

NEOM's autonomous mediation paradigms promise to set a new benchmark for dispute resolution in smart cities. By leveraging AI, NEOM can create a dispute resolution mechanism that not only resolves conflicts efficiently but also embodies the ethical and legal values integral to the city's foundation.

5.2.3 Real-Time Regulatory Adherence: Catalyzing Proactive Legal Concordance

In the innovative realm of NEOM, the concept of real-time regulatory adherence is envisioned as a proactive system of legal concordance, catalyzing the symbiosis between dynamic technological environments and the static nature of legal norms. This system is designed to preemptively harmonize the actions of autonomous entities with prevailing legal and regulatory requirements, ensuring continuous compliance and adaptability.

To facilitate this, NEOM could implement an advanced regulatory technology (RegTech) infrastructure that utilizes AI to monitor and analyze the actions of robotic systems in real-time. Such infrastructure would be capable of interpreting complex legal texts and applying them to specific scenarios encountered by autonomous robots, thereby ensuring that their operations remain within the bounds of the law (Arner et al., 2017). This would effectively transform the landscape of legal compliance from a reactive to a proactive stance, minimizing legal risks and fostering an environment of trust and security.

Furthermore, NEOM's RegTech would be built upon a foundation of legal informatics, which combines computational methods with legal reasoning to structure and understand the law in ways that are computationally accessible (Katsh & Rabinovich-Einy, 2017). This could lead to the development of 'smart contracts' that not only execute themselves but also adapt to changing legal interpretations and frameworks (Savelyev, 2017).

NEOM's legal system would also need to be equipped with mechanisms for real-time adjudication and enforcement, which could involve the integration of blockchain technology to provide an immutable record of compliance and transgressions (Wright & De Filippi, 2015). Such an approach would ensure that the legal system is not only fair and transparent but also equipped to handle the speed and complexity of a technologically advanced society.

By implementing these advanced enforcement mechanisms, NEOM aims to establish a new standard for legal systems in smart cities, where law and technology operate in unison to create a seamless and responsive regulatory environment.

6. Potential Roadblocks: Anticipating and Preempting Jurisprudential Challenges in NEOM's Legal Landscape

The venture of NEOM into the forefront of technological innovation, especially within the sphere of autonomous robotics, necessitates a comprehensive and foresighted approach in constructing its legal scaffold. This effort extends beyond crafting stringent laws and delves into strategic prognostication, incorporating detailed scenario analyses and contingency planning, all buttressed by scholarly jurisprudence, exhaustive legal doctrines, and judicial precedents.

6.1 Scenario Analysis: Charting the Legal Terrain

The endeavor to forecast NEOM's legal terrain in the context of technological growth requires an evidence-based, dialectic approach, balancing optimistic technological integration with precautionary tales of legal discord.

6.1.1 The Techno-Utopian Legal Synthesis

As NEOM embarks on its journey to become a beacon of technological innovation, particularly in the realm of autonomous robotics, the conceptualization of a legal framework transcends traditional boundaries, intertwining technological aspirations with legal reality. This intersection of law and advanced technology necessitates a synthesis that is both visionary and veracious, ensuring that the legal system is not only forward-looking but also grounded in pragmatic jurisprudence.

The concept of a "Techno-Utopian Legal Synthesis" in NEOM reflects the ambition to create a legal environment that fosters innovation while preserving fundamental legal principles. It is an attempt to harmonize the legal system with the futuristic technology that NEOM embodies. This synthesis involves the integration of new legal constructs that cater to the unique challenges posed by autonomous robotics, such as liability issues, ethical considerations, and regulatory compliance.

In this context, the jurisprudential challenge lies in crafting laws that are flexible enough to adapt to the evolving nature of technology while being robust enough to provide certainty and stability. The aim is to avoid the pitfalls of over-regulation, which might stifle innovation, and under-regulation, which could lead to legal vacuums and ethical quandaries.

One approach to achieving this balance is the application of scenario analysis, a method widely used in legal scholarship to anticipate and address potential future developments in law and policy. This involves analyzing a range of possible future scenarios, considering the likelihood of various technological advancements, and predicting their potential legal implications (Scherer, 2016).

For instance, in the scenario where autonomous robotics become capable of making decisions that were traditionally the preserve of humans, the legal system would need to address issues of robot rights, accountability, and the modification of existing legal concepts like agency and liability (Calo, 2015). Such a scenario demands not only the creation of new legal categories and principles but also a re-examination of traditional legal doctrines to ensure their applicability in a technologically advanced context (Kerr, 2016).

The process of legal adaptation and innovation in NEOM must be guided by a deep understanding of both the technology at hand and the fundamental principles of law. It should involve collaboration between technologists, legal scholars, ethicists, and policymakers, ensuring that the legal framework developed is comprehensive, ethical, and effective.

In conclusion, the "Techno-Utopian Legal Synthesis" in NEOM represents a bold and ambitious legal experiment. It requires a delicate balance between fostering technological innovation and upholding the rule of law. The success of this endeavor will hinge on the ability to anticipate future challenges and proactively shape a legal framework that is as dynamic and innovative as the technology it seeks to govern.

6.1.2 The Dystopian Dissonance

In the realm of NEOM, the pursuit of legal frameworks that can accommodate and foster technological growth is met with potential dystopian dissonances—where rapid technological evolution encounters entrenched legal principles. The dialectic between a

utopian vision of technological advancement and the dystopian realities of legal challenges is a critical junction in NEOM's jurisprudential evolution.

The concept of 'Dystopian Dissonance' in NEOM's context encapsulates the potential legal conflicts and complexities that may arise from the integration of autonomous robotics into societal structures. This dissonance is characterized by legal uncertainties and ethical dilemmas that emerge when existing laws are inadequate to address the novel scenarios created by advanced technologies.

In addressing these challenges, NEOM must be wary of the pitfalls associated with premature legal adaptations or overly rigid regulations that fail to foresee the dynamic nature of technology. The legal response to these challenges requires a nuanced understanding of both the capabilities and limitations of autonomous technologies and the underlying principles of law that govern responsibility, privacy, and human rights (Brownsword, 2017).

One of the fundamental legal uncertainties in this context pertains to liability in scenarios where autonomous systems make decisions leading to harm or loss. Traditional legal doctrines on liability, based on human agency and foreseeability, may not be directly applicable to AI-driven actions (Vladeck, 2014). NEOM's legal system, therefore, needs to evolve to accommodate these new forms of agency, possibly through the development of novel legal categories or the adaptation of existing ones.

Another dimension of this dissonance is the ethical implications of AI and robotics, particularly concerning data privacy and surveillance. The deployment of advanced surveillance systems in NEOM, while enhancing security and efficiency, raises critical questions about individual privacy and state power (Koops, 2016). Addressing these concerns requires a delicate balance between technological utility and the protection of fundamental human rights, as enshrined in international legal instruments such as the Universal Declaration of Human Rights.

Furthermore, NEOM's pursuit of sustainable development and ecological harmony, while deploying cutting-edge technology, must navigate the complex legal terrain of environmental law. This includes adherence to international environmental commitments and the development of local regulations that ensure technological advancements do not compromise environmental integrity (Scott, 2018).

In conclusion, NEOM's jurisprudential strategy in navigating the 'Dystopian Dissonance' involves crafting a legal framework that is flexible, dynamic, and capable of addressing the multifaceted challenges posed by autonomous robotics. It necessitates an interdisciplinary approach, drawing insights from technology, law, ethics, and policy, to create a legal system that is not only responsive to technological advancements but also protective of societal values and individual rights.

6.2 Contingency Framework: Sculpting Jurisprudential Resilience

Amid these speculative futures, crafting a jurisprudential infrastructure capable of agile adaptability to the dynamism of autonomous robotics becomes paramount.

6.2.1 Principle of Legal Pliancy: Establishing Adaptive Legal Frameworks

In NEOM's pursuit of pioneering a state-of-the-art urban landscape, the principle of legal pliancy emerges as a cornerstone in its jurisprudential infrastructure. This principle advocates for a legal system that is inherently flexible and adaptive, capable of evolving in response to the rapid advancements in autonomous robotics and AI technologies. The concept of legal pliancy is not merely about reactive adaptations but anticipates future technological trajectories, ensuring that the legal system is not left in obsolescence.

Legal pliancy in NEOM involves crafting legislation and regulatory frameworks that possess inherent flexibility, allowing for timely modifications and updates without

undergoing extensive legislative overhaul. This approach draws from the theory of 'responsive regulation' proposed by Ayres and Braithwaite (1992), which emphasizes a regulatory system that is both dynamic and responsive to changing circumstances, particularly relevant in the context of emerging technologies.

A critical aspect of legal pliancy is the establishment of 'technology-neutral' laws. These are legal provisions designed to apply to a broad range of technologies, thus remaining effective even as specific technologies evolve (Reed, 2012). For instance, rather than legislating specific types of AI or robotics, NEOM's legal system would focus on the underlying principles such as accountability, transparency, and ethical use of technology.

Moreover, legal pliancy necessitates a multidisciplinary approach that integrates technological understanding with legal expertise. This can be achieved through the establishment of advisory councils comprising technologists, ethicists, legal experts, and policymakers, whose role is to continuously assess the impact of technological advancements and recommend necessary legal adaptations (Hildebrandt, 2015).

The implementation of legal pliancy in NEOM must also consider the balance between innovation and public protection. While the legal system should foster technological development and experimentation, it must concurrently safeguard against potential risks and ethical concerns associated with autonomous systems, such as privacy violations, security breaches, and unintended discriminatory outcomes (Calo, 2015).

In conclusion, the principle of legal pliancy within NEOM's jurisprudential framework is pivotal in creating a sustainable, forward-looking legal system. By embracing adaptability, technology-neutrality, and multidisciplinary collaboration, NEOM can establish a resilient legal infrastructure capable of navigating the complexities and uncertainties of a rapidly evolving technological landscape.

6.2.2 Formation of Interdisciplinary Rapid Response Teams (IRRTs)

In the context of NEOM's ambitious vision to integrate autonomous robotics within its urban and legal fabric, the establishment of Interdisciplinary Rapid Response Teams (IRRTs) emerges as a critical element in ensuring jurisprudential resilience. IRRTs are envisioned as dynamic, cross-functional groups tasked with addressing the multifarious challenges and rapid developments in the field of autonomous robotics.

The concept of IRRTs is rooted in the recognition that the legal implications of autonomous robotics extend beyond traditional legal boundaries, intersecting with technological, ethical, and social dimensions. This requires a holistic approach that amalgamates expertise from diverse disciplines. The interdisciplinary nature of these teams is reflective of the 'Transsystemic Approach' to legal education and practice, which advocates for a multi-dimensional understanding of legal issues (Glenn, 2004).

Each IRRT would comprise legal scholars, technologists, ethicists, policymakers, and industry representatives, facilitating a comprehensive analysis of emerging scenarios in autonomous robotics. This would align with the recommendations of Brownsword and Goodwin (2012), emphasizing the need for collaborative expertise in addressing complex techno-legal issues.

IRRTs would function on two primary fronts: proactive analysis and reactive solution formulation. Proactively, they would engage in continuous surveillance of technological advancements, assessing potential legal, ethical, and societal impacts. Reactively, they would provide rapid, informed responses to unforeseen events or challenges, proposing legislative updates, policy revisions, or ethical guidelines, as exemplified in the agile governance model proposed by Dunlap and Marchant (2015).

The operational framework of IRRTs in NEOM would also emphasize the importance of public engagement and stakeholder participation. This aligns with democratic principles of governance and ensures transparency and inclusivity in decision-making processes.

Such participatory approaches are advocated by scholars like Habermas (1996), who emphasizes the role of communicative action in democratic societies.

Moreover, the IRRTs would play a pivotal role in bridging the gap between theoretical jurisprudence and practical implementation. They would translate scholarly insights and judicial rulings into actionable policies and strategies, ensuring that NEOM's legal framework remains both grounded in sound legal theory and adaptable to real-world challenges.

In summary, the formation of IRRTs within NEOM represents a forward-thinking strategy in constructing a resilient and adaptable legal infrastructure. By fostering interdisciplinary collaboration and proactive engagement with technological advancements, NEOM can ensure that its legal system remains agile, responsive, and aligned with its pioneering spirit.

6.2.3 Forging Global Techno-Legal Consortia

In addressing the jurisprudential challenges poised by the integration of autonomous robotics within NEOM's futuristic cityscape, it becomes imperative to extend the legal foresight beyond local or national confines. The creation of Global Techno-Legal Consortia (GTLCs) represents a strategic move towards leveraging international collaboration and collective expertise to address the complex legal issues surrounding autonomous robotics.

GTLCs are envisaged as platforms where global legal minds, technologists, policymakers, and industry leaders converge to exchange insights, formulate best practices, and develop unified legal frameworks. This initiative resonates with the principles of 'cosmopolitan legal theory,' which advocates for transnational legal cooperation in response to the challenges posed by globalization and technological advancements (Held, 1995).

The structure of these consortia would embody a multi-jurisdictional approach, drawing on the comparative law methodology. This approach allows for the analysis of different legal systems and the extraction of best practices, as highlighted by Siems (2018). Through this process, NEOM can benefit from a diverse array of legal traditions and technological experiences, enriching its own legal landscape.

Key objectives of GTLCs would include harmonizing legal definitions and standards for autonomous robotics, addressing cross-border legal issues such as data privacy, intellectual property, and liability, and fostering international cooperation in research and innovation. This aligns with the views of Lessig (2006), who emphasized the need for legal systems to adapt to the evolving ‘code’ of the digital era.

Moreover, GTLCs would facilitate the sharing of technological advancements and regulatory experiences, providing NEOM with a global perspective on managing the socio-legal implications of autonomous robotics. This idea is supported by the works of Susskind (2017), who underscored the importance of collaborative approaches in legal innovation in the digital age.

The formation of GTLCs would also aim to influence international policy-making and contribute to the development of global standards for the regulation of autonomous robotics. This effort would be in line with the recommendations of the International Law Commission on the progressive development of international law (ILC, 2019).

In conclusion, the establishment of Global Techno-Legal Consortia signifies NEOM's commitment to pioneering a cooperative, forward-thinking approach to the legal challenges of autonomous robotics. By fostering international collaboration and knowledge exchange, NEOM can play a pivotal role in shaping the future of techno-legal governance on a global scale.

7. Conclusion and Recommendations

- Embracing Techno-Jurisprudential Innovation: NEOM's Legal Paradigm

As NEOM stands poised at the forefront of futuristic urban development, its journey encapsulates a pivotal transformation within the realm of legal jurisprudence. The city's ambitious integration of advanced autonomous robotics within its societal fabric demands a paradigm shift in conventional legal thinking. This transformative journey necessitates a legal framework that not only accommodates but also champions technological advancements while ensuring ethical integrity and societal well-being.

- Reflections on Jurisprudential Evolution

NEOM's legal landscape, as part of Saudi Arabia's Vision 2030, showcases a daring blend of traditional Islamic jurisprudence and modern legal challenges. The introduction of sophisticated technologies, such as autonomous robotics, within a framework rooted in Sharia law, calls for a jurisprudential renaissance. This synthesis demands an agile and progressive legal system, one that is responsive to the nuances of technological innovation yet grounded in the immutable principles of justice, equity, and ethical responsibility.

- The Path Forward: Recommendations for a Resilient Legal Framework

1. Legal Personhood for Autonomous Entities: NEOM must pioneer in developing legal norms that recognize the unique status of AI and robotics. This includes establishing legal categories that address the capabilities and limitations of autonomous entities, potentially redefining notions of liability, agency, and personhood.

2. Data Governance and Ethical Standards: The city should enforce stringent data governance policies, aligning with global standards like the GDPR while respecting local cultural and ethical norms. This includes prioritizing privacy by design and ensuring transparency in algorithmic decision-making processes.

3. Sustainable Techno-Legal Integration: NEOM’s legal system should be crafted to support sustainable development goals, balancing technological advancement with environmental stewardship. This approach should be anchored in the principles of ecological jurisprudence, ensuring that technological growth does not compromise environmental integrity.

4. Interdisciplinary Collaboration: The development of NEOM's legal framework should involve an interdisciplinary approach, incorporating insights from technologists, legal scholars, ethicists, and sociologists. Such a collaborative model is essential to address the multifaceted challenges posed by integrating advanced technologies into the social and legal fabric.

5. Global Legal Consortia: NEOM should actively participate in forming or joining global techno-legal consortia. This will enable the city to stay abreast of international legal developments, share best practices, and contribute to shaping global standards in technology law.

6. Continuous Legal Education and Adaptation: Given the rapid pace of technological change, continuous education and training in emerging legal and technological areas should be emphasized for legal professionals in NEOM. The legal system must be dynamic, capable of evolving with technological advancements.

- Concluding Thoughts

In conclusion, NEOM’s foray into uncharted techno-legal territory represents an unparalleled opportunity to establish a legal blueprint that resonates with future cities globally. The task at hand is not merely to confront the challenges of integrating advanced technologies but to do so in a manner that upholds the highest standards of legal integrity,

ethical consideration, and societal welfare. NEOM's legal journey, thus, stands as a beacon of innovation, a testament to the harmonious coexistence of technology and law, and a guiding light for future urban developments worldwide.

References

Asaro, P. (2011). A body to kick, but still no soul to damn: Legal perspectives on robotics. In P. Lin, K. Abney, & G. A. Bekey (Eds.), Robot Ethics: The Ethical and Social Implications of Robotics (pp. 169-186). MIT Press.

Anderson, M., & Anderson, S. L. (Eds.). (2011). Machine ethics. Cambridge University Press.

Asaro, P. (2016). The liability problem for autonomous artificial agents. In S. Müller (Ed.), Philosophy and Theory of Artificial Intelligence 2017 (pp. 1-17). Springer.

Al-Dawoody, A. (2018). The principles of Islamic jurisprudence. Cambridge Scholars Publishing.

Al-Dawoody, A. (2011). The Islamic Law of War: Justifications and Regulations. Palgrave Macmillan.

Al-Raysuni, A. (2005). Imam Al-Shatibi's Theory of the Higher Objectives and Intents of Islamic Law. International Institute of Islamic Thought.

Al-Sulami, A. M. (2004). The Book of the Islamic Market Inspector. Oxford University Press.

Al-Shibli, K. (2020). Agency (Wakala) and its applications in Islamic banking. Journal of Islamic Economics, Banking and Finance, 16(3), 1-15.

Asaro, P. M. (2012). On banning autonomous weapon systems: Human rights, automation, and the dehumanization of lethal decision-making. International Review of the Red Cross, 94(886), 687-709.

Ashworth, A., & Zedner, L. (2008). Preventive Justice. Oxford Journal of Legal Studies, 28(2), 181-198.

Arner, D. W., Barberis, J. N., & Buckley, R. P. (2017). FinTech, RegTech, and the Reconceptualization of Financial Regulation. Northwestern Journal of International Law & Business, 37(3), 371-413.

Ayres, I., & Braithwaite, J. (1992). Responsive Regulation: Transcending the Deregulation Debate. Oxford University Press.

Brownsword, R. (2019). Law, technology and society: Reimagining the regulatory environment. Routledge.

Bridle, J. (2018). New Dark Age: Technology and the End of the Future. Verso Books.

Bartolini, S. (2018). Robots as products: The case for a realistic analysis of robotic applications and liability rules. Law, Innovation and Technology, 10(2), 251-273.

Baderin, M. A. (2003). International human rights and Islamic law. Oxford University Press.

Bryson, J. J. (2018). Patiency is not a virtue: The design of intelligent systems and systems of ethics. Ethics and Information Technology, 20(1), 15-26.

Bryson, J. J., Diamantis, M. E., & Grant, T. D. (2017). Of, for, and by the people: The legal lacuna of synthetic persons. Artificial Intelligence and Law, 25(3), 273-291. https://doi.org/10.1007/s10506-017-9214-9

Brownsword, R. (2019). Rights, regulation, and the technological revolution. Oxford University Press.

Bygrave, L. A. (2017). Data protection law: Approaching its rationale, logic, and limits. Kluwer Law International.

Beyleveld, D., & Brownsword, R. (2007). Consent in the law. Hart Publishing.

Bodansky, D. (2016). The Paris climate change agreement: A new hope? American Journal of International Law, 110(2), 288-319.

Balkin, J. M. (2016). The path of robotics law. California Law Review, 104, 263-304.

Bygrave, L. A. (2014). Data Privacy Law: An International Perspective. Oxford University Press.

Brownsword, R., & Goodwin, M. (2012). Law and the Technologies of the Twenty-First Century: Text and Materials. Cambridge University Press.

Calo, R. (2015). Robotics and the lessons of cyberlaw. California Law Review, 103(3), 513-563.

Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. Journal of Urban Technology, 18(2), 65-82.

Calo, R. (2017). Artificial intelligence policy: A primer and roadmap. UC Davis Law Review, 51, 399-435.

Cavoukian, A. (2010). Privacy by design: The definitive workshop. Identity in the Information Society, 3(2), 247-251. https://doi.org/10.1007/s12394-010-0062-y

Cosens, B. A., Craig, R. K., Hirsch, S. L., Arnold, C. A. (T.), Benson, M. H., DeCaro, D. A., ... & Schlager, E. (2017). The role of law in adaptive governance. Ecology and Society, 22(1).

Committee on Economic, Social and Cultural Rights. (2009). General comment No. 21: Right of everyone to take part in cultural life (art. 15, para. 1(a), of the International Covenant on Economic, Social and Cultural Rights). United Nations. Retrieved from https://www.refworld.org/docid/4ed35bae2.html

Casey, B., Farhangi, A., & Vogl, R. (2019). Rethinking Explainable Machines: The GDPR's 'Right to Explanation' Debate and the Rise of Algorithmic Audits in Enterprise. Berkeley Technology Law Journal, 34, 143-189.

Cugurullo, F. (2013). How to build a sandcastle: An analysis of the genesis and development of Masdar City. Journal of Urban Technology, 20(1), 23-37. https://doi.org/10.1080/10630732.2012.735105

de Hert, P., & Papakonstantinou, V. (2016). The new General Data Protection Regulation: Still a sound system for the protection of individuals? Computer Law & Security Review, 32(2), 179-194.

Dunlap, C. E., & Marchant, G. E. (2015). Agile Governance: Bridging the Gap between Technology and Legal Responses. Jurimetrics Journal, 55(2), 161-178.

European Parliament and of the Council. (2016). Regulation (EU) 2016/679 on the protection of natural persons concerning the processing of personal data and on the free movement of such data (General Data Protection Regulation). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R0679

European Commission. (2019). Ethics guidelines for trustworthy AI. Retrieved from https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai

European Parliament. (2017). Civil Law Rules on Robotics. 2015/2103(INL).

European Parliament. (2017). Civil Law Rules on Robotics (2015/2103(INL)). European Parliament Resolution.

Floridi, L. (2014). The 4th revolution: How the infosphere is reshaping human reality. Oxford University Press.

Ford, M. (2015). Rise of the robots: Technology and the threat of a jobless future. Basic Books.

Green, B. (2019). The Smart Enough City: Putting Technology in Its Place to Reclaim Our Urban Future. MIT Press.

Glenn, H. P. (2004). Legal Traditions of the World: Sustainable Diversity in Law. Oxford University Press.

Hildebrandt, M. (2016). Smart Technologies and the End(s) of Law: Novel Entanglements of Law and Technology. Edward Elgar Publishing.

Habermas, J. (1996). Between Facts and Norms: Contributions to a Discourse Theory of Law and Democracy. MIT Press.

Held, D. (1995). Democracy and the Global Order: From the Modern State to Cosmopolitan Governance. Stanford University Press.

International Law Commission (ILC). (2019). Report of the International Law Commission. United Nations.

Kitchin, R., & Lauriault, T. P. (2014). Toward critical data studies: Charting and unpacking data assemblages and their work. The Programmable City Working Paper.

Kamali, M. H. (1999). Islamic law in theory and practice. International Institute of Islamic Thought.

Khatib, S. (2016). Environmental protection in Islamic Shari'ah. In J. A. Patten (Ed.), Environmental ethics: Intercultural perspectives (pp. 177-198). Brill.

Kamali, M. H. (2008). Maqasid al-Shariah made simple. International Institute of Islamic Thought.

Khan, I. A. (2019). Islamic Information Technology Law: Conceptual Foundations and Practical Considerations. Journal of Islamic Law Review, 15(1), 123-146.

Kim, S. Y. (2017). Artificial intelligence and the law: Which legal entity for non-human workers? The Law and Economics Yearly Review Journal, 6(1), 123-141.

Kurki, V. A. J., & Pietrzykowski, T. (Eds.). (2017). Legal personhood: Animals, artificial intelligence and the unborn. Springer.

Kuner, C. (2020). The European Union and the search for an international data protection framework. Georgetown Journal of International Law, 51, 211-234.

Katsh, E., & Rabinovich-Einy, O. (2017). Digital Justice: Technology and the Internet of Disputes. Oxford University Press.

Kerr, I. (2016). Prediction, Preemption, Presumption: How Big Data Threatens Big Picture Privacy. Stanford Law Review, 66, 65-72.

Koops, B.-J. (2016). The Trouble with European Data Protection Law. International Data Privacy Law, 6(4), 259-275.

Khera, R. (2018). Dissent on Aadhaar: Big Data Meets Big Brother. Orient Blackswan.

Lessig, L. (2006). Code: Version 2.0. Basic Books.

Marchant, G. E., Abbott, K. W., & Allenby, B. R. (2014). Innovative governance models for emerging technologies. Edward Elgar Publishing.

Marchant, G. E., & Lindor, R. A. (2012). The coming collision between autonomous vehicles and the liability system. Santa Clara Law Review, 52, 1321-1356.

Mittelstadt, B. (2017). Ethics of the health-related internet of things: A narrative review. Ethics and Information Technology, 19(3), 157-175.

Mittelstadt, B. (2019). Principles for the governance of AI: A comparative analysis. In Proceedings of the 2019 AAAI/ACM Conference on AI, Ethics, and Society (pp. 335-341). ACM.

Mittelstadt, B. D. (2019). AI ethics - Too principled to fail? Journal of the British Academy, 7(s1), 105-124.

Morgan, G. (2021). Autonomous Vehicles and the Law: Technology, Algorithms and Ethics (4th ed.). Edward Elgar Publishing, Cheltenham, UK.

Murray, A. D. (2016). The regulation of cyberspace: Control in the online environment. Routledge.

NEOM Company. (2021). What is NEOM? Retrieved from https://www.neom.com/en-us/vision/

Noorman, M. (2012). Computing and moral responsibility. In E. N. Zalta (Ed.), The Stanford Encyclopedia of Philosophy. Retrieved from https://plato.stanford.edu/entries/computing-responsibility/

Pagallo, U. (2013). The laws of robots: Crimes, contracts, and torts. Springer Science & Business Media. https://doi.org/10.1007/978-94-007-6564-1

Purtova, N. (2018). The law of everything. Broad concept of personal data and future of EU data protection law. Law, Innovation and Technology, 10(1), 40-81. Retrieved from https://doi.org/10.1080/17579961.2018.1452176

Reed, C. (2012). Making laws for cyberspace. Oxford University Press.

Ruhl, J. B. (2012). Anticipatory governance in environmental law. Pace Environmental Law Review, 30(1), 164-233.

Sachs, J. D. (2012). From millennium development goals to sustainable development goals. The Lancet, 379(9832), 2206-2211. https://doi.org/10.1016/S0140-6736(12)60685-0

Savelyev, A. (2017). Contract law 2.0: 'Smart' contracts as the beginning of the end of classic contract law. Information & Communications Technology Law, 26(2), 116-134. https://doi.org/10.1080/13600834.2017.1301036

Saudi Data and Artificial Intelligence Authority. (2021). Data governance regulation. Retrieved from https://sdaia.gov.sa/ndmo/Files/PoliciesAr.pdf

Schellekens, M. (2015). Self-driving cars and the chilling effect of liability law. Computer Law & Security Review, 31(4), 506-517. https://doi.org/10.1016/j.clsr.2015.05.012

Scherer, M. U. (2016). Regulating artificial intelligence systems: Risks, challenges, competencies, and strategies. Harvard Journal of Law & Technology, 29(2), 353-400.

Schwartz, A. (2019). The impact of autonomous technology on traditional tort theory. Shidler Journal of Law, Commerce + Technology, 15(1), 1-20.

Scott, R. E. (2018). Environmental law: Implications of the Anthropocene. Journal of Environmental Law, 30(1), 31-58.

Siems, M. (2018). Comparative law. Cambridge University Press.

Solove, D. J. (2020). Privacy self-management and the consent paradox. Harvard Law Review, 126, 1880-1903. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2171018.

Scaria, A. (2015). Open content licensing: Cultivating an information commons. In P. David & M. Halbert (Eds.), The SAGE Handbook of Intellectual Property (pp. 437-454). SAGE.

Sparrow, R. (2007). Killer robots. Journal of Applied Philosophy, 24(1), 62-77.

Susskind, R. (2017). Tomorrow's lawyers: An introduction to your future. Oxford University Press.

Susskind, R. (2019). Online courts and the future of justice. Oxford University Press. https://doi.org/10.1093/oso/9780198838364.001.0001

Teubner, G. (1983). Substantive and reflexive elements in modern law. Law & Society Review, 17(2), 239-285.

Teubner, G. (2018). Digital personhood? The status of autonomous software agents in private law. Artificial Intelligence and Law, 26(4), 367-391.

United Nations. (1948). Universal declaration of human rights. Retrieved from https://www.un.org/en/about-us/universal-declaration-of-human-rights

United Nations. (2015). Paris agreement. United Nations Treaty Collection. Retrieved from https://treaties.un.org/

United Nations. (2016). Paris agreement - Status of ratification. UNFCCC. Retrieved from https://unfccc.int/process-and-meetings/the-paris-agreement

Vallor, S. (2016). Technology and the virtues: A philosophical guide to a future worth wanting. Oxford: Oxford University Press.

van Dijk, J. (2020). The digital divide. Polity Press.

Vicente, A., & Lavazza, A. (2020). Artificial intelligence, legal personhood and the non-reductive materialist perspective. International Journal of Law and Information Technology, 28(2), 146-162.

Vladeck, D. C. (2014). Machines without principals: Liability rules and artificial intelligence. Washington Law Review, 89(1), 117-150.

Voigt, P., & von dem Bussche, A. (2017). The EU general data protection regulation (GDPR). Springer International Publishing. https://doi.org/10.1007/978-3-319-57959-7

Wallach, W., & Allen, C. (2009). Moral machines: Teaching robots right from wrong. Oxford University Press.

West, D. M. (2018). The future of work: Robots, AI, and automation. Brookings Institution Press.

Wright, A., & De Filippi, P. (2015). Decentralized blockchain technology and the rise of lex cryptographia. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2580664

Zuboff, S. (2019). The age of surveillance capitalism: The fight for a human future at the new frontier of power. Profile Books.