T.C.

BAHCESEHIR UNIVERSITY

GRADUATE SCHOOL

DEPARTMENT OF GLOBAL AFFAIRS (INTERDISCIPLINARY)

THE IMPACT OF SCIENTIFIC PARADIGM SHIFTS ON HUMAN-NATURE RELATIONSHIP IN THE STRUCTURE OF WORLD HISTORY

MASTER'S THESIS

TUANA BEKIRAGAOGLU

ISTANBUL 2024

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ABSTRACT

THE IMPACT OF SCIENTIFIC PARADIGM SHIFTS ON HUMAN-NATURE RELATIONSHIP IN THE STRUCTURE OF WORLD HISTORY

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Master's Program in Global Affairs

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Human-nature relationship is a fundamental factor in shaping the structure of world history and forming the essence of the paradigms that shape human life. The global capitalist world order, shaped largely by the Mechanistic Paradigm, has long been rooted in political and legal systems that create economic and social inequality. At its core, this paradigm views nature as something to be conquered—a resource to be controlled and exploited in the name of human progress, much like a machine that needs to be dominated. The dominance established by humans over nature, through scientific and technical methods, has led to the ecological disaster of the "Anthropocene" era. Although theories and civil society movements born from ecological concerns have begun to articulate their discomfort with this state and corporate-centric order more strikingly, ending the destruction of nature by the Mechanistic Paradigm requires a combination of political and legal resistance with a scientific and philosophical synthesis for reinterpreting nature.

The once-dominant scientific methods of Bacon, Descartes, and Newton, which laid the groundwork for the Mechanistic Paradigm, have been losing validity in recent times. In contrast, the nascent "Systemic Paradigm" recognizes nature as an organically interconnected entity, maintained by life-sustaining ecological principles. This paradigm emphasizes a symbiotic relationship between humans and nature. Therefore, achieving an ecologically balanced and equitable society requires a

synthesis of our political and legal resistance with a shift in scientific and philosophical approaches to nature, guided by principles of Systemic Paradigm.

Key Words: Paradigm, Human-Nature Relationship, Ecology

ÖZ

DÜNYA TARİHİNİN YAPISINDA İNSAN-DOĞA İLİŞKİSİ BAĞLAMINDA BİLİMSEL PARADİGMA DEĞİŞİMİNİN ETKİSİ

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İnsan-doğa ilişkileri, dünya tarihinin yapısını şekillendiren en temel faktörlerden biri olarak toplumsal hayatımızı şekillendiren paradigmaların özünü oluşturmaktadır. Günümüzde baskın olan Mekanikçi Paradigma'nın fragmantasyona dayalı yaklaşımıyla beraber, disiplinler dünya tarihinin yapısını analiz ederken paradigmaları kendi kavramsal çerçevesi ve tarihsel anlatımı çerçevesinde sınıflandırarak ele almaktadır. Ancak paradigmalar; siyasi, hukuki ve ekonomik hayat ile bilim ve felsefe arasında gerçekleşen diyalektik ilişki bağlamında şekillenmektedir.

İçerisinde yaşamakta olduğumuz küresel kapitalist dünya düzeni; ekonomik ve sosyal eşitsizlikler üzerine kurulan siyasi ve hukuki paradigmanın bilimsel ve felsefi sentezi olan; insanlığın gelişimi için doğayı fethetmesini öne süren ve doğayı bir makine olarak gören mekanikçi paradigmanın etkisiyle şekillenmektedir. İnsanın doğa üzerinde kurduğu hakimiyet bilimsel ve teknik yöntemleri sayesinde doğayı tahrip ederek Dünya'nın insan müdahalesi sonucunda ekolojik bir felakete sürüklendiği "Antroposen" çağını ortaya çıkarmıştır. Ekolojik kaygılarla oluşan teori ve sivil toplum hareketleri, devlet-özel sermaye ekseni etrafında dönerek halkı yok sayan düzenden rahatsızlıklarını daha vurucu şekilde ortaya koymayı başlasa dahi mekanikçi paradigmanın doğa üzerindeki tahribatına son verebilmek adına siyasi ve hukuki direniş ile beraber, bilimsel ve felsefi bir sentezle doğanın yeniden anlaşılmasına ihtiyaç vardır. Mekanikçi paradigmanın bilimsel yaklaşımını ortaya çıkaran Bacon, Descartes ve Newton'ın yöntemleri geçtiğimiz yüzyıldan beri geçerliliğini yitirmekte ve doğanın organik bir yapı olarak görüldüğü, yaşamı sömürmeye değil üretmeye

yönelik bir dizi ekolojik ilkeyle ayakta tuttuğu gerçeği kabul edilerek insan ve doğa arasındaki karşılıklı ilişki vurgulayan “Sistemci Paradigma” doğanın yeniden anlaşılmasının bilimsel yöntemini temsil etmektedir. Dolayısıyla; ekolojik ve eşitlikçi bir toplum için siyasi ve hukuki değişim ile beraber, doğaya bilimsel ve felsefi yaklaşımımızı “Sistemci Paradigma”yla tamamlayarak gerekli dönüşümü sağlayabiliriz.

Anahtar Kelimeler: Paradigma, Insan-Doğa Ilişkisi, Ekoloji

To an Equal and Ecological World

“What we observe is not nature in itself but nature exposed to our method of questioning.”

-Werner Heisenberg

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Chapter 1

Introduction

In this chapter; the subject, objectives, and significance of the study will be delineated. Following an outline of the study's general scope, the research questions and hypotheses will be presented. Subsequently, the methodology, scope, and limitations of the study will be examined.

1.1 Subject of the Study

The structure of world history has been analysed from various perspectives and terminologies by numerous disciplines. Each discipline's endeavour to comprehend and interpret our history has identified historical turning points, revolutions, and transformations within its paradigms and principles. From the standpoint of any discipline, the human-nature relationship emerges as one of the fundamental factors shaping the structure of world history. Acknowledging that the view of nature represents human perspective towards the world and all living beings within it, the view of nature forms the basis of human perspective towards other humans. Human relationship with nature and other living beings shapes the essence of the paradigms that define the social, scientific, political, legal, and economic life of society.

In their efforts to comprehend the structure of world history, disciplines interpret history as a linear narration and arrangement. Paradigms, defined within the conceptual framework and historical narrative of the discipline, are classified and analysed within the impact of the fragmentation-based approach to human-nature relationships of Mechanistic Paradigm. However, the formation of paradigms and the paradigm shifts occur through the intersections and interactions of different disciplines across various time periods. Similarly, the effects of these paradigms and paradigm shifts can be observed in every field where humans and nature interact, reflecting changes in human-nature relationships, regardless of the era or discipline (Kuhn, 1962). The overarching structure of paradigms shaping world history is beyond a fragmentation and linear arrangement-based approach, transcending individual

disciplines and linear time. Therefore, to grasp the structure of world history, an interdisciplinary and even ‘transdisciplinary’ approach is necessary, as the human-nature relationship and the paradigms shaping history emerge through the transcended interaction of disciplines.

Today's global capitalist world order is the product of a paradigm that has evolved in a transdisciplinary manner throughout history. The mechanistic paradigm became dominant in the 16th century with the Scientific Revolution, particularly through the works of René Descartes, Francis Bacon, and Isaac Newton (Gul, 2013). The scientific approach forming the mechanistic thought traces back to Aristotle’s scientific method and atomism, which emerged in the 5th century BC with Leucippus and Democritus (Capra & Mattei, 2015). The paradigm’s approach to the human-nature relationship views humans as entities that must dominate nature to progress and nature as a machine rather than an organic entity (Gul, 2013). Mechanistic paradigm, by its nature, is a holistic analysis of non-linear interactions in different disciplines' approach to human-nature relationships before the 16th century. The human desire and effort to dominate nature is as old as history itself (Yildirim, 2014). The concept of humans dominating nature is directly related to policies and laws implemented regarding private property structures, along with economic and social hierarchies, following the transition to settled life (Bookchin, 1982). Accumulation of natural resources and private property led to centralization and the emergence of the state prototype (Karatani, 2017). Especially the interaction between science, politics, and law under the Mechanistic Paradigm shaped the modern society. Therefore, modern science and the modern state are products of the same paradigm.

The idea of human dominance over nature, observable throughout history since the transition to settled life, views nature as a machine rather than an organic entity, a notion that became distinct with the Scientific Revolution. The dominance of paradigms is linked to their ability to address the socio-economic structure and needs of the era (Kuhn, 1962). The transformation of natural resources into capital for human development, viewing nature as a machine, has led to the dominance of the mechanistic view. Therefore, the mechanistic paradigm emerging with the Scientific

Revolution is a result of the non-linear historical interaction of different disciplines, beyond the discoveries in the scientific field in the 16th century.

The world in which scientists, lawyers, and administrators who adopted the view of nature as a machine, saw nature's abundant resources as 'commons,' but lacked the capital necessary for manufacturing and industrial development. The conversion of natural resources into capital through commodity exchange, supported by scientific and technical infrastructure and political and legal reforms, elevated the economic domain above other societal areas. The structure of private property, corporations, and sovereign states facilitated the concentration of some of these common resources into capital in the hands of a few. However, after 300 years under the mechanistic approach, a world order has emerged where commons are extremely limited, and capital is abundant (Capra & Mattei, 2015).

For about 300 years, the humanity has been shaped based on the Mechanistic Paradigm's approach to human-nature relationships. The effort of corporations towards greater privatization, although it has produced effective economic outcomes in the fields of market economy and the increase in countries' Gross Domestic Product (GDP), has also been scrutinized by the analyses of academics and leaders which reveal that the freedom to utilize natural resources and value under the laws of private property inherent in capitalism carries a multitude of interconnected consequences. Among these consequences are societal inequality and exclusion, impaired democracy, rapid and intensive degradation of the natural environment, and increased alienation. (Capra & Mattei, 2015).

Following the rise of the mechanistic paradigm after the Scientific Revolution, the Industrial Revolution led to an unmeasured exploitation of natural resources, resulting in serious environmental damage. It is now increasingly recognized that humanity's dominance over nature has become as significant a factor in the workings of the world as natural phenomena themselves. Paul Crutzen highlights the departure from the current geological epoch, known as the Holocene, predominantly due to human intervention, and refers to this quantitative shift in the relationship between humans and nature as the 'Anthropocene' era (Crutzen & Stoermer, 2001).

According to Fritjof Capra, the repercussions of applying a mechanistic structure to communal assets are highly detrimental to humanity. Apart from direct environmental issues like pollution and the disappearance of forests, he emphasizes the privatization and corporate management, driven by short-term resource-exploitative perspectives, of public utilities, schools, state broadcasters, and various infrastructures. These emerging social and environmental challenges, due to their complexity and the time required to address them, are not adequately reflected in the policies of politicians, who operate within short electoral cycles and are motivated by rational choice theory to secure re-election (Capra & Mattei, 2015).

Since the 1980s, the Green Theory which is now a part of international relations theories, underlines the importance of shifting from a human-centric to a nature-centric perspective to address environmental issues, a shift necessitated by the mechanistic paradigm (Gozen & Ercandirli, 2019). Additionally, Eco-Marxists argue that the ecological problems arising from human dominion over nature cannot be solved by the institutions, regimes, or individual activities within the current global structure. They advocate for a comprehensive re-evaluation of the human-nature relationship (Elcandirli, 2019). Despite the impactful efforts of various theories and civil society movements formed around ecological concerns, the public remains a less influential actor compared to the state and private sector in the current political and legal framework, making it seem implausible to achieve change in human-nature relations independently (Gulmez & Dikmen, 2023).

When examining the structure of paradigm shifts, it is discernible that the mere existence of a public capable of intervening in the political and legal order will not suffice to create a change in the human-nature relationship. According to Kuhn, the emergence of new paradigms can only result from a substantial breakdown in the current paradigm and a significant alteration in the approach of normal science to problems. In other words, the existing methods of problem-solving must demonstrate a clear failure (Kuhn, 1962). Yet, the perception of nature as a machine, dominant along with the mechanistic paradigm, has proven insufficient not only in political and legal fields but also in finding solutions to contemporary issues in the scientific field.

Since the beginning of the 19th century, post-Scientific Revolution, the shortcomings and inaccuracies of Newton's laws, which had been fundamental to humanity's approach to nature, have started to become apparent in biology and physics. Following the Romantic Movement, which spread to art, philosophy, and science in the late 18th century, the concept of evolution in biology and physics, and subsequent Quantum and relativity theories, have significantly shaken the foundations of the mechanistic worldview and Newton's laws (Capra & Mattei, 2015).

The paradigm shifts in physics, reflecting in biology, psychology, and environmental sciences, and the dialogues between disciplines have led to the emergence of a new paradigm known as 'systems thinking' or 'systemic thought'. This approach in human-nature relations interprets nature not as a machine but as a network, acknowledging the reality that nature sustains life not through exploitation but through a series of ecological principles promoting production. The reciprocal relationship between humans and nature is being emphasized within this approach.

The concept of human dominion over nature has been a noticeable relational structure across different disciplines since the advent of settled life. However, the structure emphasizing a mutual harmony between humans and nature has existed since much earlier historical times (Mauss, 2000). During the transition to settled life, clan communities conducted their relationship with nature on the basis of reciprocity (Karatani, 2017). With the advent of settled life and the ensuing possibility of accumulating wealth, inequalities and conflicts emerged. These were managed through exchanges based on the obligations of gift and counter-gift, while an organic view of nature and animism were adopted in approaching nature. Interpreting the reciprocity principle in human relationships with nature and each other as a mode of exchange, Kojin Karatani then contrasts the structure of relationship where humans dominate nature and perceive it as a machine, with commodity exchange. Karatani emphasizes that humanity is nearing the end of the commodity exchange-based human-nature relationship, suggesting that the new mode of exchange will arise by reassigning the principle of reciprocity present in pre-settled communities (Karatani, 2017).

Today, humanity is witnessing the rise of a new paradigm, as the existing socio-cultural, scientific, and ecological needs and challenges render the structure of relationship based on human dominion over nature. The realization of the ecological destruction accompanying the view of nature as a machine to be dominated by humans, and the threat this poses to the future of human life, necessitates a social, economic and scientific transformation. Fritjof Capra defines paradigm shifts as 'a set of concepts, values, perceptions, and practices shared by a community, which forms a particular vision of reality that is the foundation of the community's way of organizing itself' (Capra, 1982). Therefore, the systemic paradigm emerging from the integration of social and scientific approaches at different times and disciplines in world history presents itself as the paradigm that will enable the reassignment of the reciprocal relationship between humans and nature.

To understand the transformation that the systemic paradigm might bring in political, legal, social, and economic terms; it is fundamental to analyze how scientific paradigm shifts have influenced the structure of world history, as the historical shifts in human interaction with nature cannot be understood without examining the underlying scientific paradigms. This study seeks to unravel these complex interdependencies that fundamentally altering the human-nature relationship.

1.2 Purpose of the Study

This study, rooted in the objective of addressing the social and ecological degradation of our time, aims to develop a new and comprehensive perspective by integrating the natural sciences, which shape our understanding of nature, with the social sciences. By bridging these two disciplines, the research seeks to offer an interdisciplinary approach to understanding the relationship between society and the nature. Through emphasizing that science is not purely scientific, but is historically shaped in a relative manner according to socio-cultural structure as well as the economic objectives of humanity, the aim is to offer new perspectives to the solutions and approaches proposed in the social sciences to address contemporary issues related to humanity and nature.

Through a historical analysis, the study aims to demonstrate how the notion of human dominance over nature and interpersonal relationships, when coupled with the Mechanistic Paradigm, has contributed to significant ecological degradation. This analysis ultimately highlights the necessity of integrating contemporary social movements with an innovative scientific perspective to mitigate the ecological harm instigated by Mechanistic Paradigm and to pave the way for sustainable and harmonious human-nature relations in the future. Beyond understanding historical impacts, the study also seeks to explore the potential of emerging Systemic Paradigm to foster a more sustainable and reciprocal relationship between humans and nature. The study emphasizes that while socio-cultural and economic objectives shape human perspectives toward nature, it is the scientific paradigm shifts that implement the effects of this change on nature itself.

Thus, while examining two scientific paradigms in the context of human-nature relations, this study aims to contribute to Thomas Kuhn and Fritjof Capra's work; highlighting the dialectical relationship between science and society; underlining that scientific paradigms are shaped not only by sequential scientific discoveries. While also interpreting Kojin Karatani's mode D approach; this study aims to stress that the socio-cultural structure challenging the Mechanistic Paradigm today, that requires a reciprocal relationship with nature and each other in order to prevent ecological extinction and create a sustainable future; will complete the transformation to a equal and ecological society by obtaining a new scientific paradigm.

1.3 Significance of the Study

The study illuminates the intricate connections between scientific developments and societal changes, particularly in the context of human-nature relationship. The significance of this study lies in its interdisciplinary approach, combining history, political science, philosophy, sociology, and environmental science to examine the impact of scientific paradigms on human-nature relationships. This way, it bridges the gap between scientific knowledge and social action, demonstrating that shifts in scientific paradigms are not merely academic but have real-world implications for policy, economics, and cultural practices.

This work provides a historical analysis of how scientific paradigms shape and are shaped by the socio-economic and cultural contexts of their time. While Thomas Kuhn primarily focused on the internal dynamics of scientific communities and the process of paradigm shifts, the study extends his framework to examine the broader impact of these shifts on human-nature relationships. By analyzing the Mechanistic Paradigm's role in facilitating humanity's dominance over nature and the ecological consequences thereof, this study underscores the socio-environmental dimensions of Kuhn's paradigms, highlighting the interconnectedness of scientific thought and societal development. The study also contributes to environmental studies by highlighting how changes in scientific paradigms can lead to more sustainable human-nature relationships. It underscores the importance of shifting from a mechanistic to a systemic paradigm to address current ecological crises.

This work also aligns in with Fritjof Capra's theories by providing historical analysis of how such paradigm shifts have occurred and their impacts on human-nature relations. By examining the emerging Systemic Paradigm, the thesis aligns with Capra's call for a holistic perspective and demonstrates how contemporary socio-cultural needs drive the transition towards more sustainable and integrative scientific paradigms. The thesis thus reinforces Capra's arguments with historical context and detailed analysis, further advocating for the systemic approach in addressing current ecological crises.

The work offers a perspective on Karatani's emerging mode D by linking it to the systemic paradigm shift in scientific thought. It posits that the transition from the Mechanistic to the Systemic Paradigm is reflective of broader socio-economic changes that align with Karatani's vision of a new societal framework. By contextualizing the emerging mode D within the dialectical relationship between scientific paradigms and social structures, this research provides a nuanced understanding of how scientific and socio-economic transformations are intertwined.

The study also integrates Turker Kılıç's interconnectedness approach by exploring how systemic thinking can be applied to human-nature relations and

scientific paradigms. The incorporation of scientific research methodologies within a social sciences framework enriches the analysis and provides a comprehensive understanding of the dialectical interactions between scientific paradigms and societal structures. By incorporating scientific research developments into a social sciences thesis this study demonstrates that systemic thinking is not only relevant but essential as its emphasis on interconnectedness underscores the need for collaborative and cross-disciplinary effort for addressing contemporary socio-environmental challenges.

1.4 Questions and Hypotheses of the Study

This study has 3 research questions and hypotheses. The research questions of the thesis are:

1) In what ways do scientific paradigms reflect and shape socio-economic and cultural contexts?

This question examines the dialectical relationship between science and society, analysing how scientific paradigms both influence and are influenced by the mindsets of society.

2) How has the Mechanistic Paradigm influenced the human-nature relationship and lead to ecological crises?

This question seeks to explore the historical development of the Mechanistic Paradigm, its impact on human dominance over nature, and the resulting ecological consequences.

3) What are the characteristics of the emerging Systemic Paradigm and how does the integration of systemic thinking in scientific paradigms contribute to addressing contemporary ecological and socio-economic challenges?

This question aims to identify the key principles of the Systemic Paradigm and evaluate its potential to foster more sustainable and reciprocal relationships between humans and nature, providing solutions to current environmental and societal issues.

The hypotheses of the study are:

1) Scientific paradigms are shaped by the socio-economic and cultural objectives and needs of their time, creating a dialectical relationship between science and society.
2) The Mechanistic Paradigm has led to significant ecological degradation by promoting a view of nature as a machine to be dominated and exploited.
3) Systemic Paradigm offers a more sustainable framework for human-nature relations by emphasizing interconnectedness and holistic thinking. Adopting systemic thinking in scientific paradigms can lead to more effective solutions to contemporary ecological and socio-economic challenges.

1.5 Methodology of the Study

The study offers a interdisciplinary methodology; integrating literature reviews from various fields including political science, sociology, history, philosophy, and the natural sciences. The research draws on historical analysis, philosophical inquiry, sociological analysis, and environmental science to construct a comprehensive narrative of paradigm evolution. Historical case studies are a component of the methodology, providing concrete examples of paradigm shifts such as the transition from teleological to humanist paradigms during the Renaissance and the subsequent Scientific Revolution. Primary and secondary historical sources are utilized to trace the trajectory of scientific thought and its influence on societal structures.

The theories Thomas Kuhn, Fritjof Capra, and Kojin Karatani are analyzed to understand the theoretical underpinnings of paradigm shifts by interpreting arguments, comparing different perspectives, and situating them within the broader context of human-nature relations. The study applies sociological analysis to explore how scientific paradigms impact and are impacted by social, economic, and legal structures. This includes examining the role of socio-cultural needs and mindsets in shaping scientific thought and the reciprocal influence of scientific paradigms on societal development. To address contemporary ecological crises, the study incorporates environmental science research, focusing on the systemic paradigm's potential to foster sustainable human-nature relationships. Scientific data and case studies related to

ecological sustainability are analyzed to support the argument for a paradigm shift towards systemic thinking.

The transdisciplinary methodology synthesizes insights from various disciplines for understanding of paradigm shifts. This comprehensive approach allows for a multi-dimensional analysis of the subject and transcends the boundaries of individual disciplines to offer a comprehensive understanding of the complex interplay between scientific paradigms and socio-cultural structures. This involves identifying and analyzing the intersections and interactions between different fields of knowledge, emphasizing the interconnectedness of scientific, social, and environmental phenomena.

This study approach the human nature relations by acknowledging that the view of nature represents human perspective towards the world and all living beings within it, therefore it forms the basis of human perspective towards other humans. Human relationship with nature and other living beings shape the essence of the social, scientific, political, legal, and economic life of society.

The study emphasizes paradigm shifts not only as scientific discoveries and inventions but as a set of concepts, values, perceptions, and practices shared by a community, which forms a particular vision of reality that is the foundation of the community's way of organizing itself by the socio-cultural needs and general mindsets of the time. Similarly, the effects of these paradigms and paradigm shifts can be observed in every field where humans and nature interact, reflecting changes in human-nature relationships, regardless of the era or discipline.

Within the framework of these two perspectives, this study examines human-nature relationships historically under the main headings of reciprocity and dominance. Dominance is examined through the lens of the mechanistic scientific paradigm, while reciprocity demonstrates its influence on the natural sciences through the systemic paradigm. The study's methodology is rooted in this conceptual framework, which requires a cohesive integration of diverse disciplines to examine the world history and the evolution of human-nature interactions.

1.6 Scope and Limitations of the Study

The scope of the study encompasses a wide historical range, from ancient scientific paradigms to contemporary scientific thought. It focuses on major scientific revolutions and their impacts on society and also explores the potential of contemporary paradigms, such as systemic thinking and ecological principles. While the primary focus is on Western history and science with their global influence, the study also considers the international context. It acknowledges the diverse ways different cultures and societies have engaged with scientific paradigms and human-nature relationships.

The disciplinary scope of the research is incorporating insights from history, political science, philosophy, sociology, and environmental science. This transdisciplinary approach is used for understanding the complex interactions between scientific paradigms and socio-cultural structures. The study emphasizes the interconnectedness of these disciplines, demonstrating how scientific thought and societal developments influence each other. The transdisciplinary nature of the study, while a strength, also presents challenges in synthesizing diverse perspectives into a cohesive analysis. The complexity of integrating insights from different disciplines may limit the depth of analysis in certain areas. Despite these limitations, the study aims to provide a comprehensive exploration of the impact of scientific paradigms on human-nature relationships.

Another potential limitation of the study is the availability and reliability of historical data that can pose challenges. To address this, the study employs a critical analysis of available sources, while acknowledging the potential biases and gaps in the historical record. Lastly, despite efforts to ensure objectivity and critical engagement with sources; the interpretive nature of this study, particularly in its philosophical and sociological analyses, introduces the possibility of subjective perspectives and biases. This is a common challenge in interdisciplinary research but essential for a nuanced understanding of human-nature relationships

Chapter 2

Reciprocity and Organic View of Nature

The relationship between humans and nature is one of necessity and vitality, rooted in humanity's essential dependence on nature for survival. This interaction, inherently reciprocal in nature, was a concept widely adopted by hunter-gatherer societies, shaping their social structures around this awareness. (Mauss, 2000) These communities sustained themselves with hunting and gathing plants, necessitating a sustainable lifestyle due to nature's finite resources. Their respect for nature mandated a harmonious coexistence, where hunting and gathering activities were balanced to preserve the ecosystem's sustainability. Humans thus fostered a mutually beneficial relationship with nature, consciously avoiding the overexploitation of natural resources. Likewise, within and across these communities, the principles of sharing natural resources, solidarity, and mutual assistance were fundamental to their lifestyles (Hess, 1845).

The reciprocal relationship in hunter-gatherer societies was not merely about sustenance and shelter; it was deeply intertwined with their beliefs and values, primarily shaped by animism and an organic view of nature. Considering the historical context where science and philosophy were not distinctly separated until nearly the 19th century, particularly before the scientific revolution, the philosophical and religious tendencies of these communities were central in interpreting and engaging with nature. The perspective of the era, referred to as 'organic knowledge,' regarded nature as a unified whole and advocated for a symbiotic coexistence between humans and the natural world. In this view, nature was perceived as a living entity, with humans as integral parts, meant to coexist in harmony with it. This philosophy encompassed maintaining ecological balance, sustainable utilization of natural resources, and living in accord with nature. Animism, considered the primary religious orientation in these societies, embodies the belief that every element in nature is imbued with a spirit or life force (Tylor, 1871). This worldview regards rivers, forests, mountains, stones, and even elements like the wind as sentient beings. The core tenets

of animism involve respecting these spirits, living in harmony with them, and honoring nature's forces (Karatani, 2014).

Today, the systemic paradigm which emphasizes reciprocity in human-nature relationship, can trace its socio-philosophical roots back to these hunter-gatherer communities. This section will delve into the historical development of reciprocal human-nature relationship throughout the world history.

2.1 Reciprocity as a Mode of Exchange

German Philosopher Hess interpreted the reciprocal relationship between humans and nature as a metabolism (Stoffwechsel), underscoring that the relationship between humans and nature inevitably reflects in their social interactions (Hess, 1845). In German, the word ‘wechsel’ means exchange. Kojin Karatani, on the other hand, interprets the principle of reciprocity as a mode of exchange based on mutual gift-giving between humans and nature. These exchange forms represent how relationships between humans, and between humans and nature, are mirrored in social context. In his work that reevaluates the structure of world history from the perspective of modes of exchange, Karatani identifies four fundamental modes of exchange that define social formations (Karatani, 2014). He defines the exchange form based on reciprocal gifting as Mode A, stating that its emergence coincided with the transition from nomadic hunter-gatherers to settled hunter-gatherer communities (Karatani, 2014, p. 68).

Historically, the principle of reciprocity can be observed in hunter-gatherer societies, influencing the structure of world history (Mauss, 2000). Societies dominated by the Mode A, which is based on reciprocity, typically have a political and legal structure in which a large portion of natural resources and lands are considered common property and used according to the needs of the community. In such decentralized conditions, solutions to property issues are grounded in the coexistence of individuals and the survival of the community. These solutions generally aim at reconciling parties and decisions are made with a future communal life in mind.

Mode A ensures a social structure that does not allow individuals to accumulate wealth or power independently. Social relationships conducted through reciprocity possess a structure that prevents unequal wealth distribution or imbalances of power. As Karatani points out; reciprocity does not accept the supremacy of one community (clan or tribe) over others, or a leader's higher status over others. It does not permit the establishment of a state. (Karatani, 2014, p. 79). In this way, reciprocity prevents the centralization of power and hinders communities from developing a hierarchical structure. The community being founded on mutual gift exchange prevents the formation of a structure that could establish the dominance of a central authority. Relationships established through exchange based on the principle of reciprocity occur without becoming an absolute central power or allowing the formation of an upper class. Therefore, Karatani evaluates mutual exchange not as a system existing within a single community but as an activity that creates a state of peace between one community and another (Karatani, 2014). This reciprocal relationship between humans and nature, grounded in respect and mutual benefit, represents an early form of what later scientific paradigms would classify as a holistic or systemic view. It stands in sharp contrast to the mechanistic worldview that emerged later, which promoted human dominance over nature.

2.2 Animism and the Cosmos

Anthropologist Edward Burnett Tylor posits that animism forms the basis of religious and spiritual beliefs in hunter-gatherer communities (Tylor, 1871). Thus, animism represents the values and beliefs of communities where reciprocity in human-nature relationships is embraced.

Animism is a worldview that attributes a spiritual essence or consciousness to all entities within the human-nature relationship. In communities where animism is prevalent, it is believed that everything in nature possesses a unique spirit or life force. This perspective does not differentiate between humans and other living entities in nature, highlighting the connections between all living and once-living spirits. Humans have aligned themselves with other living beings in nature, seeing them as ancestors

or integral parts of their own lives, thereby striving for a harmonious relationship with nature (Tylor, 1871).

When examining the reciprocal relationship between humans and nature created by attributing a soul and life force to all beings in nature from a phenomenological perspective, its significance becomes more pronounced (Karatani, 2014). Martin Buber differentiates the relationships that humans establish with nature and each other into two categories: 'I-Thou' and 'I-It'. In relationships based on 'I-It', all entities, living or non-living, referred to as 'It' are objectified and alienated. 'I' in this context becomes the subject interacting with an object ('It'). In contrast, the 'I-Thou' relationship structure does not designate 'I' as a subject nor 'Thou' as an object. It represents a reciprocal relationship established between two parties (Buber, 1970). Animism embodies this 'I-Thou' relationship, not distinguishing between humans and nature and promoting a reciprocal relationship structure.

Even today, animism is discussed among anthropologists and philosophers as a viewpoint fundamental to the basis of reciprocity in human-nature relationships. Anthropologist Irving Hallowell emphasized that while only some entities in the world are human, all entities should be considered together when examining social relationships. (Hallowell, 1960, p. 22). Graham Harvey, in his 2015 book on Animism, supports this view, summarizing his thoughts as; the world is full of persons, but only some of them are human, and life is always lived in relationship with others (Harvey, 2015).

Another significance of animism stems from its foundational role in pre-scientific organic philosophy, which sought to understand natural phenomena. Organic philosophy emphasizes a holistic and interconnected view of the universe, advocating that nature and the world are living entities, with everything from small organisms to celestial bodies interconnected and interdependent. Nature is not just an assembly of different elements but also a harmonious system, with humanity being an integral part of this larger organic whole. Thus, animism, representing the social beliefs and values of reciprocity in human-nature relationships, has also influenced the earliest philosophical thoughts about nature (Cornford, 2004).

In Ancient Greek philosophy, considered the beginning of Western philosophy and modern science, the influence of animism can be seen in certain philosophical concepts and discussions, such as Plato's World Soul concept, Aristotle's teleological view, Pythagorean transmigration of souls, and Anaximenes' principle of life (Gill & Pellegrin, 2009). Additionally, ancient Chinese philosophers developed a unique understanding of the ultimate reality underlying and uniting various phenomena of the universe, embodied in the concept of Tao (Dao). This idea is central to Taoist (Daoist) philosophy. Tao is often translated as "way" or "path," but these translations only partially reflect its full meaning. In Taoism, Tao represents the fundamental, underlying principle that is the source and driving force of everything in the universe. Tao is not a static entity but a dynamic, ever-changing process. It is the natural order of continuous flow and change, which all living and non-living phenomena are part of. For Taoist thinkers, understanding this flow and being in harmony with it is fundamental to living in harmony with the universe (Capra & Luisi, 2014).

In the 6th century BCE, during the early periods of Greek philosophy, philosophers viewed the world as a cosmos, a coherent and harmonious whole. It was believed that all parts of nature had a purpose and contributed to the orderly functioning of the universe. The explanation of natural phenomena as having purposes is defined as teleology (Gill & Pellegrin, 2009).

The perception of the cosmos as an organism implies that its characteristics are reflected in every part of it. The relationship between the macrocosm and microcosm was likened to that between the world and the human body. The source of life at the foundation of the cosmos is seen as the soul. The Greek word 'psyche' and the Latin 'anima', both meaning 'soul', derive from the root word for 'breath'. The soul being both the source of motion and life also implies that it is perceiving and knowing. An individual's soul was seen as part of the force that moves the universe, and an individual's knowledge as a part of the universal process of knowing. Plato refers to this as 'anima mundi', or 'soul of the world' (Capra & Mattei, 2015).

Chapter 3

Property and Rule

Today, traces of the principle of reciprocity, as adopted by the systemic paradigm in human-nature relationships, can be found in the early periods of world history in social and cultural structures. However, the principle of reciprocity lost its influence shortly after the transition to settled life, not resurfacing until the 21st century. Understanding this historical shift from reciprocal human-nature interactions to a dominance-based relationship is crucial for contextualizing the current resurgence of reciprocity principles in response to social and environmental degradation caused by the Mechanistic Paradigm. To analyse this transition, it is essential to investigate the economic, political, and cultural forces that led humans to adopt a dominating stance toward nature.

The dominance of humans over nature, which was embraced as the fundamental principle of our relationship with nature from the completion of the transition to settled life until the 21st century, is not a natural consequence of settled life, the agricultural revolution, or evolving production-consumption relationships. According to Polanyi, any society cannot exist without a system for the production and distribution of goods. Even in hunter-gatherer communities, where there is no explicit aim for profit, paid labor, or distinct economic institutions, relationships related to production, distribution, and exchange exist. In these communities, production and distribution occur within a network of social relationships, thus negating the need for separate economic institutions as the economic structure is embedded within and inseparable from the social structure (Polanyi, 2022).

Therefore, one of the fundamental differences between the principles of reciprocity and dominance in human-nature relationships lies in the societal position of the economic structure. With the dominance established over nature, the economic structure holds a position above the social, political, and legal structures, whereas, in

a reciprocity-based economy, it is part of the social structure. The establishment of dominance over nature has been realized not as a linear historical process but due to social factors that enhanced the position of the economic structure over other areas. This section will examine the political, legal, social factors that led to human dominance over nature.

3.1 Private Property

Privatization, and thus private property, is seen as one of the fundamental conditions of economic development. However, the transformation of nature into private property is also one of the main reasons why the reciprocal relationship between humans and nature evolved into one where humans dominate nature as a property, subsequently endangering their future due to the destruction of nature. Capra emphasizes that the primary reason for the onset of dominance over nature is the shift from nature and natural resources being common property to becoming private property (Capra & Mattei, 2015).

The emergence of private property has been extensively debated for centuries by philosophers, jurists, economists, and social reformers (Newcomb, 1886). Historically, in nomadic communities, no individual had the right to use a specific piece of land exclusively or deprive others of necessary resources. In such communities, nature was viewed as ‘common property’ without distinct boundaries. Consequently, nomadic communities, being in the best position to allocate nature for themselves, regarded it solely as common property. This approach allowed open access to resources for all community members, fostering a social order based on equality and harmony (Widerquist & McCall 2021).

Following the transition to settled life, agricultural communities developed certain farming and land strategies to resolve potential social inequalities and conflicts. One common strategy, fallowing, led to a system where community members had hereditary rights and common grazing rights to land, but rarely more than temporary rights over specific plots. Small-scale elites within communities played a significant

role in securing individual rights claims on common farmland and managing the fallowing rotation (Benneh, 1973).

In communities, small-scale elites played a significant role in securing individual rights claims on common farmland and managing the fallow rotation for agriculture. As time progressed, agricultural communities began to move to regions with high agricultural yield but required the development of new technologies like irrigation for effective farming. This increase in agricultural productivity led to surplus production, which became a primary factor in the emerging political complexities within these communities (Childe, 1950). Furthermore, the evolution of agricultural systems and growing populations necessitated large-scale political coordination for tasks such as constructing transportation networks to move crops to distant regions (Wittfogel, 1957). These conditions became examples of complex political systems and introduced new approaches to land ownership. The need to resolve disputes and problems caused by these complex political structures led to more pronounced roles for chiefs and leaders within the social structure (Fried, 1967).

The position of chiefs within societies was shaped entirely by prestige rather than wealth or power for a long period (Boehm, 2001). When someone was perceived to have excessive power, those uncomfortable with this would leave to establish their own villages, using the mechanism of splitting as a counterforce to the centralization of power. Thus, even if power and wealth created some level of social inequality, it did not lead to societal stratification (Widerquist & McCall 2021).

The first hierarchical societies emerged when a chief began to bring multiple communities under their control. With the increase in population and chiefdoms, the option for people dissatisfied with the chief's power to leave the region became difficult, especially due to the fear of attacks from warriors of other chiefs. In this situation, people generally chose to accept the existing power's rules rather than embarking on an uncertain journey (Widerquist & McCall 2021).

Some chiefdoms became so complex that they are considered the historical first states or empires (Widerquist & McCall 2021). Kojin Karatani interprets the

centralization of power, the initiation of governance and protection relationships among communities as the end of reciprocal exchange and the beginning of the state. The victorious chiefdom in inter-chiefdom conflicts provided protection in exchange for tribute, which is essentially protection against plunder and raids by others. This exchange between the two parties made the establishment of the state possible. Karatani interprets this process as a transition from reciprocal exchange (Mode A) to Mode B, exchange based on governance and protection (Karatani, 2014, p. 110).

Although the earliest states were still primarily agricultural, even the oldest states had complex economies consisting of specialist warriors, administrators, rulers, priests, professionals, and cities. Therefore, states eventually became highly hierarchical in political, economic, and social aspects (Trigger 2003).

Trigger (2003) argues that the widespread establishment of hierarchical relationships in everyday life has made social and political inequalities appear natural. The inequality brought about by hierarchy was seen as natural and inevitable, despite the violence and power used to sustain it. Early states built strong political, economic, and social structures to maintain inequality. Religion was used as a key tool to legitimize these structures. Legal systems established structures to control natural resources and produced goods, sustaining power relationships. Similarly, according to Karatani, the state's administration, protection, and redistribution were primarily facilitated through the legal system (Karatani, 2014).

The legal approach that facilitated the global spread of private property has its origins in Roman law (Capra & Mattei, 2015). Roman law initially encompassed the everyday life of people and the entirety of the rural sector. This system, carrying traditions of customary folk law, through its inclusivity, shifted the position of property based on private and individual rights, integrating collective responsibilities from the community to central political institutions. The Roman Republic and subsequent legal systems from 510 BCE onwards divided laws concerning people, property, and actions. However, as the legal system grappled with resolving new conflicts, it became increasingly complex. Emperor Justinian I (483-565) facilitated the reorganization of the complex legal system and the writing of laws that shaped the authority and

responsibilities of property owners, secured by state sovereignty. These laws became the foundation of today's property law, solidifying the transition to concentrated private property and, ultimately, to accumulable capital. The concept of private property became the principal tool in dissecting the whole into individual components, with the sovereign state form assuming the role of mediator between these parts (Capra & Mattei, 2015).

In the process of privatizing common resources, political and legal actors legitimized this action by labeling the resources as "owned by no one." Resources that were "owned by everyone," accessible to ordinary villagers, were suddenly classified as belonging to no one and became available to whoever claimed them. The application of central authority and power to natural resources led to their division and separation from common wealth. This tradition facilitated the privatization of commonly held resources, expanding the domain of human dominance over nature. Privatization was further supported by a legal system that encouraged the use of anything labeled as "owned by no one" by whoever could claim it. After Justinian's death, his texts disappeared and lost influence until they resurfaced in Italy in the early 11th century. European scholars adapted these texts to new conditions, translating them into Latin and integrating them into the legal systems of various European regions (Capra, 2015).

The development of a detailed legal system supporting private property intensified economic inequalities, which escalated alongside the expansion of private ownership and hierarchical structures. Over time, these economic inequalities also led to social inequalities. Agricultural labourers, comprising a large portion of the population yet seen as the lower class, were not subjected to equal protection under the law. A small ruling group institutionalized and appropriated much of the wealth produced by the lower classes. Farmers and artisans, despite creating almost all the existing wealth, did not accumulate wealth. On the other hand, the elite class, economically and socially distinct from the lower class, continued to amass wealth. Common properties were transformed into private properties owned by the ruling and elite classes, sometimes through actions by the rulers or due to the inability of the indebted public to maintain their rights (Trigger 2003).

Widerquist and McCall (2021) emphasize that demonstrating the historical process in this manner does not imply that it could only have existed in this way and argue that the establishment of economic inequalities was not inevitable but rather the result of deliberate actions and aggressive sanctions by powerful groups. They critique the idea that private property and economic inequality are natural or inevitable, contrasting this view with anthropological evidence showing that many pre-propertarian societies had more collective forms of ownership. This deliberate construction of inequalities by powerful groups laid the groundwork for hierarchical system of feudalism, where social and economic disparities were maintained and institutionalized through political and legal structures.

In states and empires arising from economic and social inequalities supported by political and legal structures and institutions, the most fundamental relationship among people is that of a vassal's dependence on their lord (Duhn, 1996). According to Karatani, the feudal period marks a transition from an exchange system based on reciprocity and gift-giving, with nature seen as common property; to Mode B, an exchange form involving governance and protection. A vassal pledged obedience and service to their lord in exchange for protection. In the feudal structure, loyalties flowed upward, and protection downward, forming a pyramid-like (hierarchical) order. At the top of the pyramid stood the king (or emperor). Below him, the king's vassals distributed large lands they received from the king to feudal lords. While being a vassal to the king, they were also obliged to protect their own vassals. At the broad base of this pyramid of land transfers were the serfs working the lands (Bloch & Coziol, 1965).

Medieval empires, continually waging wars and conquests for more land and goods, represent a period when wealth and power constantly changed hands. Meanwhile, during this period of frequent disintegration and reformation of political and legal institutions, the accumulation of land and wealth by religious institutions continued uninterruptedly. Initially egalitarian in structure, the Church became an institution of inequality and a significant actor in state governance in Europe (Holmes, 2001). The Church, leveraging its existing spiritual power and being the only widely organized institution, established itself as a state-like entity based on economic foundations, with a hierarchical organization and extensive properties. However, the

Church's excessive enrichment and transformation into an institution of inequality led to increasing resistance and revolts. In its attempts to preserve its power through inhumane methods like the Inquisition, the Church significantly lost respect. One of the Church's major endeavours to regain its prestige and expand its influence within the Christian community was organizing the Crusades. The call by the Pope that all sins of those who joined the Crusades would be forgiven resonated with people who were discontented with the feudal order and social inequalities, including knights, princes, landless or lesser-landed princes, and destitute peasants who could not find refuge under a feudal lord (Lynch, 2014). The Crusades, combined with the already increasing population and agricultural production, initiated commercial relations starting with products like spices and developed international trade between East and West. They also began overseas trade, significantly enriching cities like Naples, Genoa, and Venice in Italy. The emerging trade networks contributed to the development of urban economies and cultures (Holmes, 2001). While the Crusades were expected to provide participants with opportunities for economic and social advancement, instead led to unintended consequences.

The evolution of private property and legal frameworks surrounding land ownership aligns with the mechanistic paradigm's approach to nature—as something to be owned and controlled. The privatization of land laid the groundwork for capitalist modes of production and this shift in property ownership directly influenced economic structures, increasing production and trade, and reinforcing the mechanistic view of nature as a resource to be exploited.

3.2 Production and Trade

According to Karatani, the transition from an exchange based on governance and protection to a historical period dominated by commodity exchange occurred alongside the development of production and trade, fueled by the accumulation of commodities. However, he argues that commodity exchange and trade have been ongoing since hunter-gatherer communities. No community can be entirely self-sufficient, necessitating the acquisition of some resources from outside. Thus, commodity exchange, especially after the transition to settled life, becomes an inevitable process. For commodity exchange to occur between different communities, it is first necessary to end hostile relations and establish stable, friendly ties. Before the emergence of hierarchy and inequality, reciprocal gift-giving was an effective way to overcome this process. In the feudal era, interstate relations (trade and war) arose. Central state governance secured property rights in exchange for taxes, enabling commodity exchanges and asset transfers. Karatani highlights the importance of the state in the dominance of commodity exchange, stressing that for the exchange to occur, the owners of commodities must act based on a legal and also economic contract between both parties (Karatani, 2014).

In states and empires of the Middle Ages, where power shifted through conflicts among emperors, popes, kings, and bishops; the escalation of class conflict between lords and vassals over the control of agricultural surplus led to an increase in productivity and commodity production (Moore, 2003). Karl Marx suggested that Western European Feudalism, despite chronic instability and insecurity, was a system with a very strong bias in favour of maintaining methods and relations of production (Marx, 1996). By this period, the approach of human dominance over nature through private property, coupled with economic production, began to assume a position transcending other societal areas. Additionally, the fact that production now signified more than just meeting human needs led to a distinct separation and relationship between production and trade, forming a dialectical structure (Tomich, 1997).

Marx posited that the continuous collection of unpaid surplus labor due to the unequal distribution of production surplus lay at the foundation of the relationship

between the governed and the governors. This relationship structure naturally adapts to the constant increase in labor methods and productive forces. This situation causes the economic field to lead to a variety of levels and differentiations in social life, even if the fundamental conditions remain the same (Marx, 1996).

Moreover, the coercive relationship structure, based on the ruling class directly extracting excess internal labor from producers, progresses to some extent dependent on the development of productive forces. The relative simplicity of production methods (Marx termed this the ‘petty mode of production’) allowed the producer's own labor power to become an individual unit of production. Sweezy & Dobb (1950) state that this relationship led to commodity exchange becoming a more determining common factor in the interaction with other economic forms like production and market.

Hilton argues that within the feudal societal structure, the economic struggle between lords and vassals to benefit from agricultural surplus production led to an increase in produced commodities and, from the 10th century onwards, to the development of trade centers and markets characteristic of the medieval era. Additionally, the development of international trade alongside these evolving European cities witnessed significant economic growth, especially with the onset of overseas trade (Hilton, 1976).

Following the Crusades, trade in commodities between the East and the West intensified, and in some European cities, traders joined the ranks of the wealthy class alongside aristocrats, fueled by international trade and wealth derived from land. With the advancement of manufacturing, the foundations of industry began to form. The emerging wealthy class, living in towns and cities, was termed 'bourgeois,' meaning town-dweller or city-dweller. The limitless nature of trade, despite natural resources being finite, facilitated the growth and strengthening of the bourgeois class (Senel, 1982).

In this historical period involving governance, protection, and commodity exchange, the economically empowered bourgeoisie in European cities, particularly in

Italy, began to challenge the dominance of the feudal rulers (Senel, 1982). Considering that the period's structure has been shaped by distinct economic dominance over other social areas and the rise of human dominion over nature, it is considerable the bourgeoisie's rebellion against the ruling class would have political and legal consequences that would transform the governance structure. When considering that the end of the reciprocal exchange process between humans and nature led to the emergence of economic and social hierarchy due to wealth generated from production surplus, and that the conflict over control and protection of natural resources resulted in the development of trade and manufacturing; it becomes evident that the continuous enrichment of a class through constant production and trade of commodities and their rising wealth would naturally lead to a significant hierarchical position.

With the development of trade, merchants provided raw materials to peasants in a system known as ‘putting out,’ where work was given for production at home, thereby increasing production and initiating ‘standard’ production with numerous apprentices and laborers. Subsequently, merchants opened large workshops and factories for more profitable and efficient management, employing peasants and artisans for wages, thus laying the foundation for the transformation of trade capital into industrial capital (Hall, 1997).

Production in these workshops led to the division of labor in the industry and, consequently, the 'proletarianization' of artisans. In factories employing many people, it was realized that workers performing only a part of the work produced more, leading to the allocation of smaller tasks to workers within the factory. This method reduced production costs. Artisans who couldn't adapt to this new situation, who produced in their own shops with their own tools, failed to compete with the cheaper products of factories, went bankrupt, lost their means of production, and started working for wages in factories. (Senel, 1982). Additionally, the invitation of peasants working under the 'putting out' system to factories initiated economic integration within society (Sweezy & Dobb, 1950).

According to Senel (1982), economic integration is a production order that creates economic "cooperation" and "division of labor" among people living in a

certain geography. This order ensures that members of the society are part of a network of relationships that are economically complementary and dependent on each other, either voluntarily or coercively. Such economic interactions eventually trigger "political integration" to maintain the continuity and reliability of economic relationships. Political integration aims to preserve the continuity of the economic system and to prevent or suppress opposition to this system. The more one-sided and exploitative the economic integration, the more severe the force and oppression applied to sustain such an economic structure. Here, as Karatani suggests, occurs the need for reliable political and legal structures for economic relationships to take place in a reciprocal continuity. However, historically, the opposite has occurred; in medieval Europe, where warfare in pursuit of governance and protection was almost constant, developments in manufacturing and industry reflected in war technologies, leading to a period of destructive wars (Roberts & Aytuna, 2010). During this period, economic, political, and cultural interactions led to significant changes in the political and legal systems in Europe.

The transformation in Europe was not solely due to economic development and integration but was a process resulting from this condition. The development of international trade relations, along with the economy, greatly increased cultural interactions. This lead to significant advancements in art and science, especially through the emerging bourgeois class, as they sought relief from the intense pressure of the Church. Scientists, artists, and thinkers produced many works during this period, known historically as the Renaissance. Starting in the 13th century, a philosophical and ethical approach emphasizing the value and agency of the individual and collective human being, commonly preferring critical thought and evidence (scientific, philosophical, or ethical) over dogma or superstition, known as humanism and associated with the 'studia humanitatis' of the era, spread through European universities, bringing deep respect for Roman history, poetry, and moral and political philosophy (Davies, 2014). At the same time, the bourgeoisie, dissatisfied with general rulers, developed thoughts on political sovereignty and independence. For the bourgeoisie, this approach, signifying 'Freedom,' was also associated with a single sovereign, well-organized political and legal structure needed for economic integration; among the philosophers who made significant contributions to the

changing political and legal order was Machiavelli. Advocating for a state where politics and religion are separate, with clear hierarchical relations based on power among the ruler, nobles, and people, Machiavelli was a proponent of absolute and indivisible sovereignty, laws, and the military (Russell, 2004).

In Early-Modern Europe, political and legal changes were under the influence of two fundamental approaches: private property rights and and power-based sovereignty of Roman states, and the Greek valorization of the natural ordering of the state made possible by the regulation of wealth. Historically, by the late 11th century; advancements in military and agricultural technology and expansion of trade increased pressures on the feudal system (Roberts, 2010). As monarchies intensified their interventions in taxation, administration, and social control, laws formalized by the reinvigorated Roman law during the Renaissance increased the legitimacy of royal authority over citizens, beyond the personal bonds of the feudal era. As a result, monarchies began to transition from primarily protecting the private interests of feudal lords to fulfilling a broader public administrative role. The emergence of absolute monarchies was driven by the influence of the burgeoning bourgeoisie, exerting their hierarchical stance through economic, political, and cultural approaches developed alongside growing trade and manufacturing (Spruyt, 2002).

Examining the political and legal foundations of the process of human domination over nature; the wealth and private property arising from surplus production with the transition to settled life enabled the economic field to gain an independent force within society. This autonomy of the economic sphere, fueled by the growth of trade and manufacturing, contributed to the rise of a class that gained hierarchical superiority. Despite the many factors influencing the change in Europe's political and legal structures; most observable is the influence of the bourgeoisie, manipulating political and legal fields through the dominance of the economic field. Furthermore, the need for political and legal structures to ensure the continuity and reliability of economic relationships, This transformation in economic and political power parallels the broader societal shift towards a mechanistic view of nature, where human dominance over both nature and society became central. Just as the bourgeoisie restructured the political landscape to suit their needs, society's relationship with

nature shifted to one of control and exploitation, as reflected in the scientific paradigms of the time.

Chapter 4

The Mechanistic Paradigm

According to Thomas Kuhn, when interpreting history, the strength of transformation in the image of science in history is only observable if looked beyond a mere temporal sequence and narrative arrangement. Kuhn advocates analyzing science and the history of science not just within its own field but in conjunction with world history and the events that divide historical periods, offering an interdisciplinary perspective on history. He asserts that the key determinant in the history of science is the understanding of history itself. That is, scientific revolutions do not progress through the accumulation of individual discoveries and inventions but are significantly influenced by socio-economic factors within the paradigm (Kuhn, 1982).

This approach suggests that multiple theoretical structures can be built on a static accumulation of data. When a new paradigm candidate is first proposed, it typically solves only a few of the encountered problems, and most of these solutions are far from perfect. Kuhn likens proponents of different paradigms to members of distinct language-culture communities, each justified within its own context. This relativistic view implies that both communities, in a sense, are equally valid. When applied to cultural development, this perspective acknowledges that higher-level principles, often semi-metaphysical in nature, are the enduring characteristics of science as shown by historical studies. In the absence of universal rational criteria applicable to all theories, the behaviors and values of scientific communities become the decisive factors in theory selection, making it an inherently subjective process. Kuhn argues that scientific knowledge is therefore relative (Kuhn, 1982).

Understanding Kuhn’s perspective on scientific revolutions as socially and culturally embedded phenomena helps contextualize the historical shifts that laid the groundwork for modern scientific thought. The Renaissance and the Reformation are prime examples of how changes in socio-cultural values and intellectual movements influence the development of scientific paradigms. During the period of trade and industrial production, the capitalist bourgeois economy began to shape among Europe

as the Renaissance flourished. The Renaissance, led primarily by the European bourgeois class, sparked a revival of art, science, and secular thought, challenging the dominant influence of the Catholic Church. Renaissance was followed by the Reformation, a religious upheaval that further weakened the Church's authority. The Reformation, particularly through the spread of Protestantism, promoted values such as individualism and hard work. These intellectual and cultural movements laid the ideological groundwork for a shift in how society viewed both itself and the natural world. This evolving mindset paved the way for the Scientific Revolution and the emergence of the Mechanistic Paradigm, where the pursuit of knowledge and control over nature became central.

The scientific understanding brought by the Mechanistic Paradigm laid the groundwork for industrial society's aim for unlimited capital and economic growth by exploitation of natural resources. As mentioned earlier, scientific paradigms, rather than linearly progressing through scientific discoveries and inventions, become dominant as a result of choices made between multiple scientific methods and realities, influenced by the socio-economic structure and cultural factors of the period. Therefore, considering the relative nature of scientific knowledge, the Mechanistic Paradigm can be considered as the scientific manifestation of the domination of nature. Just as human domination over nature is not a linearly evolving concept historically, the Mechanistic Paradigm is not a linearly developing approach scientifically.

The relationship of human dominance over nature has a long historical political and legal past, just as the mechanistic paradigm emerged through the integration and analysis of certain scientific approaches and discoveries in the historical process. Therefore, to understand the scientific approach of the mechanistic paradigm, it is necessary to examine the scientific developments that evolved this approach throughout the history.

4.1 Physics and Philosophy of Aristotle

In the 6th century BCE, during the early stages of Greek philosophy, the first philosophers who attempted to understand nature and the universe defined reality as a whole and perceived the universe as a Cosmos functioning in harmony and order (Martin Merino, 2020). This view, Teleology, is based on the belief that all phenomena in nature (physis) exist for a purpose or goal, essentially based on causality (Junior & Vasconcelos, 2012).

The first philosophers to move away from the teleological approach were Anaxagoras and Empedocles during the Pre-Socratic period. Anaxagoras emphasized the diverse composition of the world and proposed that all objects are made up of mixtures of elements like air and water. Around 490-430 BCE, Empedocles introduced the idea that the material world is composed of four elements: earth, water, fire, and air, represented as concentric spheres interwoven around a common center. The world is depicted with the earth at the center, followed by spheres of water, air, and fire (or light) (Warren, 2014).

Pre-Socratic philosophers Leucippus and his student Democritus (460-370 BCE) proposed the idea that material objects consist of constantly moving, indestructible 'atoms' with spaces between them. This way of thinking is known as Atomism (Berryman, 2005). Pre-Socratic philosophers, particularly atomism, laid the groundwork for central concepts of Western civilization and paved the way for scientific methodology (Capra & Mattei, 2015). However, Aristotle, who established the fundamental method of experimentation and significant contributions to empiricism in modern scientific methods, preferred to view nature as a holistic cosmos and thus stood opposed to atomism (Lloyd, 1986).

Aristotle, who lived in the 4th century BCE, is considered the most significant Greek philosopher in the history of science for subsequent centuries. His syntheses and organization of the scientific knowledge of antiquity into a coherent system served as the foundation of Western science for 2000 years and contributed significantly to

the development of philosophical and scientific thought during the Middle Ages and the Renaissance. Aristotle's scientific method, which posited observation as the most suitable method for gathering knowledge and research, played an important role in the Scientific Revolution when the mechanistic paradigm became dominant. His view of the world as a cosmos and his organic approach to nature; also his holistic understanding, often summarized by the phrase 'the whole is greater than the sum of its parts,' provides a foundational perspective that is significant for the systemic paradigm, which is based on reciprocity in human-nature relationship (Capra & Luisi, 2014). Aristotle created a closed and unified system to describe and explain the entire universe, melding his scientific approach and philosophy. While his universe's holistic and divine structure contrasts with its scientific aspect of being composed of a series of interlocking spheres; his empirical approach to nature in his biological studies, where he classified and studied about 540 animal species, has become a part of modern scientific methods. Beyond his empirical approach, he believed that an organism's habits of life, anatomical structure, and level of development depend on the nature of its soul (Yildirim, 2014).

Aristotle also worked extensively on politics and ethics, believed that humans needed external material goods such as wealth and property to achieve happiness. Therefore, he supported the concept of private property, incorporating it into his legal theories and laying the foundation for key distinctions in modern law. He regarded private property as an institution that fosters virtue through reason (Capra & Luisi, 2014). Although Aristotle’s empirical methods laid the groundwork for one of the fundamental approaches of modern scientific inquiry, he maintained a systemic perspective in his philosophical thought. He rejected atomism—a view held by many contemporary philosophers—because it conflicted with his understanding of the universe as a cosmos governed by purpose and causality.

Additionally, Aristotle believed that all beings possess a soul, a concept linked to animism, which contrasts with the mechanistic view that reduces nature to purely physical processes. This illustrates that the determination of anomalies in the current scientific paradigm and the selection among competing scientific theories are not solely based on empirical evidence but are also influenced by the socio-cultural beliefs

of scientists and society (Kuhn, 1962). According to Kuhn, an individual's general mindset significantly affects the development and acceptance of scientific knowledge.

After Aristotle, during a period when the Church gained authority in economic and social life, religious influence became increasingly prominent in the understanding of nature and in philosophy in general. Plato's Academy continued for 900 years until forcibly closed by Christian Roman Emperor Justinian in 529 AD. Teleology, especially in the context of Christian theology, held a significant place in medieval European thought. This concept, deeply connected with the belief that everything has an inner purpose or ultimate goal, was primarily influenced by ancient philosophers, especially the works of Aristotle (Capra & Luisi, 2014). In medieval Europe, teleology was often interpreted through Christian doctrine, viewing the natural world and processes as having purposes defined by God. This belief was fundamental for medieval scholars, especially those involved in the Scholastic movement, who believed that every aspect of creation carried a purpose in alignment with divine will. Aristotle's idea of the "final cause" was particularly influential in this context. Aristotle stated that everything in nature has four causes: material, form, efficient, and final, with the final cause being the reason for existence or ultimate purpose of a thing (Henry, 2011).

Medieval philosophers like Thomas Aquinas integrated this Aristotelian framework with Christian theology. Aquinas argued that the ultimate purpose of all creation is to glorify God and that understanding the purposes of things is key to comprehending God's plan. During this period, natural science (which would later evolve into modern science) was seen not just as a quest for knowledge but also as a method to understand God's plan and purpose for the universe. This teleological view reinforced the belief that the natural world is orderly and rational, reflecting the intelligence of the Creator. However, this approach, quite different from Aristotle's empirical approach, tended to fit observations into pre-established theological frameworks rather than empirical explanations (Yildirim, 2014).

Thomas asserted that there was no conflict between Aristotelian logic and religious teaching, as both the holy scripture and the book of nature were authored by

God. The establishment of this link between science and theology made it quite difficult for any research or discovery that might conflict with religion to occur in the scientific field. As Kuhn mentioned, this period saw the conservatism of the normal era in science. For a new acceptance to emerge in science, it had to prove almost entirely that a completely different world existed within the prevailing normal science.

4.2 The Shift of Paradigms

Fritjof Capra (2014), considering the structure of paradigms as described by Kuhn (1962) – not just as linear scientific discoveries and inventions in history but also stemming from the mental structure of the scientist, socio-cultural processes, and societal needs – posits that paradigm shifts involve models and practices that include a society's concepts, values, and perceptions. Therefore, to understand the structure of paradigms that form a particular scientific approach, it is necessary to acknowledge that they encompass all beliefs, rules, values, and conceptual/experimental tools used to examine nature, the relationship between nature and humans, and to find a network of relationships. Thus, in this study, the concept of paradigm is considered not only from a scientific perspective but also as a structure shaping our social, scientific, political, legal, and economic lives.

In examining the political and economic structure of the era dominated by Catholic Teleology in understanding and interpreting nature, it is recognized that Church's hierarchical position in the scientific field could exert pressure due to the dominance and governance system built on economic and social inequalities. Furthermore, Kuhn (1962) has stated that the dominant paradigm will not back away from suppressing innovations that could threaten its main tenets. The Church's approach to scientific thoughts that contradicted its theologically based, causality-centered view of nature aligns with this perspective. Scientifically, the transition from animals to atoms in Ancient Greek thought, although a necessary scientific discovery to demonstrate the existence of a completely different world, was sufficiently suppressed by the strong relationship between the prevailing teleological paradigm and dominant Church.

During the Renaissance, Reformation, and consequent Scientific Revolution, when rational and scientific thought regained prominence; the authority of feudal lords, aristocrats, and the Church was diminished. The emergence of the bourgeoisie class, driven by the development of trade and manufacturing, necessitated a shift to a new paradigm. This shift, considering the need for paradigms to respond to socio-cultural and societal needs, makes the collapse of the teleological paradigm predictable (Kuhn, 1962).

According to Kuhn, the completion of a transition to a new paradigm brings an entirely new perspective to the respective scientific field. What scientists fundamentally do during an anomaly or crisis is to change their attitudes and research structures against existing paradigms. The desire to solve problems, the external expression of dissatisfaction, and the reevaluation of fundamental principles are signs of the shift from normal to extraordinary research. The transition to a new paradigm is not a cumulative process. Its realization necessitates demonstrating the existence of almost entirely a different world within the current paradigm (Kuhn, 1962).

Historically examining this transition, as defined by Kuhn as the Scientific Revolution, the Humanism reinterpreted and made effective again during the Renaissance laid a significant foundation for the intellectual infrastructure that led to the Scientific Revolution. During the Renaissance, humanism shifted its focus from religion to human beings, advocating that humans could understand and dominate nature through empirical observations and rationality. This anthropocentric thought emphasized a method based on reason and experimentation, standing in contrast to the traditional medieval approach based on God and causality. The shift from teleology to humanism, as Kuhn suggests, was realized with the near-complete invalidation of the teleological paradigm's acceptances and methods.

With the dominance of humanist thought over teleological thinking, nature began to be seen not as a final creation by God with each existence having a reason and purpose; but as a challenge presented by God to humanity, which humans had to improve using their will and virtue (Varvis, 1983). The humanist approach to humans and nature, considering the socio-cultural and economic conditions of the bourgeoisie

class, laid the foundation for the unlimited use and exploitation of natural resources necessary for commodity exchange facilitated by manufacturing and industrial production.

Considering paradigm shifts as a result of interactions in all areas where humans exist including social, scientific, political, legal, and economic; the transition to a centralized and organized state structure as required by the bourgeoisie for the uninterrupted and continuous exchange of commodities, can be seen within the scope of paradigm change.

Consequently, Kuhn, considering the relative structure of scientific knowledge and its progression through the dismantling and rebuilding of the existing order rather than through accumulation in a historical context, likens scientific paradigm shifts to political paradigm shifts (Kuhn, 1982). The start of political paradigm shifts is marked by the apparent failure of existing institutions to solve the problems arising from their decisions and actions. The precursors of both revolutionary processes are signs that the existing order has lost its functionality and is leading to a crisis. At this point, the dominant feudal order in Medieval Europe's failure to satisfy the bourgeoisie politically, legally, and economically and its opposition to the approach that gained hierarchical superiority through economic relationships can be cited as factors triggering both scientific and political paradigm fields shifts.

In conclusion, the history of science and scientific revolutions, like political history and political revolutions, occur under the influence of current socio-economic conditions, directly related to the behaviors and values of the communities that bring forth the problems of the normal period, and progress through the destruction and establishment of new orders, rather than through accumulation. Therefore, when interpreting history, the dialectical relationship between the social and scientific conditions of the period should be considered. Interpreting paradigm shifts occurring in both politics and science during the same period will provide a different perspective in understanding the paradigm of each field.

4.3 The Scientific Revolution

Michelet (1855) interprets the period starting with the Renaissance and extending to the Scientific Revolution as a time when people turned their eyes from contemplating their afterlives to observing the real world. Although the emergence of modern science is often associated with this era, its roots trace back to Atomism and Aristotle's empirical methods.

Following the proposal of Atomism, philosophers began developing thoughts on how elements obtained their forms in nature. Pythagoras and his school believed that numerical ratios and relationships were the basis of all forms. This connection between the concrete world of natural forms and the abstract world of numerical relationships, although not immediately transformative, became the foundation of classical physics in the 17th century (Capra & Luisi, 2014).

Despite advancements in medicine, mathematics, and astronomy after this period, the influence of teleology persisted. The Protestant Reformation following the Renaissance, diverging from the Catholic Church, led to numerous scientific discoveries. The scientific breakthrough that shattered the Church's geocentric model and positioned the Earth as a planet orbiting the Sun was introduced by Nicolaus Copernicus (1473-1543), a canon at the Cathedral of Frombork in the Kingdom of Poland. Copernicus tried to convince that the Earth was not stationary at the center of the universe, as Aristotle suggested, but revolved around the Sun along with other known planets, completing a rotation on its axis every 24 hours. His scientific discovery emphasizes the importance of reason and the scientific method, challenging seemingly invincible personal experiences of the world with observations and evidence (Henry, 2011).

The mechanistic paradigm was influenced not only by scientific discoveries and inventions but also by a changing philosophical approach to humans and nature. Francis Bacon (1561-1626), a philosopher and statesman, holds a significant place in the history of modern science, not for making a scientific discovery or conducting

scientifics studies, but for his efforts to reform how natural philosophy was conducted. Bacon rejected the Copernican theory and opposed the idea that mathematics could be useful in understanding the physical world's rules. (Russell, 2004). He identified a primary mistake in understanding nature as jumping to conclusions without considering all possibilities. Bacon, emphasizing that natural phenomena could be explained with careful observations and solely inductive reasoning, is acknowledged as one of the founders of the inductive method. Advocating that knowledge equates to power, Bacon emphasized the necessity of human domination over nature through scientific discovery and invention (Henry, 2011).

As one of the most important proponents of human domination over nature, Francis Bacon is particularly relevant to this study. His advocacy of this approach, combined with his influential role as a statesman and political thinker, sets him apart from other scientists. For Bacon, humans are superior to nature yet alienated from it. Nature is harsh and unforgiving, requiring conquest. He views humans as both rulers and interpreters of nature, able to observe the natural order materially or mentally, but only within the limits allowed by nature. The true understanding of nature, and thereby its conquest, is possible through science. Bacon downplays human observations and the studies of nature as situations that do not require deep investigation, emphasizing the importance of inventions facilitated through mechanical arts for the service of humanity (Capra & Luisi, 2014).

Bacon's conceptualization of knowledge as power is not merely a scientific and philosophical assumption but also relevant in social and governmental practices. In his work "Nova Atlantis," he describes a state founded entirely on science. In this state, an organization called the "House of Sciences" regulates all scientific studies and research, fostering and preserving high culture. Bacon's ideal state is fundamentally based on knowledge; the society should be equipped with knowledge and governed through scientific data. Thus, for Bacon, to understand the world, escape poverty, and establish a kingdom of knowledge and wealth; humanity must conquer nature. He describes the establishment of an empire of industry, science, and prosperity, where humans achieve the highest level of control within their domain, as the "Reign of Man." Influenced by Machiavelli's thoughts, Bacon argued that governance should

also prioritize the advancement of knowledge and the utilization of resources to strengthen the state's economic and military power (Martin, 1992).

However, in the historical context of his time, Bacon's scientific method was seen as theoretically and mathematically incomplete, as he was not a scientist in the modern sense. René Descartes, a mathematician and a foundational figure in modern philosophy, developed the theoretical and mathematical essences of the mechanistic paradigm, thereby advancing scientific studies. Unlike Bacon's purely inductive approach, Descartes advocated for first establishing fundamental principles through deductive reasoning. Emphasizing rational thought and the mathematical modeling of natural sciences, Descartes' method is fundamentally analytical and aimed at discovering scientific truths. He proposed breaking down complex questions and ideas into simpler parts, then logically organizing these parts. Known as the Cartesian method, this approach has been influential in the development of scientific methodology in subsequent centuries, although it has also been criticized for its fragmented view of knowledge (Rodis-Lewis, 1978).

Descartes posited that thinking is the foundation of existence, viewing nature as essentially two distinct substances: the mental substance (res cogitans) and the material substance (res extensa). Opposing Aristotle's system of examining organisms in terms of their spiritual structure, Descartes argued that the material universe is a machine operating according to mechanical laws. In nature, everything in the material world, both living and non-living, can be explained in terms of shape, movement, and size. Descartes also viewed the human and animal body as a machine, asserting that animals are automatons without emotional consciousness, governed by physical laws. He developed three fundamental principles regarding the transfer and conservation of motion states in material objects, which he termed as laws of nature. His first and second laws state that an object at rest will stay at rest, and an object in motion will continue in a straight line unless acted upon by an external force. Isaac Newton later reformulated these rules into his laws of motion. Descartes' third law, concerning colliding objects, was incorrect due to the lack of contemporary understanding of momentum (Henry, 2012).

Following Copernicus, another significant figure in astronomy with important scientific contributions was Johannes Kepler, who discovered the three laws of planetary motion. Kepler posited that planets move in ellipses rather than perfect circles, that a line connecting a planet to the Sun sweeps out equal areas in equal times, and that the square of the period of a planet's orbit is proportional to the cube of its distance from the Sun. Kepler's scientific approach influenced by his natural philosophy; asked how scientific phenomena occurred and why it has happened, contemplating why there are only six planets and why they are positioned at specific distances from the Sun (Henry, 2012).

Astronomer and physicist Galileo Galilei made significant advancements in scientific discovery and invention after Copernicus. He studied speed, acceleration, gravity, free fall, and the principle of relativity, and also worked in applied science and technology. He invented various military compasses and improved the telescope for scientific observations of celestial bodies. Galileo, who advocated that humans should study material objects in terms of their quantifiable and measurable properties, combined Bacon and Descartes' inductive and deductive methods, developing what is now known as the hypothetical-deductive method in modern science (Yildirim, 2014).

Isaac Newton (1642-1727) is widely regarded as a pivotal figure in the Scientific Revolution, synthesizing the work of Copernicus, Kepler, Bacon, Galileo, and Descartes into a comprehensive mathematical formulation of the mechanical view of nature. Newton's theory explained the movements of planets, stars, and satellites, as well as phenomena like gravity and tides, in minute detail. His discoveries in astronomy enabled physicists to successfully explain the behavior of solids, liquids, gases, heat, and sound based on fundamental particle motion laws. The development of atomic theory, becoming more prominent in the 20th century, laid the groundwork for the conceptual unity of chemistry and physics. Newton's laws gained importance beyond the scientific community and were considered the epitome of scientific genius well into the 20th century (Martin, 1992).

Newton also successfully brought together all prior mechanistic philosophy in a comprehensive mathematical synthesis. By presenting a coherent mathematical

theory of the world, he laid the foundation for scientific thought until the 20th century. His laws of gravitation, refraction, and motion significantly elevated the mechanistic view (Capra, 2015).

4.4 The Shift of Society

As discussed in the previous section, the Scientific Revolution unfolded under the influence of the economic, political, and social conditions of the era. The period's socio-economic trends and needs not only influenced the discoveries and inventions of the revolution—such as technological innovations that supported economic growth—but also shaped the philosophical approaches, like the mechanistic worldview, that aligned with the era's expanding capitalist economy. These emerging inventions and philosophical views, in turn, significantly shaped the post-revolution world. The dialectical relationship between science and society during this period is evident, as scientific advancements not only spurred social and economic transformations but were also influenced by the political and economic needs of the time. Therefore, examining the structure of world history during the Scientific Revolution is crucial for understanding the paradigm shift, as this period introduced new scientific and philosophical worldviews that would shape society's relationship with nature in the centuries that followed.

The rise of independent cities specializing in production and trade in medieval Europe led to the dominance of the bourgeoisie; demanding a unified, organized political and legal structure under a single sovereign authority. Consequently, between 1550 and 1800, the world witnessed the rise of "Absolute Monarchy." The governing principle adopted by absolute monarchies was "absolutism," which could only be achieved by combining three fundamental principles. The first was the establishment of a strong central government that could not be obstructed in policy-making. The second involved maintaining a powerful military to handle war during territorial expansions or invasions. The third principle was the implementation of mercantilism (a policy of more exports than imports) to support the country's economy and wealth (Roberts, 2010).

The structure of absolute monarchies aligned with the bourgeoisie's need for political integration to achieve economic unification. Just as scientific advancements emphasized control over nature, the rise of absolute monarchies reflected a similar desire for centralized control over political and economic systems, ensuring that the state could manage resources efficiently in the growing global economy. From a social and cultural perspective, the influence of philosophical thoughts following Machiavelli also played a role in the transition to a sovereign state. Also Jean Bodin, believed to have conceptualized sovereignty, contributed to the understanding of the modern state through his works. In "The Six Books of the Commonwealth," he attempted to outline the general principles of law (institutionalized power) to address religious and political conflicts in power. Bodin characterized sovereignty as "absolute," "indivisible," "inalienable," and "perpetual," placing "God" at the top of the hierarchy that he believed constituted the state (Senel, 1982).

Thomas Hobbes, famously known for his assertion "Man is a wolf to man," explored the creation of a peaceful society, claiming that notions of good and evil are determined by the state. In his conception of the state, he proposed that fear of death and the desire for peace drive people to form governments, and that religion should be subject to the state. He argued that religious sermons and scriptures should be interpreted by the sovereign authority. Hobbes maintained that laws are made by the king, not by God, and that even the king's actions are not constrained by divine commands. Advocating for strong sovereignty, Hobbes warned that conflicts between the parliament and the king could lead to civil wars. Thus, he believed that all sovereign rights should be concentrated in the monarch (Goodin, 2009). Hobbes' assertion that order and control should rest with a strong sovereign mirrored the scientific discourse of the time, which sought to impose order on the natural world. Just as the state sought to control its subjects, the mechanistic worldview that emerged from the Scientific Revolution promoted control over both nature and labor, viewing them as resources to be optimized for economic gain.

The absolute monarchy structure, along with an increase in royal officials, enhanced the efficacy of rulers' power. Monarchs continued to generate revenue from their lands and also imposed taxes, sold prestigious and profitable positions, and

confiscated lands from rebellious nobles. From the 16th century, states transformed into large institutions for the collection and allocation of revenue. The rise in public debt indicated an increase in monarchic authority. The dependence of kingdoms on merchant-banker credits enriched these financiers, allowing for more capital provision. The taxes imposed by the royalty for war financing, collected with the consent of the taxed (except for the rights-deprived peasants), reflected a dialogue between the rulers and assemblies, laying the groundwork for the emergence of modern government in Europe (Merriman, 2009).

The absolute monarchy structure provided the necessary infrastructure for the bourgeoisie's economic unification and the advancement of manufacturing and trade. The rise of modernity in the West brought about a mass mobilization to process vast amounts of natural and human resources, represented collectively under the concept of 'capital' (Hertz, 2002). By the 16th and 17th centuries, states needed almost infinite capital for power structures and economic capital, along with labor and commodities, driven by the bourgeoisie leading production and trade. The legal and secured right to dominate "no man's lands" provided all the necessary justifications for exploiting the uncharted territories of the New World and the need for unlimited capital was met with the discovery of new continents. The colonization of the world represents a significant period in humanity's domination over nature. The Renaissance, Reformation, and Scientific Revolution in Europe, combined with significant technological advancements in navigation and warfare, led to the discovery of different continents. However, while colonization brought positive developments in human and commodity capital, it led to the cultural, social, and economic destruction of many societies in the colonized regions. This period marks the impact of the economic domain over other societal fields, where the domination and exploitation of nature led to the subjugation or even extinction of some societies. The ability to exploit distant lands and peoples was greatly enhanced by scientific advancements, particularly in navigation and military technologies. The tools of exploration, backed by scientific discoveries in astronomy and mechanics, enabled European powers to dominate global trade and exploit natural resources on a massive scale, further entrenching the commodification of both labor and nature.

The first colonial empire was established by Portugal through Africa. The most immediate outcome was the substantial drop in prices of Eastern-origin goods like spices in Europe due to the direct trade routes, making them significantly cheaper in Lisbon compared to Venice, which still relied on old trade routes. This naturally triggered other European states to embark on their colonial quests. Queen Isabella's support for Christopher Columbus' discovery of the American continent in 1492 propelled Spain into establishing an overseas empire. The Spanish, eager to balance Portugal's dominance in the East, ventured deep into America. The government saw the continent as a gold and silver deposit, and the Spanish conquerors, known as Conquistadors; decimated the Aztec civilization in Mexico and the Inca in Peru, melting down their unique gold artifacts into currency. The the import of around 100,000 African slaves to the Americas in 1560 further exemplify the extent of this exploitation (Merriman, 2009).

Following these discoveries, Europe became a "world center" accessible from America, Africa, and Asia. However, this also worsened ongoing wars within Europe, now fueled by conflicts over territories, colonial possessions, and capital. The shift from a city-centered to a nation-centered economic system accelerated with the rise of absolute monarchies and colonial ventures. The growing population, along with rising production costs and transportation expenses led to significant price increases. The cost of all goods doubled on average between 1550 and 1600, particularly in agricultural products. Some governments responded by devaluing their currency, which initially boosted royal revenues but eventually fueled long-term inflation. The persistent inflation during this period had the most devastating effects on workers and peasants. Others raised taxes, leading to conflicts with parliamentary bodies and contributing to the constitutional crises of the 16th century (Roberts, 2010).

As the supply of these metals increased faster than the production of goods and services, their value declined, leading to higher prices. This situation contributed to the rise of mercantilism. In response, rulers implemented policies to ensure that the flow of gold and silver was directed into their countries, which ultimately led to the development of mercantilist economic practices. The main principles of mercantilism included increasing the export of manufactured goods, reducing the export of raw

materials, and banning imports except for essential raw materials, all with the goal of achieving a favorable trade balance (Merriman, 2009). These developments including the accumulation of wealth, the capacity of states to maintain strong and constant armies, and the rise of central authority; laid the foundation for the emergence of the "nation-state," which would become a significant political entity in the future of European history. The rise of mercantilism and the push for national wealth were bolstered by technological advancements from the Scientific Revolution, which provided the means to exploit nature and labor on a much larger scale. Scientific discoveries in mechanics, particularly the development of machines, contributed to the growing industrial sector, where both nature and human labor were increasingly commodified and controlled.

During this period, the effects of the paradigm shift were continuing to be experienced in the social and cultural fields. The Enlightenment, an intellectual and philosophical movement in the 17th and 18th centuries, primarily in Western Europe, was founded on the empiricism of Bacon and the rationalist philosophy of Descartes. The Enlightenment's core principles were individual freedom and religious tolerance, which stood in opposition to absolute monarchy and religious authorities. It was characterized by a growing consciousness of the relationship between the human mind and the world, an emphasis on the scientific method and reductionism, and increasing questioning of religious dogmas (Merriman, 2009).

John Locke, following Newton's understanding of physics, analyzed society from an atomistic perspective and defined it in terms of its fundamental components: individuals. Like physicists reducing the properties of gases to the motion of atoms or molecules, Locke attempted to reduce observed social phenomena to individual behaviors. His principles, derived from examining human nature, were also applied to economic and political problems (Capra & Luisi, 2014).

John Locke's analysis of human nature describes the human mind as a blank slate or “tabula rasa” at birth, indicating that knowledge is acquired through sensory experiences and subsequently inscribed onto this slate. According to Locke, all

humans are born equal, and their development is entirely shaped by their environment. He also posited that human actions are always motivated by self-interest.

When applying Locke's theory of human nature to societal events, it becomes evident that the power governing human society is shaped by natural laws, similar to those governing the physical universe. Thus, the government's role is not to impose its own laws on the people but rather to discover and apply the natural laws that existed even before any government was formed. Locke asserted that these natural laws include the freedom and equality of all individuals, as well as the right to property represented by the fruits of one's labor. However, he emphasized that an individual should only own as much property as they have produced. Locke's approaches, while encompassing implications relevant to all segments of society, have ultimately yielded outcomes beneficial to the dominant capitalist bourgeoisie and detrimental to the oppressed workers and peasants (Russell, 2004).

Locke's ideas have had a significant impact on the development of modern economic and political thought, extending beyond the Enlightenment. The ideals of individualism, property rights, free markets, and representative government can be grounded in Locke's theories (Capra & Luisi, 2014). Voltaire (1694-1778), a crucial thinker during the French Revolution and influenced by Locke; emphasized human autonomy in shaping their lives, social and governmental structures, and engaging in scientific endeavours. Since humans are rational beings capable of understanding and governing both society and nature through reason, Voltaire argued that the priority should be to enlighten individuals by facilitating their access to knowledge. Contributing to encyclopaedic works, he aimed to disseminate knowledge to the masses. Voltaire, who held the belief that no evil can be attributed to God, advocated for the enlightenment of individuals and society through reason and science, leading to the enlightenment of human reason and, consequently, civilization (Russell, 2004).

While Locke and Voltaire focused on individual autonomy, political freedom, and the pursuit of knowledge as essential to societal progress, the economic dimension of these Enlightenment ideals found its most prominent voice in the work of Adam Smith. Regarded as the founder of modern economic theory, Smith viewed the self-

regulating market as a system that grows slowly but steadily, with increasing demand for goods and labor over time. Building on the concept of natural laws, he argued that trade and exchange are inherent to human nature and proposed that labor-saving machines would enhance workers' comfort and productivity. Anchoring his theory in Newtonian laws of equilibrium and motion, he employed the metaphor of the 'invisible hand'. Just as Locke's theories of property and individual rights influenced modern political structures, Smith's ideas on self-regulating markets and the 'invisible hand' laid the foundation for modern economic thought. The market's invisible hand guides individual interests towards achieving better conditions for both producers and consumers. In this context, improvement is equated with material wealth, creating an objective science of economic activity, independent of individual intentions (Merriman, 2009). According to Smith, prices should be determined by supply and demand balances in free markets that follow natural laws. This perspective laid the groundwork for the competitive model widely used in later economic theory. The fundamental assumptions of this model include the immediate and equal dissemination of information about market transactions to all participants, the rapid mobility of displaced workers, machines, and resources, and the belief that all buyers and sellers in the market are small and have no influence on prices. Like the legal system, the price system is viewed as an objective entity, akin to how Descartes described the material world (Capra & Luisi, 2014).

The concept of unlimited economic growth, popularized by Adam Smith, has gained considerable traction among economists and politicians. This belief has been institutionalized in the form of modern corporations. However, the endless growth of corporations is not a natural condition but rather a political choice. Many corporations' relentless pursuit of economic expansion has led governments to transfer sovereign rights over public assets, resulting in the widespread privatization of common resources. The size of some corporations has reached a level where they can influence laws and policy processes. Their lobbying efforts, substantial investments in legal proceedings, and shareholder-driven structures—often disregarding social and environmental costs—have turned corporations into powerful actors within institutional and social life (Unger, 1976).

Similarly, earlier waves of privatization during the enclosure movement in England reflected a comparable shift toward the concentration of ownership and control. This process, which accelerated in the 17th and 18th centuries, was further fueled by the ideas of European thinkers like Locke and Smith, also had profound social and economic consequences. Widerquist and McCall (2021) note that the enclosure movement, along with colonial expansion backed by military force and European intellectual thought, was aimed at appropriating land. The privatization of commonly enclosed properties in England had a particularly devastating impact on landless commoners. Rights of usage, once commonly held, were transformed into individual property rights, shifting land ownership and production relations.

Absolute private property in land was established through the division, enclosure, and seizure of commonly used lands. Locke's property theory provided the theoretical foundation for this shift, where communal property was increasingly fragmented, giving rise to absolute private ownership. According to Locke, while everything in nature was initially open for communal use by all humans, individuals own themselves and their labor. Therefore, no one else has a right over an individual's labor. Locke stated that communal and collective resources could be converted into individual property through labor. The enclosure of common areas, preventing others from using them and improving them for increased yield, engendered the right of property for the encloser. Locke evaluated common land property similarly. Although lands owned by the community were given by God, God also ordained that humans could sustain their lives and existence by utilizing these lands; the extent to which an individual could benefit from the products of the land determined its ownership. The idea that land could be separated from the commons through human labor, without requiring consent from everyone with a right to the communal lands, laid the foundation for absolute private property. The transition to absolute private property in England led to adverse outcomes for peasants and workers in the usage of common lands (Capra & Luisi, 2014).This transformation laid the foundation for the capitalist-liberal order, with legal texts serving as tools of legitimacy to establish a liberal political system (Merriman, 2009).

Alongside Europe's endless pursuits of commodities and sovereignty, the Scientific Revolution's subsequent technological advancements initiated geographical explorations and colonization efforts. As previously mentioned, with the rise of the bourgeois class, the supremacy of the economic domain became evident. Consequently, activities aimed at economic enrichment often overlooked social values, leading to the near extinction of some societies on the discovered lands. The enrichment of settlements in America following the discovery of North America primarily relied on African slave trade. Additionally, the desire to create a global trade system led to the forceful occupation of Native American lands and the development of agricultural production through the introduction of slaves. However, the British administration's negotiations with Native Americans and the establishment of forts to protect them provoked the settlers' opposition (Roberts, 2010).

In the settlements established in the United States, the prominent bourgeois class was fundamentally influenced by Enlightenment philosophers like John Locke, Voltaire, and Adam Smith. Their common characteristic was a deep interest in the modern system. Therefore, the primary goal of the bourgeois class in America was to transition from British governance and oppression to individualism, independence, and a free market. Consequently, armed conflicts that started in 1775 and the assertion of the Declaration of Independence in 1776 led to war. Following the American colonies' victory in the war of independence, a new republic was established in America with the constitution that came into effect after 1789. The legal structure of the United States aimed to create an effective government that consolidated administrative and military authority and a robust property rights system. Property rights were seen as both the protector of all other rights and the sole means of pursuing happiness in a capitalist system (Capra & Mattei, 2015). In the United States, the granting of private property rights to individuals and corporations, coupled with sovereignty rights to federal systems, realized the dream of constructing a rational society from scratch on vacant lands. This transformation was facilitated by the complete separation from England, the desire to establish a new political regime, and the availability of vast unoccupied lands, providing ideal conditions for implementing a rational management system. The American Revolution served as a catalyst for European uprisings, particularly inspiring the French (Merriman, 2009).

Napoleon's policies during this historical period, caused unease in Europe, triggering reactions and resistance against his administration. The French Revolution, rooted in the principle of popular sovereignty, became closely associated with nationalism. French principles advocated for the right of people to self-governance, asserting that the nation-state was the most suitable structure for this purpose. Thus, revolutionaries proclaimed their republics as "one and indivisible." This principle, adopted by foreigners, was attempted to be implemented in their own countries (Merriman, 2009). However, the French, in directing Europe towards their national interests, opposed the national rights of other Europeans. Consequently, the Napoleonic era became a significant catalyst for national movements. The resistance of patriots in Germany, Italy, Spain, and Russia, coupled with opposition to the revolution, fueled hostility among European populations against Napoleon's intended dynasty and empire, leading to transformative political consequences across the continent (Roberts, 2010).

During this period when Europe was experiencing wars and social transformations; economic and technological developments continued at a great pace. The growth of cities, railway construction, and capital investments in the 18th century laid the foundation for the global economy. Geographical discoveries, advances in agriculture, and an increasing workforce accumulated the capital necessary for economic capacity development. Additionally, the growth of banking and credit institutions in Western Europe facilitated the accumulation of financial capital necessary for trade. Urbanization and population growth also led to a continuous increase in the demand for metals, significantly increasing the number of workers in industrial sectors. The development of mechanized production in the textile and metallurgy industries led to a rise in the workforce employed in large workshops and factories (Merriman, 2009).

The strengthening of capitalists, who held the means of production and added value to national currencies through exports while controlling most employment opportunities; necessitated states to adjust their governance, social life, and even legal systems in favor of capitalists. Although beneficial for states, this empowerment of

capitalists resulted in harsh working conditions, low wages, insecure environments, hunger strikes, work stoppages, and violent protests for the working class. Socialist tendencies and demands for democratization increased among the working class; leading to awareness, organization, and, despite being illegal in some countries like England, the start of unionization (Roberts, 2010).

However, the development of trade and capital, while fostering the growth of the bourgeoisie, made the livelihoods of workers and peasants more challenging. These economic shifts were further accelerated by the onset of the Industrial Revolution, which not only transformed the means of production but also fundamentally altered societal structures, leading to the rise of industrial cities and the laboring class. Marx and Engels, observing the rapid industrialization and its effects on the working class, offered a critique of this mechanistic approach, noting that the reduction of human labor to mere commodity was a direct result of capitalist structures. They argued that the Industrial Revolution caused significant and rapid changes in cities, shifting production from human to machine power and bringing about large-scale production. The surplus generated from increased production led to capital accumulation, significantly widening the gap between classes. Marx described the emergence of the proletariat, workers who could sell their labor, and the capitalist class owning the means of production. These rapid transformations particularly impacted cities, triggering massive migrations from rural areas to urban centers. Initially, cities were unable to accommodate this influx, resulting in the formation of shantytowns on the outskirts. These settlements, often lacking infrastructure, were characterized by overcrowded, sometimes windowless single rooms, where multiple people lived together and even shared beds on a shift basis. The rise of shantytowns and overcrowded cities highlights the human costs of the mechanistic paradigm, which treated both nature and human labor as resources to be exploited for industrial and economic gain. This shift not only affected the environment but also led to a social structure where the needs of the many were sacrificed for the profit of the few. This situation led to the formation of post-Industrial Revolution cities lacking basic amenities like water and electricity, and accompanied by various health issues (Marx and Engels, 1975).

Polanyi (2002) argues that the historical process of commodifying labor, land, and money to ensure continuity in raw material and labor supply for the investment costs of complex and specialized machine production during the Industrial Revolution is not a natural structure. Economic relations, part of social life, have been sustained since the existence of humanity. He notes that in primitive societies' markets, exchanges occurred without the motive for profit, instead based on two principles of behavior: reciprocity and redistribution. Polanyi mentions that these three principles (reciprocity, redistribution, and exchange) have different organizational forms in primitive societies. In more centralized societies, redistribution was more influential, whereas in societies with less state hierarchy, the principle of reciprocity played a more decisive role in economic relations. The commodification of labor, where individuals become dependent on the market for their livelihood, leads to the marginalization of reciprocity and redistribution principles. This commodification, which fragmented traditional social structures, is reflective of the broader societal acceptance of the mechanistic worldview. Just as nature was dissected and reduced to its components in scientific inquiry, so too were human labor and relationships compartmentalized and commodified within the emerging capitalist economy. Consequently, the transformation of these factors (labor, land, and money), not originally produced for profit, into commodities subjects human relationships and society to market dominance, leading to fragmentation and disintegration.

Chapter 5

Globalization

The principles of the Mechanistic Paradigm not only shaped scientific thought but also laid the groundwork for the socio-economic structures that would later define globalization. This chapter explores how this paradigm extended its influence beyond to shape global political and economic systems. The Scientific Revolution introduced new methods of inquiry and technological advancements, particularly in navigation and engineering, that significantly expanded global trade networks. These advancements, along with the mechanistic worldview, provided the foundation for globalization, as they allowed European powers to explore, conquer, and dominate distant territories, thereby shaping the global economic system.

Globalization is defined as an open international economy characterized by a significant and increasing flow of trade and capital investments among countries. Although the acceleration of globalization is often linked to the economic growth following the Industrial Revolution, its origins can be traced back further (Castells, 1996). Initially, globalization emerged and developed within specific geographic locations, enhancing the interconnection between national economies. The development of international trade and investments increasingly involved new countries and economic actors. The social and economic impacts of the Scientific Revolution, particularly between 1450 – 1640, led to rapid increases in world trade and a consequent acceleration of globalization trends. During the mercantilist period, exports were viewed as vital for capital accumulation, while imports were seen as almost equally detrimental. This period was characterized by a pursuit of colonies for capital accumulation and new external markets for exports, while fiercely protecting the domestic market from foreign goods. However, trade partnerships remained the sole model during this time. Local trade, oriented towards basic needs and resembling medieval city markets, coexisted with limited luxury and scarce goods trading over distances.

5.1 A World Economy

By the end of the 15th and the beginning of the 16th centuries, the development of some European maritime nations significantly increased trade. By the mid-17th century, while Northeastern European economies were leading, the world trade system underwent a triple division into core, semi-periphery, and periphery regions. Consequently, industrialization began and spread rapidly. Mercantilist views, which directed the economic policies of Western European countries between the 15th and 18th centuries, gradually changed, reflecting the transition from commercial to industrial capitalism. The continued price increases in the 18th century shifted income distribution in favor of the capitalist class, significantly enhancing their savings capacity. Furthermore, the Scientific Revolution and subsequent technological developments facilitated the replacement of human labor with machinery and ensured a broad market for investment profitability, both domestically and overseas. The complete dismantling of the Feudal system and the commercialization of agriculture transformed land, labor services, and raw materials into commodities freely purchasable from the market (Klein & Smith, 2008).

The technological inventions and changes in production relations accompanying the Scientific and Industrial Revolutions mutually influenced and accelerated each other. The first phase of globalization is recognized as starting with the technological advancements of the 18th-century Industrial Revolution and extending to the period between 1870-1914. This rapid expansion of global trade was facilitated by innovations such as steam engines, improved navigation technologies, and early industrial machinery—many of which were direct applications of scientific discoveries made during the Scientific Revolution. These technologies allowed for greater extraction and commodification of natural resources and labor, thus linking the scientific advances to the burgeoning global economy. This era saw rapid economic surplus creation and economic growth processes due to technological change and industrialization. A key feature of this first wave of globalization was the adoption of the gold standard in monetary markets and trade relations. The swift industrialization

phase also marked the emergence of "third world" countries that failed to industrialize (Roberts, 2010).

The individualism and economic freedom philosophies prevalent during the Scientific Revolution and Enlightenment, followed by the transformation in production relations during the Industrial Revolution, led to liberal economics and intense globalization. The dominant liberal economic perspective from 1775 – 1850 not only facilitated expansion in already heavily industrialized capitalism but also laid the groundwork for more tangible globalization processes. Adam Smith's late 18th-century notion of cross-border trade and labor movements, intensifying connections between countries and leading to an international community, became a fundamental approach to globalization (Capra & Luisi, 2014).

By the second half of the 19th century, a truly integrated global trade system had emerged. The laying of submarine telegraph cables in the 1860s enabled intercontinental connections, allowing instantaneous communication between America and England for daily trade and price determinations. This innovation accelerated international monetary flows. Initially, international investments were limited to minority group holdings (consortiums) in foreign companies, represented by bonds and stock shares, but soon expanded to foreign capital trade, also known as foreign direct investments. These investments, referred to as 'foreign capital,' represent investments made by foreigners in factories that are wholly owned and operated by foreign entities (Merriman, 2009).

In subsequent developments, a world market emerged for certain primary products, foodstuffs, and minerals. Advances in transportation and communication expanded the market areas where producers could compete, leading to a more widespread equalization of prices. The establishment of the International Wheat Market in 1901 marked the creation of the first global market, transforming the world into “one place” for commercial wheat producers. During this period, globalization conditions in foreign trade, migration, and free capital flows began to be predominantly met, largely determined by wealthy nations. Following World War I, the United States emerged as the first nation to surpass the economic dominance of the

United Kingdom. However, the absence of a leading nation to implement the necessary minimum measures for the smooth functioning of the world economy led to trade wars and protectionist tendencies among central countries, causing a collapse in the world's economic trade network. The failure of European economies to recover after the war, coupled with the U.S.'s inability to dispose of its surplus in agriculture and industry, inevitably led to a crisis (Roberts, 2010).

The 1929 Crash initially manifested as a panic in the U.S. capital market, followed by drastic declines in the country's industry, production, and employment levels. Subsequently, the nation's imports plummeted, and its provision of credits to the external world ceased. The Great Depression of the 20th century significantly eroded confidence in international trade and free market economies. The years following the Great Depression witnessed a period devoid of international cooperation in world trade. Countries acted individually to resolve their external payment balance and unemployment issues, leading to competitive devaluations and mutual tariff hikes. The Keynesian thought and Demand-Side Economics that emerged during this period offered a state ideology suitable for the era's conditions. Keynes, in his work on national income and employment, formulated a theory suggesting that reaching a balance in incomplete employment is more common than achieving full employment under unregulated free market conditions. Consequently, the state should abandon a completely free, unregulated economic policy to achieve and sustain full employment. Keynes's effort aimed to position international economic relations in a middle ground between total freedom and strict protectionism. This approach is considered a product of Keynes's attempt to find a "third way" between "free (foreign) trade" and a "closed economy" (Capra & Luisi, 2014).

With the United States assuming the UK's leading role in the world economy after World War II, it abandoned its protectionist policies to become a fervent advocate of free trade, as the UK had once been. The post-1945 changes in the global economic and political system added a new dimension to the globalization process. The world divided into three distinct groups: countries under American leadership, those under Soviet leadership, and the non-aligned Third World nations. Both America and the Soviet Union exerted considerable effort to expand their spheres of influence. The

Soviet Union established clear boundaries around its domain, implementing an economic system distinct from the capitalist economies of the West. In contrast, the Western economic boundaries reflected American policy and economic influence. Under U.S. leadership, the United Nations system was established, along with institutions like the IMF, World Bank, and GATT, equipped with objectives and aims to ensure the functioning of market rules in the global economy. Simultaneously, Western European countries, devastated by World War II, began to recover through assistance provided under the Marshall Plan. Countries in the Far East, Latin America, Oceania, and newly independent former colonies started to take their places in the global markets (Merriman, 2009).

The post-war period until the mid-1970s is often referred to as the golden age of capitalism. The first quarter-century following World War II witnessed the rise of advanced capitalist welfare states. This era saw the expansion of social and collective services, increasing subsidies in education, culture, health, and housing, rising purchasing power, and low unemployment levels. However, this period ended in the mid-1970s. By the late 1960s, the post-war growth model, Fordism, began to struggle with the exhaustion of productivity increase potential and entered a crisis. The accumulation of capital and the slowing rate of productivity increases reduced profit margins, causing difficulties in industrial investment valuation and leading to a profit crisis. In the 1970s, the global economy deviated from stable growth, characterized by low growth rates, rising unemployment, and a turn towards protectionist policies, prompting parallel trends in globalization and regionalization. The end of the golden age was marked by increased competition among advanced capitalist countries, militancy of trade unions, rising inflation, financial crises accompanying welfare state reforms, and the 1973 oil crisis. Additionally, the collapse of the Bretton Woods system in 1973, the severance of the dollar's gold linkage, the decline of U.S. hegemony, and the entry into a new phase of international economic polarization were crucial factors (Capra & Luisi, 2014).

In the post-Bretton Woods era, a transition from fixed exchange rate regimes to various other regimes occurred, alongside the reduction of capital controls. The defining feature of this period was the removal of national financial system constraints

and the opening of economies to international capital flows. Additionally, in the late 1970s and early 1980s, under the new economic order, goals of a fully free market economy and globalization were set. This era of transnational capitalism is considered a qualitative transformation of globalization. Commencing in 1973, it witnessed the diminishing role of states in economies, the transformation of international trade into e-commerce, and the migration of financial markets to electronic platforms (Merriman, 2009). The 1980s saw the implementation of liberalization and opening-up programs worldwide under the influence of neoliberal policies.

Polanyi (2002) critiques this historical process, arguing that, like capitalism, it is not a natural outcome of the economy. He contends that in a free market society, rather than the economy embedding within social relations as in primitive ancient societies (and would naturally continue to do so), social relations have developed as dictated by the economic system. Polanyi views the free market economy as a "political project" realized through institutional changes that commodify land and money. He posits that the movement leading to the formation of a capitalist, free market economy in 19th-century England undermined the conditions necessary for capitalism's continuous existence, thereby triggering a counter-movement aimed at protecting society. Polanyi describes this double movement as a dynamic shaping market society for two centuries, with the market on one side and protection on the other. He sees the market as a mechanism that commodifies everything within it and respects only the dignity of objects, disregarding brotherhood, compassion, local human relations, and the individual's self-worth. Consequently, Polanyi assesses the market as a mechanism that turns labor, land, and money into commodities, rendering human communities universally dependent on it in an unprecedented institutional uniformity.

Globalization has profoundly altered the relationship between capital and labor (Castells, 1996). With advancing technology and electronic networks, money has become completely independent of production and services. White capital is inherently global, labor remains local. Consequently, money and people exist in different spaces and times. While capital circulates globally within the financial networks of

corporations, labor is subject to local constraints in the real world. Capital has become more decentralized, while labor loses its collective identity and bargaining power.

The global capitalist order has significantly transformed social life by turning diversity into monoculture, ecology into engineering, and generally converting life into a commodity. A global elite of entrepreneurs has achieved immense wealth through the freedom to exploit resources and values, leading to socially and environmentally destructive consequences (Klein & Smith, 2008). The weakening of government and public interests has elevated the dominance of powerful corporate actors. The continuous movement of leaders between the private and public sectors created conflicts of interest, known as the revolving door phenomenon. Today, the lives of millions are influenced as much by the decisions of private corporations as by government policies. Meanwhile, governments' attempts to control international economic policies are increasingly inadequate. The prosperity standards expected as a result of unlimited economic growth are not being met by governments. The process up to the present day has brought about changes favorable to capital groups and the global expansion of multinational corporations. Consequently, in the process leading up to the present day with globalization, the economic domain has become entirely independent. The most destructive consequence of this independence in human-nature relationships is the accelerated destruction of natural resources following the mechanistic paradigm, leading humans to prepare their ecological disaster (Capra & Luisi, 2014)

5.2 The Anthropocene

The Mechanistic Paradigm, which sought to control and exploit nature for economic gain, laid the foundation for the environmental degradation that now characterizes the Anthropocene. The unchecked consumption of fossil fuels and natural resources, driven by scientific and industrial advancements, has pushed the Earth’s ecological systems to the breaking point. The Anthropocene Age, characterized by human dominance over nature, has emerged as a new era where human impact rivals the most significant forces of nature. This term, introduced about

a decade ago and increasingly used in recent times, encapsulates the global scale of human environmental impact recognized since the 1800s (Steffen et al., 2004).

Prior to the Industrial Revolution following the Scientific Revolution, humanity's primary energy sources were wind, water, and the biosphere's plants and animals, all ultimately derived from the flow of solar energy. This process provided the fundamental energy source for atmospheric circulation, the hydrological cycle, and photosynthesis. The transition to the exploitation of fossil fuels has been a disruptive force in energy processes. Fossil fuels represent a store of solar energy accumulated over hundreds of millions of years through photosynthesis. With their energy-rich, dense, easily transportable, and accessible characteristics, they have become an ideal fuel source for a humanity driven by insatiable capitalistic ambition. This transformation has sharply increased human energy use. Post-Industrial Revolution, humanity began to use four or five times more energy than before (Steffen et al., 2011). The technological advancements that drove the Industrial Revolution not only transformed societies but also dramatically altered the relationship between humans and nature. As the exploitation of fossil fuels surged, humanity’s environmental footprint grew exponentially, marking the beginning of profound ecological changes.

The exploitation of fossil fuels has enabled humans to expand and diversify their dominion over nature, providing the necessary energy. Between 1800 and 2000, as the human population grew from about one billion to six billion, energy use increased roughly 40-fold, and economic production increased 50-fold. The proportion of land surface dedicated to intense human activity rose from about 10% to 25-30%. Environmental impacts became evident in the increase of atmospheric greenhouse gases like CO2, CH4, and nitrous oxide (N2O). Particularly, carbon dioxide, an inevitable result of burning fossil fuels, is directly linked to the increase in energy use during the industrial age.

Post-World War II, human intervention in nature significantly escalated. The mid-20th century saw growth rates increase dramatically, leading to the period from 1945 to the present being termed the Great Acceleration. In the last 50 years, the human population, which doubled, has increased 15-fold in this period, with oil consumption

rising to 3.5 times its previous levels. Additionally, in the last century, over 3 billion people have migrated from rural areas to cities due to the impact of the Industrial Revolution. The increase in motor vehicles, expansion of electronic communication, and economic interconnectedness have continually accelerated energy use (Richardson, 2011). These changes reflect the mechanistic paradigm's focus on controlling and exploiting nature, mirroring the broader trends of globalization and industrialization. Just as scientific advancements emphasized control over nature, the global economic systems that emerged reinforced a similar approach to resources, driving ecological degradation at an unprecedented scale.

The spread of the Industrial Revolution to countries like North America, Russia, and Japan, and its continuation post-World War II with the advent of automobiles and airplanes, has accelerated global integration. Globalization began in earnest with the integration of outputs from mines and plantations in Australia, South Africa, and Chile into the rising global economy. New international institutions were established to support economic recovery and promote renewed economic growth. Under U.S. leadership, the world transitioned towards a system built around neo-liberal economic principles characterized by more open trade and capital flows. The post-World War II economy rapidly integrated, with growth rates reaching their highest values in the 1950-1973 period. Additionally, the 20th century witnessed widespread partnerships between government, industry, and the scientific community due to wars, further advancing innovation and growth. More public goods were converted and incorporated into the market economy, making growth a fundamental socio-economic and political value driving both societal and political domains (Capra & Luisi, 2014)

From a long-term perspective, developing countries have contributed only about 20% of total cumulative emissions since 1751, yet they have housed approximately 80% of the world's population. The poorest countries, with a total population of around 800 million, have contributed less than 1% to cumulative CO2 emissions since the beginning of the Industrial Revolution (Richardson, 2011).

Many characteristics of the Anthropocene period are beyond the scope of past environmental management experiences. For example, time lags in the Earth system can be significant; decisions made in the next decade or two could commit future societies to meters of sea-level rise over centuries. Irreversibility is also a common feature; once a species is lost, society cannot recover it even if it later decides the species was valuable or worth protecting. The continued rise in global temperatures due to greenhouse gas emissions could result in catastrophic consequences, including extreme weather events, sea-level rise, and the displacement of millions of people. Entire ecosystems face collapse, and humanity's ability to mitigate these changes will determine the severity of the Anthropocene's future impacts. The accelerating loss of biodiversity threatens to destabilize ecosystems that are essential for human survival, including those that provide food, clean water, and oxygen. As ecosystems collapse, the services they provide may become irreparable, further increasing the vulnerability of human societies. Climate change is also expected to increase the spread of infectious diseases, while air and water pollution will continue to contribute to rising rates of respiratory and waterborne illnesses. Food insecurity, driven by crop failures and changing weather patterns, may further threaten global health. Issues of equity are often magnified in the Anthropocene. The stark disparity between the wealthy countries most responsible for additional greenhouse gases in the atmosphere and the poorest countries that are likely to suffer the most severe impacts of climate change.

Finally, the complexity of the Earth system's operation, such as the possibility of tipping points in major subsystems, presents policymakers with an array of challenges. Given the nature of the emerging problems in the Anthropocene, it is arguable that political leaders, policymakers, and managers struggle to find effective global solutions (Steffen et al., 2004).

This section discusses the consequences of human dominance over nature in conjunction with the mechanistic paradigm. The philosophy of science and nature forms the foundation of our approach to understanding, shaping, and adapting nature to our lives. The mechanistic paradigm, which views nature as a resource for humans to conquer and consume, combined with an individualistic approach, is driving the world towards ecological destruction. However, the dominance of the economic

domain over other social spheres has led to a structure where even an impending ecological disaster may not find a place on politicians' agendas. Yet, there is a societal segment today that is conscious of the economic and social inequalities and the ecological disaster that humanity is facing. In recent years, civil society, non-profit organizations, academics, and scientists have emphasized the ecological and social harms of unlimited economic growth and have argued for the necessity, even the urgency, of changing our perspective towards nature. Examining the historical process so far, it is evident that the approach adopted in human-nature relations has impacted humans politically and legally, and nature scientifically and philosophically. Therefore, humanity needs a new scientific paradigm that respects the ecological values, advocates equality, and shapes nature based on a societal structure that shapes economy.

Chapter 6

Toward a New Paradigm

Scientific paradigms are a synthesis of concepts, values, perceptions, and practices shared by society; fundamentally shaping our understanding and relationship with nature. The Mechanistic Paradigm reflects a worldview in which nature is seen as a resource to be controlled and exploited for human development, closely linked to the economic and political systems of commodity exchange as a catalyst for human dominance over nature. Today, the disruption of natural systems—through climate change, biodiversity loss, and ecosystem degradation—poses a critical threat to humanity's future. The mechanistic paradigm's approach to understanding and interacting with nature has failed to recognize that nature, subjected to intense and continuous human domination, could reciprocate in a manner that significantly impacts humanity's future. The ecological crises humanity face today reveal the failures of fragmented approaches to science and governance. A new paradigm is required—one that is rooted in the understanding of interconnected systems and sustainable relationships between humanity and nature.

While the mechanistic paradigm has long dominated scientific thought and societal practices, its growing inability to address the complexities of modern ecological crises underscores the limitations of its fragmented approach. The dominance of scientific paradigms does not necessarily mean they completely succeed in one issue or achieve sufficient success in multiple issues (Kuhn, 1962). A paradigm essentially acts as an indication of success, representing the success expected to be derived from selected and as yet unresolved examples. The Mechanistic Paradigm presented the continuous exploitation of nature as a resource for human development and has become ordinary science by facilitating the targeted economic development for an extended period. Although this paradigm shaped by Galileo's quantification, Bacon's emphasis on human domination over nature, Descartes' dualism and Newton's immutable laws, continues to influence society; its authority in the scientific field has been shaken and is rapidly losing its influence.

6.1 The Crisis of Mechanistic Paradigm

In the 19th century, developments in science (such as evolution, electromagnetism, and thermodynamics) exposed the limitations of the Newtonian model and strengthened the opposition that began with the Romantic movement in the late 18th century. The Romantics challenged the mechanistic worldview, Newtonian science, and Enlightenment philosophy. While they did not oppose reason, they argued that aesthetic judgment should accompany scientific reasoning to truly understand the nature of reality. Instead of the dominant scientific paradigm of a mechanical order, they advocated for interpreting nature through an organic concept. This organic view of nature finds echoes in the ancient belief systems of pre-settled communities, where animistic traditions recognized the living, interconnected nature of the world. In these societies, humans saw themselves as part of a larger web of life, maintaining reciprocal relationships with the land, animals, and natural forces—a perspective that stands in contrast to the mechanistic paradigm's emphasis on control and exploitation. William Blake (1757-1827), a significant figure in English Romanticism, criticized the reduction of all phenomena to fundamental mechanical laws as a myopic view and strongly criticized Newton. This situation aligns with Thomas Kuhn's (1962) notion that the transition to a new scientific paradigm often occurs through the identification of anomalies within the existing paradigm. Thus, the emergence of a new scientific paradigm is facilitated by identifying and addressing the anomalies within the current paradigm. (Capra & Luisi, 2014).

German Romantics, with their interest in philosophy, art, and science, integrated their diverse knowledge to develop thoughts ranging from poetry to biology, history, and anthropology. Their primary focus in biology was the nature of organic form. As Romantic thought influenced the transition from the 18th to the 19th century, biologists' main interest shifted to biological form. One of the key ideas of Romantic biology was the notion of 'archetypes' - that forms in nature possess characteristics of types that have evolved over time. This idea played a central role in Charles Darwin's development of his theory of evolution. This way of thinking, moving beyond the mechanistic worldview, laid the foundation for future scientific thought. Darwin's "On the Origin of Species" (1859), with its theory of evolution, shifted the mechanistic

view of the world as a machine crafted by a creator to a concept of the universe as an evolving and continuously changing system, where complex structures evolve from simpler forms (Eiseley, 1976).

In the natural sciences, the concept of evolution has signified an increase in order and complexity from a biological perspective; while from a physical perspective, it has indicated a movement towards disorder. Michael Faraday (1791-1867) and James Clerk Maxwell (1831-1879), whose research into the forces of electrical and magnetic phenomena brought Newtonian physics into crisis, focused on the concept of force as the primary subject of their new studies. They then introduced the more subtle concept of the field, becoming the first physicists to demonstrate that fields have their own reality and can be studied independently of material objects. Their theories of electrodynamics gained significant importance with the realization that light is an electromagnetic field moving through space in wave form. Subsequently, physicists acknowledged that heat is energy produced by the motion of atoms and molecules, thus developing the theory of thermodynamics. The two fundamental laws of thermodynamics state that the total energy in a process is always conserved, changing form but never disappearing, and even if the amount of energy remains constant, the quantity of useful energy decreases, dissipating in forms like heat and friction. These laws led to the understanding that physical processes move in a certain direction from order to disorder, suggesting that the universe is subject to increasing disorder, slowing down, and eventually coming to a stop (Capra, 2015).

This thought in physics, contrasting with the biological evolution theory that observes living nature evolving from disorder to order and increasing complexity, replaced Newton's view of the universe as a perfectly functioning machine with two evolutionary perspectives. The resolution of these conflicting evolutionary paradoxes occurred almost a century later with Ilya Prigogine (1917-2003). Prigogine realized that the second law of thermodynamics applies only to closed physical systems, whereas biological systems are continuously open to the flow of energy and matter. In the living world, order and disorder are created simultaneously; living organisms increase their own order at the expense of making their environment more disordered. By the end of the 19th century, although the ideas of Newton and Descartes were

spreading as being insufficient, they were still widely believed to be true. This changed entirely in the first quarter of the 20th century. The theories of quantum mechanics and relativity shook the foundations of the mechanistic worldview and Newton's laws (Henry, 2011).

One of the most significant shocks was the discovery that the world cannot be divided into independent fundamental particles. Since Newton, physicists had attempted to understand physical phenomena by reducing them to the properties of hard and solid material particles, but the components forming atoms and molecules are not isolable entities; they can only be defined in terms of their relationships with each other. While in classical physics, the properties and behaviors of parts were used to understand the whole, quantum mechanics operates in a formalism of probabilities within a dynamic system. The behavior of all particles is determined by the whole itself. Living systems, whose fundamental properties arise from the connections and relationships between parts, are wholes whose properties cannot be reduced to those of smaller parts. This shift in conceptual understanding from parts to wholes also rendered Descartes' method of analyzing complex problems through their components ineffective (Capra, 1975).

6.2 The Systemic Paradigm

In the field of physics, the conceptual shift that took place in the 1920s was paralleled in biology when German biologists revisited Romantic ideas from the 18th century. A new discipline, 'organismic biology,' was established, focusing on the holistic structures of living organisms. Organismic biologists collaborated with psychologists who viewed perception processes as holistic processes exhibiting properties not found in their parts. Psychologists, using the German term 'gestalt,' meaning 'form' developed 'gestalt psychology' to describe integrated perceptual patterns (Capra, 2015).

A third science joining this dialogue on wholeness was the science of ecology, emerging in the 19th century from biologists' studies of organism communities. Environmental scientists observed in ecosystems the holistic structure seen by

biologists in organisms and psychologists in perception. They realized that the success of communities living in ecosystems depends on the success of their members, and the success of members, in turn, relies on the success of the entire community. They recognized networks of relationships among these communities. Environmental scientists defined ecosystems as communities of animals, plants, and microorganisms connected by feeding relationships. They expanded the concept of food webs into the concept of life webs. The network concept, three centuries after Descartes and Newton, has become the key concept of the era, replacing the machine concept. While machines are analyzed in terms of their parts, networks are analyzed in terms of connections and relationships. The dialogues between these disciplines resulted in a new scientific paradigm known as 'systems thinking' or 'systemic thought.' Its common area of study encompasses living systems, including individual organisms, their parts, and communities of organisms like ecosystems. Therefore, systems thinking is an 'interdisciplinary' approach due to its widespread applicability across various fields. (Capra & Luisi, 2014)

The fundamental concepts of systems thinking were developed in the 1920s and 1930s. The next phase occurred in the 1970s and 1980s with the development of advanced new models and theories in systems theory. A significant feature of these new theories was the creation of a new language capable of mathematically addressing the complexity of living systems. Mathematical systems incorporating new theories like chaos theory and fractal geometry, with the development of computers capable of solving complex equations in the 1970s, have revealed the patterns underlying chaotic behaviors and the order within chaos. In the past 30 years, an important approach developed within systems thinking is the concept of autopoiesis by Humberto Maturana and Francesco Varela (Maturana and Varela, 1991). This theory posits that the defining characteristic of living networks is their self-creation or autopoiesis. The term combines the Greek words 'auto' (self) and 'poiein' (to make). Living networks continuously recreate themselves by transforming or replacing their components, thus maintaining patterns while the structure is in constant change. (Kilic, 2020)

The emergence of systemic scientific manifestations during the dominance of the mechanistic paradigm does not imply they started then. The process unfolded this

way because in science, new paradigms emerge through the anomalies of the current paradigm. However, the systemic paradigm, like the mechanistic paradigm; dates back to at least as far in history.

In pre-settlement societies, animism and the organic view of nature were adopted to understand the nature. The idea of nature as a holistic entity composed of living organisms continued to be influential through the cosmos in Ancient Greek philosophy. Aristotle's view as "The whole is greater than the sum of its parts," has become the fundamental logic of contemporary systems theorists. Even during the emergence of the mechanistic paradigm, significant systemic thinkers existed. Leonardo Da Vinci (1452-1519), one of the early representatives of modern scientific thought, developed a new empirical approach that systematically studied nature, integrating mathematics and reasoning. This approach forms the foundation of today's scientific method but differs significantly from the mechanistic science that emerged about two centuries later. Leonardo's perspective focused on organic transformation processes. According to him, nature is a living whole, and the patterns and processes in the microcosm are similar to those in the macrocosm. If Leonardo's view is expressed in contemporary terms, he can be regarded as a systemic thinker. For him, understanding a phenomenon fundamentally meant establishing connections through examining similarities between patterns. The Romantic view, which saw nature as a harmonious whole, led some scientists to extend their search for wholeness to the planet, seeing the world as a living entity. The Romantics revived a tradition that began with the Ancient Greeks' conceptualization of the world as a cosmos, developed through the Middle Ages and Renaissance, and continued until it was suppressed by the Mechanistic paradigm that saw the world as a machine. (Russell, 2004)

Considering that a new scientific paradigm emerges when the existing paradigm fails to meet the socio-cultural and practical needs of society, it can be argued that the systemic paradigm has been initiated by the urgent necessity to create an ecological world. A fundamental acceptance required to understand nature in the systemic paradigm is that nature sustains life not by exploitation but through a series of ecological principles geared towards production. From a human life perspective, social

reality should be seen as a whole composed of social networks and communities, not just as an aggregate of individual building blocks.

Türker Kılıç, discussing how our method of understanding and relating to nature through science shapes the society, emphasizes that the method of the new systemic scientific paradigm set to replace the mechanistic worldview will be based on the concept of connectivity. This concept is the totality of information relationships where life forms itself through the interlocking network structures, where each whole is a part of a larger whole. This approach is grounded in the common findings of various studies seeking to answer the question, 'How does the brain create the mind?' (Kilic, 2020).

This approach differs from deductive and inductive reasoning by primarily examining not the parts but the relationships between the parts. This relational coding of parts processes information. In the Descartes-Bacon-Newton science, which shaped our current civilization, the building block of the physical universe is the atom, of the biological universe is the cell, of the brain is the neuron, and of language is words. However, in the concept of connectivity and holism, information is fundamental in all whole-part relationships. The brain, comprising about 100 billion neurons, is not only itself but the entirety of an information system with 2 raised to the power of 100 billion possibilities that creates consciousness. This perspective views the brain as an organ that generates the mind. In short, thought, gene, belief, and matter are subordinate; the whole, the mind, or life is more than the sum of its parts. According to Türker Kılıç, humanity might escape the illusion of possession with this new understanding, potentially leading to a society shaped by the approach 'not life for humans, but humans for life' (Kilic, 2020).

The systemic paradigm marks a significant departure from the fragmented, mechanistic worldview that has dominated scientific and societal thought. By recognizing the inherent interdependence between humans, nature, and all systems, this approach fosters a deeper understanding of equality and sustainability. This paradigm reflects a necessary shift towards a systemic framework that not only responds to the crises of the Anthropocene but also redefines humanity's place within the complex web of life, advocating for reciprocal relationships over exploitation.

Chapter 7

Conclusion

Throughout history, scientific paradigms have not only shaped how humans perceive and interact with nature, but have also fundamentally interacted with society. This research set out to explore the ways in which the Mechanistic Paradigm fostered a worldview of dominance over nature, and how the emerging Systemic Paradigm offers a necessary shift toward sustainability and interconnectedness. The study has examined the influence of scientific paradigms on human-nature relationships and the role these paradigms play in shaping socio-political and economic spheres throughout history. By focusing on the transition from the Mechanistic to the Systemic Paradigm, this research highlights the shift from a worldview of dominance over nature to one that fosters reciprocal relationships.

Human-nature relationship is among the most fundamental factors shaping the structure of world history and form the core of the paradigms that shape the society. Today's dominant Mechanistic Paradigm, with its approach based on fragmentation, categorizes and approaches the structure of world history within its conceptual framework and historical narrative. However, paradigms are shaped in the context of a dialectical relationship between society and science. When considering that the essence of society is based on human-nature relations, assuming nature as a commodity that can be converted into capital lays the foundation for economic and social inequalities. In this process, humans have also become commodities within the production and consumption chain. The commodification of everything has allowed technological and economic developments to overshadow potential consequences in other segments in society.

The study analyzed the development of the Mechanical Paradigm from the 16th century onwards, particularly through the contributions of figures such as René Descartes, Francis Bacon, and Isaac Newton to address the second research question.

The findings revealed that the mechanistic view, which treats nature as a machine to be dominated, has permeated various aspects of society; including science, politics, economics, and law. This paradigm has significantly influenced human progress and environmental exploitation, leading to significant environmental degradation, resource depletion, and biodiversity loss.

The Scientific Revolution led to advances in humanity's domination over nature. Scientific discoveries and inventions were utilized to enhance trade and industry, intensify economic and social inequalities, develop warfare technologies, and conduct colonial endeavours. Although the impact of the Mechanistic Paradigm on human-nature relations has been significant since the Scientific Revolution, its real effects on nature became more pronounced following the Industrial Revolution. Historically, behaviours based on the unequal distribution of production surplus, accompanied by private property structures generating wealth, led to political and legal structures that reinforced human dominance over nature. However, until the Mechanistic Paradigm and the Scientific Revolution, this dominance was predominantly political and legal, lacking a tangible counterpart in terms of its impact on nature. The realization of this relationship in nature, as a consequence of viewing nature as a machine to be commodified and exploited under the Mechanistic Paradigm, led to irreversible damage and brought about a new geological era solely due to human intervention. In other words, the real consequences of human domination over nature manifested its influence on nature through the scientific paradigm shift, since science is the method of understanding and interacting with the nature.

Human dominance over nature, manifested through the conversion of production surplus into wealth and the establishment of private property, created economic and social inequalities. This led to the continuous enrichment of certain individuals and institutions within the emerging hierarchical order, fostering ambitions and needs for management and protection. This, in turn, led to the rise of a class that could create political and legal changes in line with their interests, solely due to their economic superiority. The dominance of the economic domain over other societal areas has become evident, leading to the emergence of the Mechanistic Paradigm, which supports the limitless needs for commodities, individualization, and free trade. The

idea of human dominance over nature is historically observable since the transition to sedentary life, but the view of nature as a machine rather than an organic structure is an extension of this approach, becoming prominent with the Scientific Revolution.

The study also aimed to highlight the dialectical relationship between science and society, demonstrating that scientific paradigms are shaped not only by sequential discoveries but also by the socio-cultural needs and general mindsets of the time. The analysis confirmed that the dominance of scientific paradigms is intrinsically linked to their ability to address the socio-economic structures and needs of their respective eras. This perspective, rooted in the theories of Kuhn and Capra, underscores the reciprocal influence of scientific thought and societal development.

As Thomas Kuhn suggests, the identification of anomalies within the current scientific paradigm and the need to choose between opposing scientific views is not merely a scientific process but is also dependent on the socio-cultural beliefs of scientists and society. Thus, a person's general mindset in scientific thought influences the emergence of scientific knowledge. The mechanistic structure, focused on economic development, has led to political, social, and cultural areas becoming reflections of the economic foundation.

According to Fritjof Capra, the outcomes of the mechanistic structure applied to common assets are quite harmful to humanity. Beyond direct environmental issues like pollution and deforestation; public facilities, schools, state radios and televisions, and other infrastructure are privatized and managed with the short-term, resource-exploitative perspectives of corporations. These societal and environmental issues are challenging and time-consuming to resolve, thus not reflected in the policies of politicians who operate within short-term election cycles and focus on rational choice theory for re-election.

At this point, humans have significantly altered the cycles of elements essential for life in nature, leading the world towards a new extinction, as indicated by Steffen et al. (2004). As humanity is coming to realize, the fundamental position of human-nature relations in the structure of world history stems from humans' essential need for

nature to survive. Under the mechanistic order, nature has undergone massive destruction, and ecological research has shown that nature cannot sustain this exploitative system for long. According to Hess, the relationship between humans and nature is reciprocal, a type of metabolism. Kojin Karatani suggests that humanity is nearing the end of commodity exchange and the reciprocity, evolving from the principle of reciprocity rooted in ancient history, will emerge. This reciprocity will be a synthesis of the previous three modes of exchange. The scientific paradigms are also applicable in this context. The nation, defined as Mode A, corresponds to reciprocity and a shared life in human-nature relations during the period of organic view of nature, concretized in clan communities living a communal life. The state, defined as Mode B, represents the abandonment of organic view, the transition from philosophical scientific research to the acceptance of atoms and elements, and the commencement of analyzing nature by dividing it into parts; bringing private property, protection, and governance. The emergence of Mode C exchange through the scientific revolution that blossomed from Mode B signifies a completely mechanistic relationship between humans and nature, where nature is viewed as a commodity for exploitation.

Karatani has indicated a transition to a new world order through a new mode of exchange, but has not fully illustrated how this transition will take place. The influence of scientific revolutions on the structure of world history shows a significant alignment with Karatani's discussed forms of exchange. Just as in the past, the transition to Mode D will be possible through the adaptation of scientific paradigm shifts to our political, social, cultural, and economic life.

Just like the emergence of Mode C, the principle of reciprocity in Mode D which is essential for creating an order where humans can coexist with nature, requires adapting the scientific paradigm shift into the society. According to Kuhn's theory of scientific development, humanity is currently transitioning from a crisis period to a period of scientific revolution. Karatani points out that the transition to Mode D requires a cognitive change in human-nature relations, necessitating an end to treating nature and each other as mere tools. Scientific paradigm shifts fundamentally transform the relationship between humans and nature; forming the political, social, and economic foundations of their universe. The society can reinstate the principle of

reciprocity in Mode D through a scientific revolution. So far, examining the historical process, it's evident that the approach adopted in human-nature relations has impacted humans politically and legally, and nature scientifically and philosophically. Therefore, humanity needs a new scientific paradigm that respects the ecological values aimed to develop, advocates for equality, and shapes nature based on a societal structure that shapes the economy.

As Thomas Kuhn mentioned, scientific paradigms emerge in line with the socio-cultural and economic needs of the era. The needs met by the Mechanistic Paradigm when it emerged have become today's problems. On the other hand, the emergence of a new paradigm is directly related to the failure of the current paradigm to meet the needs of its time. In this context, the emergence of the systemic paradigm, which has been revealing itself for about 30 years, demonstrates that the Mechanistic Paradigm fails to meet today's needs.

To answer the third research question, the study evaluated the rise of the Systemic Paradigm and its potential to transform human-nature relations. By exploring recent developments in biology, physics, and environmental sciences, the study highlighted how systems thinking, which views nature as an interconnected web of relationships, is fostering a more holistic and sustainable approach to human-nature interactions. This paradigm shift emphasizes interconnectedness, ecological balance, and long-term sustainability.

The systemic paradigm, becoming prominent in science over the last 30 years, can arguably be shaped by the urgent need to create an ecological world. This paradigm's approach to studying nature involves analyzing living systems, including individual organisms, their parts, and organism communities like ecosystems. Consequently, systemic thinking, with its interdisciplinary nature, suggests a fundamental understanding that nature sustains life not through exploitation but through a series of ecological principles. From the human perspective, reality should be viewed not as a collection of individual building blocks but as a whole composed of social networks and communities. Thus, the systemic paradigm, emerging from the integration of various political, legal, and scientific approaches across different times

and disciplines, presents itself as the paradigm that will facilitate the reassignment of the reciprocal relationship between humans and nature.

In conclusion, the study answered the research questions by providing a historical and interdisciplinary analysis of the evolution of scientific paradigms and their impact on human-nature relations. The hypotheses posited at the outset have been substantiated through the findings. The study confirms that the mechanistic paradigm has led to ecological disasters and that a shift to the systemic paradigm is crucial for fostering sustainable human-nature relations. By emphasizing the dialectical relationship between science and society and incorporating interdisciplinary insights, this research contributes to the ongoing discourse on environmental sustainability and the importance of adopting the Systemic Paradigm that emphasize interconnectedness and holistic thinking.

Future research should continue to explore the systemic paradigm's potential for transforming human-nature relations, with a focus on developing practical applications for governance, economics, and ecological management. While this study has primarily focused on the historical development and theoretical framework of paradigm shifts, further investigation is needed into how the systemic paradigm can be integrated into current global policy frameworks. Additionally, future research should address the challenges of shifting societal mindsets and overcoming resistance from entrenched economic interests that benefit from the mechanistic worldview. By studying how interdisciplinary approaches can be practically applied across different segments of society, future research can help guide the transition to a more sustainable and equitable world.

REFERENCES

Acemoglu, D. (2015). Why nations fail?. The Pakistan Development Review, 54(4), 301-312.

Armstrong, J. S., Botzler, R. G. (1993). Environmental Ethics: Divergence and Convergence, McGraw-Hill, New York.

Benneh, G. (1973). Small-Scale Farming Systems in Ghana1. Africa, 43(2), 134-146.

Berryman, S. (2005). Ancient atomism.

Bloch, M., & Koziol, G. (2014). Feudal society. Routledge.

Boehm, C. (2001), Hierarchy in the Forest: The Evolution of Egalitarian Behavior. Cambridge, MA: Harvard University Press.

Bookchin, M. (1982). The ecology of freedom (p. 232). Naperville, IL: New Dimensions Foundation.

Buber, M. (1970). I and Thou (Vol. 243). Simon and Schuster.

Capra, F., (1975). The tao of physics. London: Wildwood House.

Capra, F. The Turning Point: Science, Society, and the Rising Culture (Simon and Schuster, New York, 1982)

Capra, F. 'The Concept of Paradigm and Paradigm Shift', in Re-Vision, 9 (1), 1986

Capra, F., & Luisi, P. L. (2014). The systems view of life: A unifying vision. Cambridge University Press.

Capra, F., & Mattei, U. (2015). The ecology of law: Toward a legal system in tune with nature and community. Berrett-Koehler Publishers.

Castells, M. (1996). The information age: Economy, society and culture (3 volumes). Blackwell, Oxford, 1997, 1998.

Childe, V. G. (1950). The urban revolution. The town planning review, 21(1), 3-17.

Cornford, F. M. (2004). From religion to philosophy: a study in the origins of western speculation. Courier Corporation.

Crutzen, P. J., & Brauch, H. G. (Eds.). (2016). Paul J. Crutzen: a pioneer on atmospheric chemistry and climate change in the Anthropocene (Vol. 50). Springer.

Crutzen, P. J., & Stoermer, E. F. (2021). The 'Anthropocene'(2000). Paul J. Crutzen and the anthropocene: A new epoch in earth's history, 19-21.

Daston, L., & Stolleis, M. (2008). Introduction: Nature, law and natural law in early modern Europe. Natural law and laws of nature in early modern Europe: Jurisprudence, theology, moral and natural philosophy, 1-12.

Davies, N. (2014). Europe: A history. Random House.

Dunn, J. (1996). The History of Political Theory and other essays. Cambridge University Press.

Dryzek, J. S., Honig, B., & Phillips, A. (2008). The Oxford handbook of political theory. Oxford University Press.

Eiseley, L. C. (1956). Charles Darwin. Scientific American, 194(2), 62-76.

Erçandırlı, Y. (2019). Antroposen Çağında Marx ve Eko-Marksizm (ler): Toplum-Doğa İlişkisinin Diyalektiği. Praksis, 50(2).

Fikri, G. Ü. L. (2013). İnsan-doğa ilişkisi bağlamında çevre sorunları ve felsefe. Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, (14), 17-21.

Fried, M. H. (1967), The Evolution of Political Society: An Essay in Political Anthropology. New York: Random House.

Friedman, L. M. (2005). A history of American law. Simon and Schuster.

Gill, M. L., & Pellegrin, P. (Eds.). (2009). A companion to ancient philosophy. John Wiley & Sons.

Grierson, D. (2009). The shift from a mechanistic to an ecological paradigm. International Journal of Environmental, Cultural, Economic and Social Sustainability, 5(5), 197-206.

Goodin, R. E. (Ed.). (2009). The Oxford handbook of political science. OUP Oxford.

GÜLMEZ, D. B., & DİKMEN, B. A. (2022). Gezegensel siyaset manifestosunun ardından yeşil teorinin uluslararası ilişkilerdeki konumu. Uluslararası İlişkiler Dergisi, 19(76), 19-38.

Hall, J. R. (Ed.). (1997). Reworking class. Cornell University Press.

Hallowell, A. I. (1960). Self, society, and culture in phylogenetic perspective. S. Tax, S., The Evolution of Man. Man, Culture, and Society. Vol. II of Evolution after Darwin, Chicago and London (The University of Chicago Press) 1960, pp. 309-372.

Hanly, C. (1988). From animism to rationalism. In Philosophy, History and Social Action: Essays in Honor of Lewis Feuer with an autobiographic essay by Lewis Feuer (pp. 221-234). Dordrecht: Springer Netherlands.

Harvey, G. (2005). Animism: Respecting the living world. Columbia University Press.

Held, D., & McGrew, A. (2007). Globalization/anti-globalization: Beyond the great divide. Polity.

Henry, J. (2011). A short history of scientific thought. Bloomsbury Publishing.

Hertz, N. (2002). The silent takeover: Global capitalism and the death of democracy. Simon and Schuster.

Hess, M. (1845) On the Essence of Money. trans. Julius Kovesi, in Julius Kovesi. Values and Evaluations (New York: Peter Lang, 1998), 185.

Hilton, R. (1976, March). Feudalism and the Origins of Capitalism. In History Workshop Journal (Vol. 1, No. 1, pp. 9-25). Oxford University Press.

Holmes, G. (Ed.). (2001). The Oxford illustrated history of medieval Europe. Oxford Illustrated History.

Karatani, K. (2014). The structure of world history: From modes of production to modes of exchange. Duke University Press.

Kilic, T. (2020) Yeni Bilim: Baglantisallik Yeni Kultur: Yasamdaslik. Ayrinti Yayinlari

Klein, N., & Smith, N. (2008). The shock doctrine: a discussion. Environment and Planning D: Society and Space, 26(4), 582-595.

Kochan, J. (2021). Animism, Aristotelianism, and the Legacy of William Gilbert's De Magnete. Perspectives on Science, 29(2), 157-188.

Kuhn, T. S. (1963). The function of dogma in scientific research.

Kuhn, T. S. (1982). Bilimsel devrimlerin yapisi. Alan.

Kuhn, T. S. (1982). Commensurability, comparability, communicability. In PSA: Proceedings of the biennial meeting of the Philosophy of Science Association (Vol. 1982, No. 2, pp. 668-688). Cambridge University Press.

Lloyd, G. E. R. (1968). Aristotle: the growth and structure of his thought (Vol. 456). Cambridge University Press.

Lynch, J. (2014). The medieval church: a brief history. Routledge.

Martin-Merino, M. (2020). The origins of scientific thought.

Martin, J. (1992). Francis Bacon, the state and the reform of natural philosophy.

Marx, K. (1996). Das Kapital (F. Engels, Ed.). Regnery Publishing.

Marx, K., & Engels, F. (1975). Karl Marx, Frederick Engels: Collected Works. (No Title).

Maturana, H. R., & Varela, F. J. (1991). Autopoiesis and cognition: The realization of the living (Vol. 42). Springer Science & Business Media.

Mauss, M. (2000). The gift: The form and reason for exchange in archaic societies. WW Norton & Company.

Michelet, J. (1855). Renaissance. Chamerot.

Merriman, J. (2009). A history of modern Europe: from the Renaissance to the present (Vol. 1). WW Norton & Company.

Moore, J. W. (2003). Nature and the Transition from Feudalism to Capitalism. Review (Fernand Braudel Center), 97-172.

Newcomb, G. B. (1886). Theories of property. Political Science Quarterly, 1(4), 595-611.

Polanyi, K. (2002). The great transformation. Readings in economic sociology, 38-62.

Roberts, J. M., & Aytuna, F. (2010). Avrupa tarihi. İnkılap Kitabevi.

Rodis-Lewis, G. (1978). Limitations of the mechanical model in the Cartesian conception of the organism. Descartes: Critical and interpretive essays, 152-70.

Russell, B. (2004). History of western philosophy. Routledge.

Sander, O. (2006). Siyasi tarih: İlkçağlardan 1918'e. İmge Kitabevi.

Şenel, A. (1982). Siyasal düşünceler tarihi: Tarihöncesinde ilkçağda ortaçağda ve yeniçağda toplum ve siyasal düşünüş. Ankara Üniversitesi Siyasal Bilgiler Fakültesi.

Smuts, J. C. (1931). The Overthrow of the Mechanistic Theory. Journal of the Royal Astronomical Society of Canada, Vol. 25, p. 413, 25, 413. Book Series. Berlin, Germany: Springer.

Spruyt, H. (2002). The origins, development, and possible decline of the modern state. Annual review of political science, 5(1), 127-149.

Steffen, W., Grinevald, J., Crutzen, P., & McNeill, J. (2011). The Anthropocene: conceptual and historical perspectives. Philosophical Transactions of the Royal

Society A: Mathematical, Physical and Engineering Sciences, 369(1938), 842-867.

Steffen, W. et al. 2004 Global change and the earth system: a planet under pressure. The IGBP

Sweezy, P. M., & Dobb, M. (1950). The transition from feudalism to capitalism. Science & Society, 134-167.

Tomich, D. (1997). World of capital/worlds of labor: A global perspective. Reworking class, 287-311.

Trigger, B. G. (2003). Understanding early civilizations: a comparative study. Cambridge University Press.

Tylor, E. B. (1871). Primitive culture: Researches into the development of mythology, philosophy, religion, art and custom (Vol. 2). J. Murray.

Uluslararası ilişkiler teorileri. İletişim Yayınları, 2019.

Unger, R. M. (1976). Knowledge and politics. Simon and Schuster.

Unger, R. M. (1987). Politics: Volume 3, Social Theory: Its Situation and Its Task: A Work in Constructive Social Theory. CUP Archive.

Varvis, S. (1983). Humanism and the scientific revolution: Bacon's rejection of Aristotle. Comitatus: A Journal of Medieval and Renaissance Studies, 14(1).

Warren, J. (2014). Presocratics. Routledge.

Weber, M. (2013). The agrarian sociology of ancient civilizations. Verso Books.

Widerquist, K., & McCall, G. (2021). The Prehistory of Private Property: Implications for Modern Political Theory. Edinburgh University Press.

Wittfogel, K. A. (1957). Chinese Society: An Historical Survey1. The Journal of Asian Studies, 16(3), 343-364.

Wood, E. M. (2002). The origin of capitalism: A longer view. Verso.

Yıldırım, C. (2014). Bilim tarihi. Remzi Kitabevi.