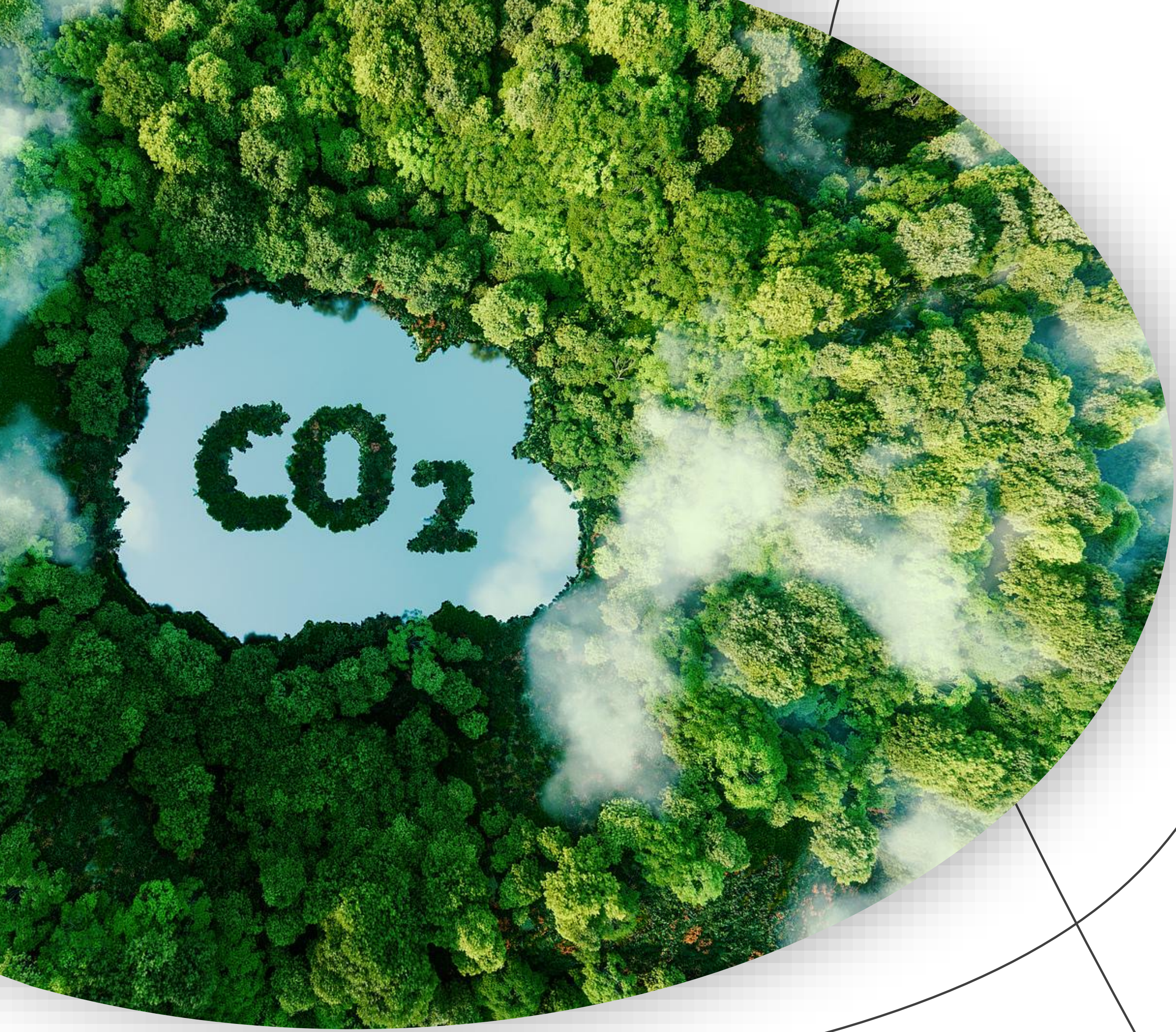

Exploring Metaphors of Carbon Market

Master thesis by Sun Xu,1354639

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Supervisor: Marko Lovric

Forest and Nature Conservation Policy Group, Wageningen University and Research

ABSTRACT

With the various initiatives proposed in response to global climate change, carbon markets function as a core governance tool for reducing greenhouse gas emissions. Their complex and technical mechanisms result in limited public understanding. Metaphors used in news reporting help explain these mechanisms and influence public perceptions. This study examines how carbon markets are metaphorically constructed in news discourse to understand how this technical policy instrument is conceptualized.

It uses qualitative content analysis and is grounded in Conceptual Metaphor Theory (CMT). The corpus consists of 1,350 English-language news articles collected from Nexis Uni. Metaphor Identification Procedure (MIP) was strictly applied, and the Gioia methodology was used to group and aggregate the identified metaphors. A total of 241 conceptual metaphors were identified, with structural and ontological metaphors being dominant. Six main metaphor themes were identified: STRENGTH, PITFALL, JOURNEY, GOLDMINE, LIVING ENTITY, and MACHINE. The metaphors of STRENGTH present the market as a foundation or driver sustaining climate governance, while the PITFALL metaphors reveal its perceived instability, risk, and political fragility. JOURNEY metaphors envision the market as a collective pathway toward decarbonization, while the GOLDMINE metaphors highlight its economic promise and investment potential. The LIVING ENTITY and MACHINE metaphors emphasize the capacity of the market for growth, adaptation, and regulation but also its dependence on maintenance from outside.

These metaphors support a dual narrative: carbon markets as a reliable governance tool and as a dynamic field marked by risks and opportunities. The findings show that metaphors act as explanatory tools that make this abstract concept more comprehensible. They also frame carbon markets as a foundation for climate action as legitimacy functions and shape expectations among the public and investors as mobilization functions.

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1 Introduction

1.1 Background

The increasing carbon dioxide and other greenhouse gases (GHG) have made irreversible climate change, which makes GHG emission is one of the most pressing issues now (Stein, 2024). Climate scientists predict that if GHG emissions cannot be significantly reduced, temperatures will rise by 1.5 to 3°C by the end of this century (Masson-Delmotte et al., 2021). The special report *Global Warming of 1.5℃*, released by the IPCC in 2018, warns that exceeding 1.5°C of warming will cause droughts, floods, heatwaves, and rise sea levels, threaten humans and biodiversity (Ipcc, 2022). The United Nations Framework Convention on Climate Change (UNFCCC), together with its subsequent agreements such as the Kyoto Protocol (1997) and the Paris Agreement (2015), provides the international framework for addressing GHG emissions. Within these frameworks, carbon markets function as one of the policy instruments to reduce emissions, particularly carbon dioxide. To achieve the necessary emission reductions, carbon markets have become a key component of greenhouse gas reduction instrument in many countries due to their cost-effectiveness compared to alternative approaches such as regulatory controls or subsidies for low-carbon technologies (Olsen et al., 2022).

Currently, there are two types of carbon markets: the voluntary market and the compliance market (Ahonen et al., 2022). The voluntary market generates most carbon credits, yet its scientific legitimacy is debated. The compliance market applies complex accounting to manage permanence, leakage, double counting, and additionality. Both markets face limited investment due to high transaction costs and strict verification requirements (Maguire, 2011). Despite these differences, both also aim to offset carbon emissions or increase carbon removal through the generation and trading of carbon credits (Kaarakka et al., 2023). The development of carbon markets has primarily been driven by compliance requirements, making the compliance market ($968 billion in 2022) significantly larger than the voluntary carbon market ($1.7 billion in 2022) (Betz et al., 2022; World bank group, 2024).

Currently, there are 75 carbon tax and Emissions Trading Systems (ETS) worldwide, which are primarily part of compliance carbon markets(World bank group, 2024). As of April 1, 2024, the operational ETS and carbon taxes cover nearly 13 billion tons of carbon dioxide (CO_2)

equivalent, accounting for approximately 24% of global greenhouse gas emissions. In fact, for many jurisdictions, the cap under ETS is gradually decreasing, meaning the level of covered greenhouse gas emissions declines over time, demonstrating that carbon pricing can help reduce emissions to some extent (Koumpli, 2024; World bank group, 2024).

1.2 Problem statement

The carbon market is not just a tool for combating climate change but also a complex global financial market (Newell et al., 2013). Traditional economic models think about markets as rational systems in which participants make decisions on the principle of maximum utility. Prices are supposed to reflect the real existing value of a product (Lo, 2004; Lux & Alfarano, 2016). However, this view is clearly insufficient for understanding carbon markets. In the carbon market there is well-organised stages, such as the creation, verification, trading, and regulation of carbon credits. Each stage is not only shaped by policy, technology, economics, and social dynamics, but also subjective and cultural aspects of how markets are perceived and experienced (Ji et al., 2018). Moreover, external driven and internal nonlinear dynamics with network effects make the market difficult to fully comprehend (Sergeev, 2006).

A new approach to explore the complexity of markets by using metaphors is available. Metaphors are a linguistic device that concrete abstract notions and offer a light on how to understand the market framework. In this way, researching metaphors of the carbon market provides valuable insights into how this specific market is conceptualized and understood. Metaphor widely present in academic discussions and policy circles, which is also embedded in public discourse (Lakoff & Johnson, 1980a). Diving into metaphors used in public discourse, the concept of carbon market could be understood by people, by which they can make decisions about it. For example, policymakers, market participants and the public can use interpretation of the metaphors to help with better comprehend market dynamics and more informed decisions (Mintz & Terris, 2024). So indispensably metaphors have practical implications for shaping the carbon market.

Previous studies have explored market metaphors across various domains and languages. Chung (2005) compared the differences in market metaphors across three languages English, Malay, and Chinese. Oberlechner (2004) described how market participants conceptualize the foreign exchange market through metaphors and examined how these metaphors socially construct financial markets. Morris (2007) focused on analysing the metaphors of subject(investors or traders) and object(stocks, shares, or market trends) in stock market commentaries. This study seeks to address this gap by analyzing metaphorical expressions in English news coverage of the carbon market. Because news media are a key site where metaphors circulate and gain traction. with identifying and interpreting the metaphors used in emerging environmental market, the study also wants to reveal how metaphorical mechanisms make the carbon market intelligible to the public.

1.3 Research objectives and questions

This study explores metaphors used in English-language news to describe the carbon market, aiming to gain deeper insights into the complex dynamics of how understanding and communication shaping the carbon market. The main research question is the following:

What metaphorical expressions are used to describe the carbon market in English news, and in what ways do these metaphors shape public understanding of the market?

To address this primary research question, we will investigate the following two sub-questions:

1. *What are the most common metaphors used in English-language news articles about the carbon market?*
2. *How do these metaphors conceptualize the carbon market?*
3. *What are the implications of these metaphorical framings for public understanding and engagement with the carbon market?*

2 Theoretical Framework

This chapter builds the conceptual and methodological foundation of the thesis. Section 2.1 reviews different definitions of market and practice-based perspectives. Section 2.2 introduces the carbon market as a market-based environmental policy tool and explains how carbon credits and trading work. Sections 2.3 & 2.4 trace the development of metaphor theories, with focus on Metaphor Theory as the study's main framework. Section 2.5 discusses the role of metaphors in economic, ecological, and public discourse, providing a basis for the later analysis of metaphors in the carbon market.

2.1 Different views on markets

Markets typically involve elements such as demand, buyers and sellers, competition, and exchange (Rosenbaum, 2000). However, when we refer to these elements, we are not necessarily talking about the market in the straightforward sense typically conveyed. In economics and the social sciences, the concept of market is a term with multiple meanings and complexities (Hoogstra-Klein, 2013; Rosenbaum, 2000). Some economists believe that markets are spontaneously emerging social phenomena, which can operate freely as long as property rights and price mechanisms are clearly established (Kornai, 1994). Under this perspective, markets spontaneously arise.

However, Rosenbaum (2000) argues that the market do not emerge emerge of their own across all social and historical contexts. With the aim to explore all kinds of definitions of markets within the context of the competitive societies, he divided the definition of markets into three main categories: 1) observational, 2) functional, and 3) structural (Rosenbaum, 2000).

The *observational* definition of markets is based on observable empirical phenomena, usually involving price or the act of exchanging goods. Early markets were considered physical spaces where transactions occurred (Rosenbaum, 2000). Two centuries ago, markets were perceived as zones of interaction where frequent exchanges between buyers and sellers led to swift price convergence. Later, this concept evolved into a similar definition, describing markets as 'areas where buyers and sellers negotiate transactions for specific goods'(Lipsey, 1983, p. 69). However, in the context of globalization, the notion of a market has expanded far beyond physical spaces such as town squares or the customary Saturday market and is no longer confined to a specific geographic area. In many definitions, the market is seen as the interface between buyers and sellers. The carbon offset market is an example, as it is not restricted by geographical boundaries. Jevons (1871) in his book *theory of political economy* defined the market as "any group of people who are in close business relations and engage in extensive transactions in any commodity" In this definition, the transaction remains something that can be observed, including transaction itself, along with the relationship networks and negotiation processes within the market community.

As the space for international trade expanded, along with the lengthening of supply and distribution chains and the increasing presence of intermediaries (Cetina, 2006), the direct observation of product exchanges became less meaningful. This led to the emergence of *functional* definitions. In traditional orthodox economics, the market is seen as distribution mechanism, similar to Adam Smith's (1759) concept of the INVISIBLE HAND. Through supply and demand relations, markets determine relative prices and attain an efficient allocation of goods and resources. Neoclassical economic literature further specifies that, conceptually, the market can be perceived as a system whose function is to accomplish an efficient allocation of goods, resources, and services through supply and demand (Rosenbaum, 2000). Demand reflects the quantity of resources consumers are willing to purchase at a given price since the higher the price, the lower the demand. Supply represents the quantity of goods producers are willing to provide at a given price-the higher the price, the more goods are supplied. The interrelation between supply and demand jointly determines how resources are allocated within a market. If supply and demand are in equilibrium, the market is said to be in balance, and resources are allocated in the most efficient manner. The market is never in equilibrium, as prices and quantities continuously fluctuate until supply equals demand and the market returns to equilibrium (Hoogstra-Klein, 2013). This is also reflected in Walras' general equilibrium theory, in which the market is conceptualized as a hypothetical relationship between supply and demand (curves) rather than as something tangible. It lacks institutional, spatial, or social aspects, and each market is considered an interlinked part of the economy, determining conjointly the relative prices of goods and the allocation of resources (Bridel, 2013).

Although the functional definition shows the vital role of the market, it usually neglects the particular institutions and mechanisms that underpin market operation (Rosenbaum, 2000). Thus, the *structural* definition attempts to complete the above deficiency, focusing on how social institutions, mechanisms, and networks contribute to market formation and functioning (Rosenbaum, 2000). Trust and relationships in this context have a great part in being the ground for uncertainty reduction and the building of cooperation between market participants. This type of definition goes beyond the simple transaction level, trying to analyse the structures that support the markets to operate, including legal frameworks, contractual systems, or social trusts. Hodgson's definition (Hodgson, 1988) belongs to the last category, defining the market as "a system of exchange constituted by numerous social institutions" and trying to show how these institutions affect market phenomena. Similar conclusions are explained in Akerlof's article "The market for Lemons". The model of Akerlof (Akerlof, 1970) illustrated how information asymmetry disrupts the efficiency of the market and how the efficient social mechanisms such as laws, contracts, and trust could remove these failures. Information asymmetry occurs when one party holds more information than the other in a transaction (Lewis, 2011). Using the used second-hand car market as an example, there is the existence of sellers having more information about the condition of the car than buyers of the car. This causes mistrust from the buyers, resulting in adverse selection and gradual elimination of good cars from the market. Markets are not just mere transactions between buyers and sellers; they incorporate social institutions such as contracts, regulation, and reputation mechanisms that may decrease the risks of asymmetry in information and, at the same time, enhance the efficiency of markets (RosenSbaum, 2000).

In recent decades, markets as practices have also emerged in market research, with two major theoretical orientations. The first one is Market Performativity Theory, which is inspired by the theory of sociological translation by Callon's (1998) and was referred by scholars such as Kjellberg and Helgesson. Under this orientation, market is seen as dynamic order including three types of practices: exchange practices (specific activities of goods exchange), normalization practices (activities that establish market rules), and representational practices (activities that depict markets and their operations) (Andersson et al., 2008; Araujo et al., 2008; Kjellberg & Helgesson, 2006). The theory considers markets are regulated by dynamic elements like rules, tools, and measurements. It was applied to fields such as retail transformation, the analysis of obstacles in market formation, and electricity market restructuring (Hoogstra-Klein, 2013). Nevertheless, first orientation has a tendency to break down markets into independent constitutive elements of practice that cannot fully capture the complexity of markets as holistic systems (Hoogstra-Klein, 2013). The second orientation Market Constructionist Approach, proposed by Smith defines markets as evolving social practices. Considering them as dynamic and social constructed phenomena where the WHO (participants), WHAT (objects of exchange) and HOW (modes of exchange), this perspective emphasizes the nature of markets are not fixed but are continuously generated and adjusted in specific contexts (Smith, 2007a, 2007b). Compared to the first one, this approach goes beyond the analytical framework of decomposing practices, focusing more on the social and evolutionary dimensions of markets. It provides a holistic and dynamic way to approaching markets. (Hoogstra-Klein, 2013).

Given all above, we can define markets from three perspectives. Choosing a particular market definition is not about being right or wrong, but about selecting what fits the current purpose. The concept of a market is essentially a normative narrative, shaped by the specific objectives at hand. In some cases, the market is viewed as an exchange system, though certain forms of social exchange, such as bartering or gift-giving, are not considered "market-based" (Hoogstra-Klein, 2013). In its most fundamental sense, a market involves buying and selling through a common medium of exchange-money-and voluntary, specified transactions. These involve defining the characteristics of what will be exchanged, free and voluntary acceptance between trading partners, and the ability by each party to leave the deal (Rosenbaum, 2000). For instance, in second-hand car sales, information asymmetry often prevents buyers from fully knowing the condition of the car, and with time, the quality deteriorates and the age of the vehicle becomes a factor in estimating price or quality. Based on past market trends, pricing becomes more transparent, leading to clearer transactions(Rosenbaum, 2000). However, in gift exchanges, such clarity is absent, as these are based on general expectations of reciprocity rather than precise definitions of value or price. For instance, in second-hand car business, buyers and sellers have the rights to exit the transaction. While in long-termism economies, transactions are usually enforced by authority, lacking voluntariness (Rosenbaum, 2000).

However, in real market dynamics there is more than voluntariness. A further prerequisite would be typification and regularity. Firstly, Typification refers to the repetition of similar characteristics across transactions, enabling stable price and quality expectations (Rosenbaum, 2000). Secondly, Regularity refers to the stability of these characteristics over time, providing a solid foundation for economic analysis. Without regularity, market transactions become dissociated from one another, and no meaningful economic pattern might be tracked. Because of that, the market analysis should consider not only individual transactions but also wider patterns of repetition and predictability. Additionally, as Georg Simmel (Simmel, 2008) described, competition goes beyond buyer-seller numbers. It arises from information asymmetry and strategic interactions between economic agents. This makes the perfect competition difficult to achieve, as market participants seek to leverage informational advantages, such as technology or preferences. So, they can reach competitive edge. Competition both influences prices and trading opportunities and drives market dynamics. As was mentioned above, typification and regularity allow prices to reflect both characteristics of the product being traded and market expectations, while competition interferes with this process. Both sides of demand and supply compete for the best trading circumstances, leading to increased volatility in prices and shifts in supply-and-demand relationships. For example, used cars tend to follow general patterns of pricing according to age, while competition through bargaining or additional services could introduce price volatility.

2.2 Carbon Market as Market-based instruments

The worsening environmental problems and the increasing public awareness of environmental protection have significantly raised the demand of governments and various sectors for more effective and cost-efficient environmental management tools. Traditional command-and-control environmental approaches are often inefficient and lack flexibility. They focus essentially on compliance with the set target, with little incentive to go beyond that. Moreover, most command-and-control measures specify technology and thus reduce the incentive to search for cheaper or more efficient alternatives. The incentives that drive innovation align with those that promote cost savings. Market-based instruments (MBIs), through incentive mechanisms, enable actors to adjust according to their specific situation and, consequently, lower the overall societal cost of reaching environmental objectives (Pirard, 2012). The advancement of information technology, particularly the widespread adoption of the internet, has drastically reduced the costs of information exchange and transactions in environmental management, making MBIs more feasible and effective.

MBIs function within a hybrid governance framework. MBI is often used alternately with economic instruments, incentive-based tools, or payments for ecosystem services (PES) (Pirard, 2012; Shen et al., 2023). In general, MBIs are policy instruments or regulations that use market signals to incentivize behavior rather than command controls. Non-Like traditional markets, they can generate incentives through innovations, profit-making opportunities, and possibilities for avoiding penalties. As a results, good MBIs offer governments a lower cost for achieving environmental results and higher flexibility for landowners at lower costs of compliance. It aligns the goals of improving the environment with the objectives of both public administrations and private actors (Shen et al., 2023). Benjaminsen and Kaarhus (2005) provide evidence from Tanzania, where a national organization acts as carbon aggregator, assisting local communities in reducing opportunity costs (Shen et al., 2023). Similarly, in China’s Grain for Green Program, the government provides farmers with incentives, including both monetary and in-kind benefits.

The carbon market as representative example of MBIs, utilize economic incentives to encourage entities to adopt sustainable behaviours and achieving emission reduction goals (Shen et al., 2023). Carbon market includes mechanisms such as carbon taxes, emissions trading systems and carbon offsets. It operates through market-driven supply-demand framework (Bleuel, 2024). So it means that high-emission entities can purchase carbon credits from those with the capability to reduce emissions, also known as carbon allowance. They mediate the balance between entities that must reduce emissions and those that can do so at lower cost. This system activates MBIs' economic incentives, compelling high emitters to pay for excess emissions while rewarding entities with reduction capabilities (Taguchi, 2022).

Carbon markets define carbon credits as tradable certificates. These credits are intangible and cannot be directly observed or handled. Their valuation is complex, even when linked to specific projects or reduction measures. They appear as digital records or verification documents that confirm and quantify reduced or absorbed carbon dioxide equivalents (CO2e). One credit equals one ton of CO2e mitigated. For example, as the most common within the carbon market, forest carbon projects generate the majority of carbon credits.Forests absorb around 4 billion tons of CO_2 annually which cover approximately 31% of the Earth's landmass, equivalent to half of global fossil fuel emissions. (Tubiello et al., 2021). According to the Intergovernmental Panel on Climate Change, reducing deforestation and forest degradation could annually cut global greenhouse gas emissions by 40 to 580 million tons of carbon dioxide equivalent (IPCC, 2022), thereby contributing 1.2% to 18% of the emissions reductions required to achieve the goal of limiting warming to 1.5°C (Cárdenas & Ayala, 2023; Ipcc, 2022). Beyond emissions reductions, forest ecosystems contribute significantly to a number of ecological benefits. For instance, It protects biodiversity, with projects in the Amazon rainforest combining carbon sequestration with ecosystem conservation (Asner et al., 2010). Forests play an indispensable role in the regulation of water cycles, enhancing ecosystem resilience including safeguarding water resources, stabilizing soil (Führer, 2000). Forest carbon market facilitates funding flows to these ecologically critical regions, promoting broader environmental conservation efforts. The voluntary market value for forest carbon emissions has surpassed the compliance market. In 2019, the compliance market was valued at $799 million, while the voluntary market reached $1.328 billion.(Cárdenas & Ayala, 2023). Market size is anticipated to range between $5 billion and $50 billion by 2030 as forecasted by carbon credit transaction volumes in forest markets (World bank group, 2024).

Carbon projects also support social welfare. They create jobs and attract long-term green investment, benefiting underprivileged or remote communities (Hu et al., 2023). As the basis of sustainable development, they address environmental, social and economic goals at the same time. As a result, carbon market deserved support from governments, corporations, and international organizations.

2.3 Conceptual Theory of Metaphor

2.3.1 Definition

The study of metaphor has gone through several important changes. In classical rhetoric, Aristotle defined metaphor as a transfer of name, which led to comparison theory. This view treated metaphor as an implicit simile based on similarity between two things (Aristotle, 1902; Bain, 1867). In the 19th century, substitution theory saw metaphor as a rhetorical device in which a figurative word replaced a literal one (Whately, 1845; Black, 1962). Two theories above both treated metaphor as secondary to literal language and decorative. After that, a big change is in Richards (1936) and Black (1962), whose interaction theory described metaphor as meaning created through the interaction of two conceptual systems. This view highlighted the creative role of metaphor and the role of readers in interpretation.

Nowadays, modern theories view metaphor not as ornament but as cognitive mechanism. One of the most influential frameworks is Contemporary Metaphor Theory (CMT). This theory marked a shift in metaphor research from rhetorical to cognitive perspective. It was first introduced by

Lakoff and Johnson in Metaphors We Live By (1980a) and subsequently elaborated by Lakoff and his colleagues. CMT states that metaphor is essentially linguistic phenomenon but also cognitive phenomenon (Lakoff & Johnson, 1980a). CMT argues that metaphor is pervasive in thought and communication, and that humans cannot understand the world without it. In this view, the target domain is structured through the source domain, allowing abstract concepts to be understood through more concrete and embodied experience (Lakoff, 1993). Such mapping is not arbitrary but constrained by phenomenological embodiment and cultural context. Once established, the framework of the source domain not only shapes but also constrains individual cognition, emotion, and social practice. Metaphor is described as a conceptual mapping, that is, a set of correspondences from the source domain traditionally called vehicle to the target domain traditionally called tenor.

For example, time and money are usually regarded as two independent conceptual domains, the former denoting duration and the latter denoting a medium of exchange. However, CMT shows that English speakers consistently conceptualize time (target domain) through money (source domain), with the classic example being the metaphor TIME IS MONEY. Expressions such as waste time, spend time, cost time, invest time, put time aside, and run out of time demonstrate how the quantifiable and scarce nature of money is mapped onto the domain of time. Another classic example is ARGUMENT IS WAR, as reflected in expressions like win an argument or lose ground. Here, the schema of war provides argument with an adversarial framework, thereby influencing participants' reasoning and interaction strategies.

Later, Lakoff and Turne (1989) supplemented image metaphors, essentially mappings from image to image, transmitting only structural and visual attributes such as color, shape, and curvature without involving deep conceptual logic, thereby redefining ontological metaphors. For example, PEOPLE ARE PLANTS She is a beautiful red rose. Here, the metaphor does not use the rose's growth cycle or ecological properties to understand people but instead maps the rose's red color and delicate appearance onto human physical features, remaining only at the level of visual attributes.

Subsequently, Lakoff and Johnson (1999) proposed a more complex version of Metaphor Theory CTM, integrating Christopher Johnson's 1999 conflation theory, Grady's (1997) primary metaphor theory, Narayanan's (1997) neural theory of metaphor, and Fauconnier and Turner's (1998) conceptual integration theory.

According to Johnson (1999), the formation of metaphor involves two stages. The first is the conflation stage, in which the source and target domains are simultaneously activated due to frequent co-occurrence in experience. The second is the differentiation stage, in which the two concepts are separated. For example, seeing and knowing are often conflated in cognition, since visual input is the primary channel for obtaining information. In Grady's theory (1997), complex metaphors are composed of primary metaphors. For instance, LOVE IS A JOURNEY derives from PURPOSES ARE DESTINATIONS, while THEORIES ARE BUILDINGS derive from ORGANIZATION IS PHYSICAL STRUCTURE and PERSISTING IS REMAINING ERECT. The advantages of the primary metaphor theory are, first, its greater generalizability, as in LOVE BUSINESS CAREER TASK IS A JOURNEY all falling under PURPOSES ARE DESTINATIONS, and second, its ability to trace the roots of metaphors back to conceptual conflation in experience, thus directly linking with research in psychology and neuroscience (Grady, 1997; Lakoff & Johnson, 1999). Examples include Lakoff and Johnson (1999): AFFECTION IS WARMTH (She gave me a warm embrace); CHANGE IS MOTION (You need to move forward). The neural theory of metaphor proposes a strong hypothesis that cross-domain conceptual mappings correspond to neural connections in the brain, and that shared sensorimotor experiences across humanity lead different languages to share the same metaphors, such as more is up being universally present across languages. At the same time, conceptual integration theory holds that metaphor is the product of conceptual integration, in which different mental spaces such as the source domain and the target domain are subconsciously integrated to form new conceptual structures. For example, he lost his way in love integrates the love space target domain of emotional relationships and the journey space source domain of paths and directions, forming a new integration structure in which love equals journey and confusion equals getting lost, thus explaining the state of losing direction in love.

2.3.2 Characteristics

Lakoff and Johnson (1980) argue that metaphors are pervasive in everyday life. It is not confined to language but is equally present in thought and action. A typical example of metaphor is often encountered in poetry, where novel or unconventional expressions extend conceptual terms to convey meaning beyond their ordinary usage (Lakoff & Turner, 1990). From a cognitive perspective, metaphor can be understood as a general mapping across conceptual domains, where one mental domain is conceptualized in terms of another. Yet metaphor is not limited to poetic language. It is deeply embedded in ordinary, everyday discourse. Many emotions such as love, hate and anger are commonly structured and understood through metaphors. More strikingly, Lakoff and Johnson (2003) demonstrate that some of the most fundamental concepts in human experience are themselves shaped by metaphorical structures, like time, quantity, state, change, causality, modality and even categories.

Therefore Metaphor is not just a linguistic phenomenon but a conceptual one. According to Lakoff and Johnson's data (2003), more than 70% of English expressions can be traced back to metaphorical concepts. They attribute the pervasiveness of metaphor to its conceptual nature. Their theory claims that our ordinary conceptual system is fundamentally metaphorical through which we think and act (Lakoff, 1999). As they put it, the essence of metaphor lies in understanding and experiencing one specific thing in terms of another. To illustrate, consider the conceptual metaphor LIFE IS A JOURNEY. Common expressions in English reflect this metaphorical structuring:

- He's at a crossroads in his life.
- She's following a different path.
- They've reached the end of the road.
- He's just starting out on his career.
- She finally found her direction.

In this metaphorical framework, life is conceived as a journey: we choose paths, encounter obstacles, risk losing our way or reaching a dead end, and hope to arrive at our goals or change direction Life is not a literal journey, yet how we think, act, and speak about life follows the schema of a journey. Thus, LIFE IS A JOURNEY does not claim that life and travel are the same. It shows how concepts, behavior, and language are structured through metaphor. As metaphor rooted in modern culture, it shapes how we understand and describe human experience.

Moreover, conceptual metaphors are interconnected. They form systems of related metaphorical concepts and the language that expresses them. Lakoff and Johnson (1980) note that "*metaphorical entailments can characterize a coherent system of metaphorical concepts and a corresponding coherent system of metaphorical expressions for those concepts*." Their analysis of the metaphor TIME IS MONEY demonstrates this systematicity:

- How do you spend your time these days?
- You need to budget your time.
- I lost a lot of time when I got sick.
- The gadget will save you hours.
- You are running out of time. (Lakoff & Johnson, 2003)

These expressions collectively reflect a conceptual mapping in which time is treated as a resource or commodity that can be spent, saved, lost, or managed. Importantly, TIME IS MONEY is not a single metaphor but part of a broad metaphorical system, which includes TIME IS A LIMITED RESOURCE and TIME IS A VALUABLE COMMODITY. Together, these interconnected metaphors could form coherent and systematic conceptual framework for understanding time.

Lakoff and Johnson (1980) noted that the cultural values are closely tied to its metaphorical patterns. When common metaphors align with public beliefs, the culture shows coherence. As Kövecses(2005) stated, shared metaphors reflect collective ways of thinking. Metaphors are not entirely arbitrary constructions but are grounded in shared human experiences. He stressed that metaphors grow from human experience, and similar experiences across cultures often lead to similar metaphors.

Metaphors and culture are based on understanding the unfamiliar through the familiar, in both function and structure. Because people's thinking is shaped by their surroundings and cultural background, the metaphors they use reflect their cultural traits (Kövecses, 2003). The link between metaphors and culture appears in theory, cognition, and social practice (Sharifian, 2011). The process of connecting a source domain to a target domain always carries cultural meaning. Through this mapping, people make sense of the world in ways that fit their own traditions and beliefs (Duxbury et al., 2015). Each culture brings its own mix of customs, mindsets, values, and faith, shaping how its members use and understand metaphors. Still, because human experiences overlap across places and times, there are also shared metaphors that cross cultural boundaries. This mix of differences and similarity captures both the unique and universal sides of human life.

2.3.3 Classification

Lakoff and Johnson proposed three different kinds of metaphors orientational ontological and structural as shown in Figure 1 below.

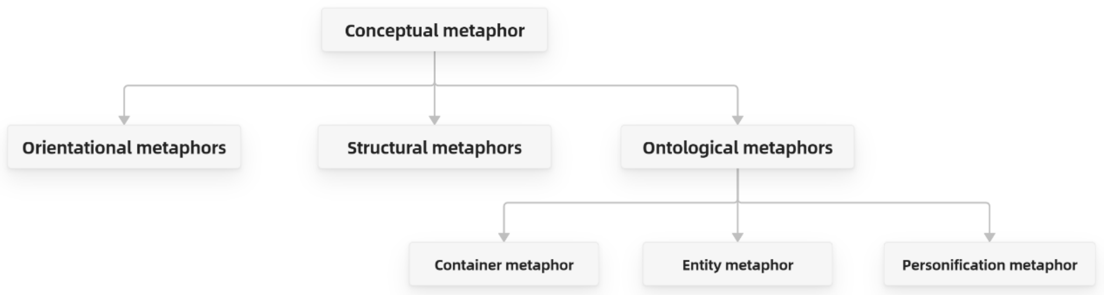

Figure 1 Classification of Metaphors

Orientational metaphors are defined as metaphors that construct abstract concepts through spatial orientation, such as up-down, in-out, front-back, deep-shallow, and centre-periphery (Lakoff & Johnson, 1980a). These patterns come from our physical experiences of moving and existing in space. Our bodies give us a natural sense of orientation, and we extend that sense to organize and explain abstract thoughts (Shapiro & Spaulding, 2021). Living on the same Earth under the same gravitational pull, it is inevitable that experiences will overlap. Lakoff & Johnson (1980) points out that there exists a universality in the way humans perceive natural and cultural experiences, and this universality gives rise to shared understandings through orientational metaphors. For instance, when we stand upright, UP symbolizes normality and stability, while DOWN implies falling or imbalance. This experience is transformed into abstract judgments, whereby POSITIVE and IDEAL are generally associated with UP, while NEGATIVE and UNDESIRABLE correspond to DOWN, thus forming stable polarity patterns across different contexts. Typical examples include the association of happiness with UP and sadness with DOWN, consciousness with UP and unconsciousness with DOWN, abundance with UP and scarcity with DOWN, as well as good with UP and evil with DOWN.

Orientational metaphors are composed of a large set of basic concepts that display internal systematicity through arrangements of one-dimensional or multi-dimensional structures (Johnson, 1987). The coherence of metaphors arises from the overall systematization of external orientational schemas, indicating that orientational metaphors are not arbitrarily constructed but systematically organized through bodily and cultural experience (Kövecses, 2005). The concepts within these metaphors are thus extensions of both bodily and social foundations, meaning that bodily experience and social environment significantly shape metaphorical conceptualization (N. Yu, 2008). Because of their grounding in spatial experience, orientational metaphors are considered the most typical and easily comprehensible type of metaphor.

Structural metaphors refer to metaphors that systematically construct abstract complex and less tangible target domains through concrete familiar and perceptible source domains (Kovecses, 2010a; Lakoff & Johnson, 1980a). Lakoff and Johnson emphasized that the key lies in the overall structure of the source domain being mapped onto the target domain, rather than mere word-level correspondences (Johnson, 1987; Lakoff, 1993). It means that the elements, relationships, and logical framework of the source domain are transferred to the target domain, forming a coherent network of meaning (G. Steen, 2011). The source domain usually comes from concrete concepts in human daily experience such as buildings food and journeys, while the target domain often consists of abstract concepts such as theories ideas and love (Lakoff & Johnson, 2003). By explaining the abstract through the concrete, structural metaphors effectively reduce the difficulty of understanding complex concepts (Semino & Steen, 2008).

Structural metaphors derive from the systematic relationships within human experience (Lakoff & Johnson, 2003). A typical example is LOVE IS A JOURNEY, in which the characteristics of a journey are employed to describe the course of love, while LOVE emphasizes the idea of partners moving forward together within a relationship. Although the fundamental structure of affection remains unchanged, humans as emotional beings engage in love in complex and institutionalized ways, highlighting more intricate forms of interaction and commitment, and reflecting higher-level modes of emotional maintenance at the social level. When relationships face obstacles, individuals may try to satisfy personal desires or break free from constraints, and the relationship may end or diverge. For example, whether in marriage, romance or daily interaction, how partners move forward together or stagnate due to disagreement can be understood and expressed through the metaphor LOVE IS A JOURNEY. This metaphor explains the development of emotional relationships, similar to the dynamics of a journey. As a Structural metaphor, it help form situational concepts by allowing people to apply their knowledge of journeys to the understanding of love, providing a framework for describing relationship dynamics.

Ontological metaphors are a type of metaphor that assign concrete forms to non-physical entities such as abstract concepts, emotions, states and activities (Lakoff & Johnson, 1980). For example, the metaphor MIND IS A MACHINE enables us to compare the brain to machine. It highlights similarities such as the ability to be activated, to operate steadily, to produce outcomes and to generate value. This metaphor connects brain functions to machine characteristics, also forming a framework of understanding one thing in terms of another. Just as orientational metaphors rely on spatial experience to underpin comprehension, ontological metaphors construct conceptual structures based on human interaction with and perception of objects or entities. However, unlike orientational metaphors, ontological metaphors are not constrained by physical space or tangible boundaries. As a result, they provide broader possibilities for interpretation, serve a wider range of linguistic functions, and generate more diverse metaphorical effects.

Lakoff and Johnson(2003) regard Ontological metaphors as one of the most fundamental tools for human understanding of experience. By reifying abstract phenomena, people are able to quantify, locate, describe, and manipulate them as if they were concrete objects. Ontological metaphors are extremely common in everyday language, with their mappings internalized into unconscious cognitive mechanisms, so that most users are unaware of their metaphorical nature and treat them as direct descriptions. The key lies in transforming intangible and untouchable abstract objects into tangible and perceptible entities. Depending on the way reification is realized, ontological metaphors can be divided into three main subtypes container metaphors entity metaphors and personification metaphors. Container metaphors conceptualize abstract ideas as bounded spaces, where things can move in and out, as in "She was filled with anger", "He bottled up his feelings", "She was overflowing with joy". Such expressions are often overlooked as metaphors because the "container experience" has become an unconscious mechanism of thought (Lakoff & Johnson, 1980a; X. Yu, 2013). Entity metaphors, by contrast, treat abstract concepts as manipulable objects, as in "You are wasting my time", "That setback cost me three days", "How do you spend your time these days". These ontological metaphors are pervasive in everyday discourse and are often mistaken for literal descriptions of reality (Lakoff & Johnson, 1980b). Personification metaphors attribute human qualities to non-human entities, as in "The evidence speaks for itself", "History teaches us valuable lessons", "The report warns of a looming crisis", "The figures show a steady increase in unemployment". Here, entities such as evidence or history are conceptualized as human agents with the ability to speak, teach, or warn(Lakoff & Johnson, 1980b).

2.3.4 Metaphor and metaphorical expression

The cognitive linguistic approach distinguishes between metaphors and metaphorical expressions (also referred to as linguistic expressions or linguistic metaphors). Metaphor is not merely a matter of language, but rather a matter of thought and reasoning. Language is secondary, while mapping is primary, since it determines how the linguistic forms and inferential patterns of the source domain are employed in the conceptualization of the target domain (Lakoff, 1993). Within the research paradigm of cognitive linguistics, metaphor and metaphorical expression are explicitly defined and strictly distinguished. Metaphor is not only a linguistic phenomenon but a basic mode of human thinking and reasoning. In this view, language is as surface expression. And the main process is cross-domain mapping, which projects the structures and inferential patterns of the source domain onto the target domain. As Lakoff (1993) states, language shows the manifestation of thought. Its structure reflects the human conceptual system, examing the view that mapping comes before language.

On the basis of the cognitive orientation, contemporary theories have reached terminological consensus. Metaphor is used to refer to the cross-domain mapping relation at the conceptual level, whereas metaphorical expression (or linguistic metaphor) is employed to denote the concrete linguistic realizations of such mappings (Lakoff & Johnson, 1980b). In other words, metaphors focus on the systematic associations between source and target domains, embodying abstract structures of thought. By contrast, metaphorical expressions are the concrete manifestations of these abstract structures at the lexical, phrasal or syntactic level (Lakoff, 1993). Thus, metaphorical expressions are the externalized forms of metaphors. Both correspond to the relationship between deep conceptual structures and surface linguistic forms.

For example, In the metaphor LIFE IS A JOURNEY, the key element is not any specific word but the mapping from the source domain JOURNEY to the target domain LIFE. This mapping projects features such as paths, stages, directions and experiences. This linkage forms the cognitive basis of the metaphor. Expressions such as *going through a lot, crossroads of life,* or *losing one's direction* are linguistic forms generated under the guidance of this metaphor. They represent its concrete realizations in discourse. Metaphorical expressions are also significant entry point for the study of metaphors. Because the correspondences, between *the path of a journey* and *the course of life* or between *a fork in the road* and *life choices,* are often manifested through linguistic expressions. Lakoff and Johnson (2003) further noted that there exists a stable and systematic relationship between metaphorical expressions in language and underlying conceptual structures. This relationship lets researchers identify structural features of metaphors through analysis of linguistic metaphors such as mapping scope and patterns of correspondence, and allow them to gain deeper insight into metaphorical thought and decision-making. Bratož (2015) likewise emphasizes thought is metaphorical, and that metaphorical expressions in language reflect the sort of cognitive mechanism of understanding one thing through another.

Differentiating between metaphors and metaphorical expressions is crucial for metaphor identification. This study shows that to discover metaphors. It is necessary to identify metaphorical expressions at the surface level. These expressions allow extraction of underlying metaphors. This has methodological implications for data processing and explains why the present study conducts comparisons at both the metaphor level and the linguistic metaphor level.

2.4 Metaphors in Ecology, Economic and public discourse

Metaphors operate across economic, ecological, and public discourse. In economics, they make abstract market logics concrete; in ecology, they frame systemic processes and mobilize action; in public discourse, they shape collective cognition through shared narratives.

As a complex social system, the economy relies on metaphors to make its core concepts (such as market, inflation, and money circulation) perceptible. Metaphors are not limited to scattered linguistic uses but are built into economic discourse. McCloskey (1983), in The Rhetoric of Economics, was among the first to note that the terminology of economics is metaphorical. The *invisible hand* likens market self-regulation to a hand's movement, making supply–demand equilibrium easier to grasp. *Elasticity* borrows the physical notion of deformation and restoration to describe the sensitivity of supply and demand to price changes. *Depression* draws on imagery of decay and withering to convey economic decline. Later studies further showed the wide and systematic presence of metaphors in economic discourse. Charteris-Black (2000), in a comparative study of The Economist and Bank of England discourse, found that metaphors are more frequent in professional economic media. Charteris-Black and Ennis (2001), using cross-linguistic quantitative analysis, reported that in economic texts, metaphors appear once every 43 words in English and once every 35 words in Spanish. This shows that metaphors are not only expressive devices but also basic units of cognitive construction in economics.

Metaphor occupies a central position in ecological discourse. It is both cognitive tool and rhetorical resource that mediate the relationship between humans and nature. Because ecological problems are abstract and intertwined. Metaphors help make them understandable by mapping unfamiliar or imperceptible processes onto familiar domains. Flusberg & Thibodeau (2023) point out that metaphors in ecological discourse are mainly concentrated in three domains: (1) the relationship between humans and nature; (2) the human impact on the environment; and (3) strategies for addressing environmental problems. Metaphors in these domains create different persuasive effects. They shape how people see urgency, responsibility, and possible actions.

Ecological metaphors have strong generative power. They allow complex systemic phenomena to be understood, felt emotionally and mobilize collective action. For example, the metaphor ATMOSPHERE IS BATHTUB helps the public form certain systemic thinking about carbon accumulation, while CLIMATE CHANGE IS WAR conveys urgency and mobilizing force (Flusberg & Thibodeau, 2023). However, Taylor & Dewsbury (2018) warned that metaphors could also limit reasoning, keep old ideas in place and reinforce unintended sociopolitical messages. Military metaphors may link ecological discourse to nationalism or xenophobia (e.g., "war on invasive species"), while mechanistic metaphors often encourage determinism or simplified views of ecosystems. Ecological metaphors therefore require critical scrutiny. Their evaluation should consider dimensions such as conventionality, systematicity, emotional impact and appropriateness (Flusberg & Thibodeau, 2023). In addition, colonial, militarized, or gendered metaphors may distance audiences and reproduce unequal worldviews by framing nature and science through dominance and hierarchy. Some scholars suggest alternatives such as PATCHWORK or COMMUNITY to describe ecological and scientific practices, framing cooperation, creativity and diversity (Taylor & Dewsbury, 2018).

Looking at public discourse. Public discourse carries metaphors beyond disciplinary boundaries into share thinking. Here, metaphors act as common cultural narratives rather than technical terms (Brugman et al., 2019; Landau & Keefer, 2014). Align with contemporary theory that views metaphor as a way of structuring thought rather than mere rhetoric (Lakoff & Johnson, 2003). In public communication, metaphors activate cultural schemas and reduce abstraction, forming coherent mini narratives. For instance, EU politics is framed as a family: Franco-German ties as a MARRIAGE, or the United Kingdom as a DIVORCING SPOUSE. These framings draw on familiar experience, embedding moral and emotional judgments in political debate.

Psychological research further explains this effectiveness. Metaphors provide cognitive closure under uncertainty and facilitate understanding with low effort (van der Hel et al., 2018). They also help connect limited factual understanding with strong motivation. In particular, vivid and emotionally loaded metaphors can encourage people to take action even when their knowledge is incomplete, making complex issues easier to engage with and respond to, and supporting more active participation in real-world decisions (Hambali et al., 2025). Yet this power is ambivalent. Metaphors can inform and inspire, but they may also mislead and distort meaning. In public health, for example, WAR metaphors used to describe disease can encourage collective action, yet they also risk creating social stigma (Naamati-Schneider & Gabay, 2022). In climate discussions, references to “tipping points” can increase the sense of urgency, but they may also lead to fatalistic attitudes (Bellehumeur & Carignan, 2024; van der Hel et al., 2018). Therefore, Communicators must balance clarity with accuracy ensuring that metaphors inform rather than mislead.

3 Materials and Methods

This chapter outlines the methodological framework. Section 3.1 introduces the research approach and explains the choice of qualitative methods. Section 3.2 describes data collection, including the use of Nexis Uni to build the corpus of news texts on carbon markets. Section 3.3 presents the data analysis process, focusing on MIP, qualitative content analysis, and the Gioia methodology.

3.1 Research approach

When a study aims to examine and interpret the subjective meanings that individuals assign to a phenomenon within a given sociocultural and linguistic context, or to compare two or more cases, societies, nations, or cultures to identify similarities, differences, shared patterns, or unique features, it can be considered both interpretive and comparative. (Collier, 1993; Richardson & Fowers, 1998).

This study focuses on the carbon market metaphors and its metaphorical representations in news reporting. The carbon market, positioned at the intersection of policy and economics, involves value concerns, risks, and uncertainties, making it prone to metaphorical expression. At the same time, news media function as a central channel for the communication of information and play a crucial role in shaping public understanding and discourse. The metaphors employed in news texts thus provide valuable insights into how societies interpret, evaluate, and frame the carbon market. Consequently, analysing news discourse offers an appropriate and effective entry point for examining the cultural and social meanings embedded in metaphors related to the carbon market. Furthermore, a deep textual analysis is necessary to uncover their underlying meanings, which are difficult to capture through numerical or quantitative approaches. Quantitative methods, which typically involve statistical analysis and rely on numerical evidence, may fail to reflect the nuanced social, cultural, and linguistic dimensions of these metaphor (Somekh & Lewin, 2004).

Given the subjective and context-dependent nature of metaphors, especially those related to carbon markets, quantitative methods do not capture the social, cultural, and linguistic detail embedded in them. This study therefore uses the Gioia methodology, a structured qualitative approach first proposed by Dennis Gioia and Chittipeddi (1991) for concept development. It organizes analysis through a coding process that moves from 1st order concepts to 2nd order themes and then to aggregate dimensions (Gioia et al., 2013). Combined with qualitative content analysis, the Gioia methodology enables inductive coding, in which patterns and structures emerge through repeated reading of the data. The method supports both creative interpretation and systematic rigor in qualitative, grounded-theory research. Its application is explained in detail in the data-processing section.

3.2 Data collection

The Gioia methodology is characterized by flexibility in data collection (Gioia et al., 2013). This study collects English-language news texts on the carbon market to examine its metaphors from a sociocultural perspective. All data are secondary sources. To ensure breadth, relevance, and representativeness, the corpus is drawn from Nexis Uni. This database provides wide coverage and extensive material. Nexis compiles news reports from major global media outlets, offering continuous long-term textual data that form a reliable basis for research. The platform also enables precise keyword searches and multi-dimensional filtering, which supports efficient retrieval of texts relevant to the topic. Compared with scattered online sources, Nexis data have authority and traceability, supporting credible and rigorous results. The time frame is from the signing of the Paris Agreement in 2015 to the present, a period of rapid development in global carbon markets. The primary selection criterion is the presence of keywords related to the carbon market, including carbon market voluntary, carbon market compliance, carbon market, and carbon trading. To ensure relevance, preference is given to texts containing these keywords in titles, abstracts, or subject headings.

Based on these considerations, the initial corpus comprised 1,350 news reports (total 1,412,714 words) retrieved from Nexis Uni using targeted keyword "carbon market". After removing exact duplicates, Python script scanned each article and extracted sentence units containing any of the target keywords using regular expression matching on word boundaries. The resulting candidate sentences were then screened manually by the researcher. Manual inclusion criteria required that a sentence explicitly engage with the concept of the carbon market (rather than merely mentioning the word "carbon" in another context), contain sufficient semantic content to support metaphor identification, and not be a verbatim duplicate of another sentence in the set. Following this automated extraction and manual screening workflow, the final dataset used for metaphor analysis comprised 276 sentences (10,557 characters). The full Nexis search expressions and the Python extraction script are documented in Appendix A and are available from the author on request to ensure reproducibility.

3.3 Data Processing

This study is primarily based on the conceptual theory of metaphor and aims to investigate metaphors in English news reports related to the carbon market. First, it is necessary to distinguish between metaphors and metaphorical expressions. As discussed in the literature review, from a cognitive perspective, metaphors are essentially underlying mechanisms of cross-domain mapping, rules that connect the target domain with the source domain and therefore are abstract in nature(Kovecses, 2010b; Lakoff & Johnson, 1980a, 2003). Linguistic metaphors, by contrast, are the concrete realizations of metaphors at the lexical and phrasal level (Moura, 2006). In other words, if an expression originally belongs to one domain but its meaning is transferred and applied to another domain, it is a metaphorical expression. For example, in the sentence the stock price slumped, the word slump originally refers to a bodily movement, but here it is used to describe the decline of stock prices, an abstract phenomenon. Its meaning has shifted, making this a linguistic metaphor. The mapping process here is that the source domain bodily movement is mapped onto the target domain market movement, and the metaphor underlying this mapping is the market moves like the body moves. Therefore, what can be identified in the corpus are metaphorical expressions, while the metaphors remain hidden behind these linguistic metaphors. Thus, in order to investigate the metaphors used in carbon market reporting, it is first necessary to identify metaphorical expressions, as they are the surface realizations of highly abstract metaphors.

To analyse the collected textual data, I apply a qualitative content analysis within the framework of the Gioia methodology. Content analysis examines the content of texts to identify underlying metaphors across thematically distinct texts. Qualitative content analysis has been defined as "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005). This approach aligns with the Gioia methodology. In parallel, deductive methods based on existing market-metaphor theories apply pre-established codes to the data (Wildemuth, 2016). The coding scheme develops through both inductive and deductive work, allowing discovery of new metaphors and validation of existing ones. This integrated approach supports the production of representative and coherent themes. A key strength of the Gioia method is its iterative structure, combining inductive and deductive analysis. The inductive stage identifies patterns and structures through repeated reading. The deductive stage applies coding schemes drawn from existing market metaphor theory (Wildemuth, 2016). This combination enables recognition of new metaphors and confirmation of existing ones, helping ensure a comprehensive and accurate coding scheme.

In the entire research process, Identifying metaphors and metaphorical expressions is the first step in this research. This study adopts the Metaphor Identification Procedure (MIP) proposed by the Pragglejaz Group (2007), which has a significant impact in metaphor research and is widely applied in subsequent studies (e.g., Krennmayr, 2011; Semino et al., 2016; G. J. Steen et al., 2010); Krennmayr, 2011; Semino et al., 2018). MIP offers a clear and flexible way to identify metaphorical language in texts. It can be applied in various empirical studies to determine whether lexical units in a given context are metaphorical. The specific steps of MIP are as follows: 1) read the entire text to grasp its general meaning; 2) identify the lexical units in the text. 3) (a) Determine the contextual meaning of each lexical unit in its sentence. (b) Check whether the unit has a more basic contemporary meaning in other contexts. Basic meanings are concrete, tied to bodily action, precise, and historically older. (c) If a basic meaning exists, check whether the contextual meaning differs from it but still relates to it. If so, mark the unit as metaphorical.

Regarding metaphor coding, this study draws on the approach outlined in The Coding Manual for Qualitative Researchers (Saldaña, 2021). I employ in vivo coding to initially extract metaphorical expressions, interpreting each in vivo code from three perspectives: literal meaning, imagery, and metaphorical meaning. Subsequently, I apply the Gioia methodology to categorize them into themes and finally aggregate them into higher-level metaphors. This process proceeds from surface to depth, and from the concrete to the abstract.

3.4 Use of AI Tools

Parts of this thesis benefited from the use of large language models (LLMs), particularly OpenAI's ChatGPT (GPT-5), to assist in tasks such as grammar correction, language polishing, translating and brainstorming. All conceptual reasoning, data analysis and interpretations were conducted by the author. The AI was used only as a linguistic and editorial aid.

4 Results

According to MIP, I identified all metaphors in the collected news data and calculated their frequencies. As the results show, a total of 241 examples of metaphors were found. Based on Lakoff and Johnson's categorization, metaphors are divided into three types: structural metaphor, orientational metaphor, and ontological metaphor. In addition, I further explored more specific subcategories under these three main types. The following table presents the distributions of the three main types and their subcategories of metaphors in the data.

Table 1 The Distribution and Frequency of Metaphor

Types		Frequency	Proportion
Structural metaphor	Strength	25	10.37%
	Journey	18	7.47%
	Goldmine	44	18.26%
	Pitfall	33	13.69%
Sub-Total		120	49.79%
Orientational metaphor	Action	10	4.15%
Sub-Total		10	4.15%
Ontological metaphor	Living entity	45	18.67%
	Machine	56	23.24%
Sub-Total		101	41.91%
	Others	10	4.15%
Total		241	100%

A total of 241 metaphors were identified. Structural metaphors dominate with 120 instances (49.79%), followed by ontological metaphors with 101 (41.91%). Orientational metaphors and others are minimal(4.15% / each).

4.1 Strength

Strength metaphors are a type of structural metaphor. Strength is linked to power, stability, and force. In human experience, it signals support, resistance to pressure, or capacity to create momentum. Used metaphorically, it maps these physical properties onto abstract systems or policies. In the carbon market, strength metaphors show two functions. They present the market as structural support that reinforces climate governance. They also mark it as a driver that can create momentum toward policy, economic, and social goals. In this way, the metaphor makes the complex institutional logic of the carbon market more intuitive, while also shaping its public image as both a stabilizing foundation and a propelling force. Several representative examples are presented below.

1) Rather than providing real and public funding into African renewables and adaptation, this week rich countries pledged money to **prop up** carbon markets that have never worked, neither in Africa nor elsewhere. (The Guardian (London), 2023)
2) This approach is undermining the United Nations' effort to **solidify** an internationally regulated carbon market. (City A.M, 2022)
3) She emphasized the government's commitment to making carbon markets a **cornerstone** of Pakistan's climate strategy. (Pakistan Today, 2024)
4) However, the viability and impact of voluntary carbon markets **hinges upon** the commitment to three fundamental principles. (CE Noticias Financieras English, 2023)

Those metaphors expression used in the texts highlight its fragile nature and its need for outside support. The phrase *prop up* presents the market as something that cannot remain stable on its own, a reading that resonates with the 2023 context when Shell retreated from offsetting and the Carbon Trust abandoned its "carbon neutral" label, while rich countries at the Africa Climate Summit pledged new funds to sustain the market. Similarly, saying that its viability *hinges upon* basic principles points to its dependence on external conditions, much like a door's strength depends entirely on its hinges. Even when the market is described as a *cornerstone* of climate strategy or as something that must be *solidified*, these metaphors still suggest that it is not a fully secure or unshakable entity. Instead, the carbon market is shown as a structure that needs ongoing support from policies, rules, and cooperation in order to play its expected role.

5) South Africa should "**energise** the voluntary carbon market" and act to "increase the access to European Union Emissions Trading System (EU ETS) to non-EU credits", explained De Ruyter. (Daily Maverick, 2024)
6) However, the multibillion-dollar voluntary carbon trading industry is still championed by many corporations including oil and gas majors, airlines, automakers, tourism, fast-food and beverage brands, fashion houses, banks and tech firms as the **bedrock of climate action**. (The Guardian (London), 2024)

7) Voluntary private carbon markets are a useful **complement to public markets**. (CE Noticias Financieras English, 2021)
8) The FT editorial board rightly argues that despite the challenges facing the VCM, it should not be abandoned - instead advocating for "standardised rules" to establish a more rigorous carbon market, which will be a **boon** for both developing countries and for the planet. (Financial Times (London, England), 2023)
9) Carbon markets are a **strategy** to address climate change based on a simple economic principle: putting a price on greenhouse gas emissions encourages their reduction. (CE Noticias Financieras English, 2023)
10) Carbon markets, while touted as a **potential enabler** of climate action in parts of the developing world…… (Daily Maverick, 2024)

The carbon market is portrayed in the texts as a dynamic and foundational force. First, the *energise* presents the market as an entity that can be activated and infused with momentum, showing its role as a positive force that can be driven toward specific goal. This resonates with calls in South Africa to link voluntary credits to the EU ETS as part of its just energy transition. Second, the *bedrock* and *complement* highlight the market as an essential foundation for climate action, serving as a pillar and as a means of increasing the overall effectiveness of public markets. This reflects how global corporations in 2024 continued to promote offsets despite quality concerns and how analysts placed voluntary markets alongside regulated schemes. Terms such as boon, strategy, and enabler reinforce its image as a positive driving force, consistent with debates at COP29 and earlier Article 6.4 negotiations where governments argued that carbon markets could unlock billions in climate finance for the Global South.

Overall, strength metaphors in carbon market discourse show a composite frame. The market is a pillar and foundation of stability and a source of momentum. The set from support-solidify-cornerstone to energise-strategy-enabler builds an image of a system that holds institutions steady and pushes climate action forward. This multidimensional frame highlights the carbon market's role in climate governance and helps explain why its meaning remains emphasized and contested in policy, economic, and social arenas.

4.2 Pitfall

Pitfall metaphor belongs to the category of structural metaphors. A pitfall, in its literal sense, refers to a hidden trap or obstacle encountered on a seemingly safe path. It conveys the idea of unexpected danger and potential failure. When applied to institutions or policies, it points to uncertainty, weakness and the risk of disruption. In the carbon market, the PITFALL metaphor underscores its inherent risks and shortcomings. It describes the market not as a reliable tool but as a fragile system that can collapse, stop working or be led the wrong way. By using the image of hidden dangers, the metaphor highlights vulnerabilities that are not immediately visible, shaping the carbon market's public image as fragile and unstable. Representative examples are introduced below.

11) But in the "**Wild West**" carbon market, where speed is of the essence, deals are made with little concern for history, culture, or rights. (The Bangkok Post (Thailand), 2023)
12) Australian industry can have faith in our carbon markets for over a decade implementing a carbon price in Australia has been a **political graveyard** that has buried prime ministers and governments. (The Australian, 2023)
13) We can't use the carbon market as a **mirage** in the desert. (CE Noticias Financieras English, 2023)
14) The voluntary carbon market has been **in the doldrums** for two years amid doubts among buyers over the integrity of the process, noted industry experts. (The Straits Times (Singapore), 2024)
15) My colleagues at Down To Earth and the Centre for Science and Environment examine this and find there is much that needs to be done to set this market in order. In fact, it is **a can of worms**. This is not what we need in this time of existential crisis. (Millennium Post Newspaper, 2023)
16) As the last decades have shown, carbon markets are not only **a false solution** to the climate crisis but also perpetuate **the extractive colonial model** of development and human rights violations. (Daily Maverick, 2024)
17) Carbon markets are **not a panacea,** but they do offer a cost-effective and viable pathway for companies to act alongside much-needed investments to decarbonise their own operations and those of their suppliers. (Financial Times (London, England), 2023)
18) Carbon markets, however, are **not a silver bullet**. (The Standard (Zimbabwe), 2023)
19) The carbon tax is **not a one-size-fits-all solution**, but it can be a powerful tool if adjusted to current global challenges. (CE Noticias Financieras English, 2024)
20) Carbon markets are not climate finance, and we cannot accept these **neocolonial schemes** to be propped as a success of COP29 in lieu of paying the climate debt owed to the Global South. (Daily Maverick, 2024)

Within this metaphorical family, *political graveyard* and *can of worms* emerge as its most emblematic members, directly exposing the dangers hidden beneath the surface of the carbon market. The first image shows the market as a deadly arena that can bury politicians and governments. It stresses political risk and harmful outcomes. This matches the trap metaphor's idea of sudden failure.

The second image says that, once examined, the carbon market brings up many complex and hard problems. Before COP28 the voluntary market was called a "can of worms," meaning opaque governance, weak oversight, and the danger that private schemes hurt vulnerable communities.

Other metaphors point to disorder, illusion, and stagnation. “The Wild West” means little regulation and chaos. Reports show some unregulated forest offset projects in Latin America and Africa led to exploitative contracts, land grabs, and “carbon cowboys” targeting indigenous peoples. This image shows a lawless frontier where corporate greed meets weak governance, causing fraud, volatility, and rights abuses. The mirage casts the market as an empty promise that fails to deliver real solutions. The doldrums suggest long periods of inactivity that block progress. Together these metaphors form a sharp critique. Calling the market a “false solution” rejects its value and says it may worsen existing injustices. Political metaphors like “neo-colonial project” link the market to unequal power and exploitation. This is the deepest level of the trap idea. Finally, terms such as panacea, silver bullet, and one-size-fits-all warn of oversimplification. The Financial Times (2023) called it “not a panacea” but said it can help corporate decarbonisation if strict “high integrity” rules apply. This cautious view warns against relying on markets alone and says they must come with broader systemic change.

In sum, These metaphors, though different, form a tight rhetorical network. Together they show the carbon market’s risks, flaws and weaknesses across many areas: political failure, systemic fraud, disorder and deep injustice. By linking the market to these negative images, the PITTFALL metaphor family shapes its public image as a system full of hidden dangers and uncertainty..

4.3 Journey

Journey metaphor belongs to the category of structural metaphors. A journey is travel from a start to a destination, passing through stages that can include pleasant experiences and unexpected obstacles. Because journeys are familiar, this metaphor frames abstract processes as progress with direction. In the carbon market, the journey metaphor highlights development. It casts the market as a path from initial institutional design, through policy implementation, to full maturity. By presenting the market as a process of advancement marked by stages, direction, and challenges, this metaphor allows abstract institutional change to be understood as an evolving and purposeful course. 18 representative instances of journey metaphors were identified in the dataset.

21) The Ma'aden CEO Robert Wilt said, "The plan to establish the MENA region carbon market is an important **step** toward enabling Saudi Arabia and the region to contribute to solving global climate change challenges. (The Saudi Gazette, 2022)
22) Carbon trading is a **step** in the right direction for companies to act more responsibly, with sustainability at their core. (The Business Times Singapore, 2021)
23) "The Portuguese Voluntary Carbon Market represents a **decisive step** in Portugal's strategy to achieve climate neutrality," argues the government. (CE Noticias Financieras

English, 2024)

24) Gonzalo Pascual Merlo, CEO of BYMA, said: "The launch of the Voluntary Carbon Market in BYMA represents a key **milestone** towards a more sustainable future. (CE Noticias Financieras English, 2024)

The journey metaphor frames policy actions as steps and milestones along a path. For instance, the establishment of a carbon market in the MENA region is described as *an important step* (21) toward achieving global climate goals. This fits Saudi Arabia's Vision 2030 and its net-zero pledge for 2060 and casts the kingdom as a regional leader in the green transition. Portugal's launch of a voluntary carbon market is called *a decisive step* (23) in its climate strategy, marking a policy turning point in the government's national roadmap toward climate neutrality. Such expressions not only provides clear directional guidance but also underscores the pivotal role these actions play within a broader journey. Similarly, positioning the expansion into new markets as *a key milestone* (24) vividly conveys its critical importance on the path toward a sustainable future. As seen in Argentina's BYMA stock exchange framing its voluntary carbon market as a landmark institutional achievement within the country's financial ecosystem, marking a stage-specific achievement.

25) The carbon market is one of the promising **avenues** for climate finance mobilization, Minister of Environment, Jeanne d'Arc Mujawamariya, said on Friday at the COP27 UN climate summit in Sharm el-Sheikh, Egypt. (The New Times (Kigali) , 2022)
26) The carbon market is an **avenue** where carbon credits are bought and sold and companies can use it to offset or reduce their GHG emissions. (CE Noticias Financieras English, 2023)
27) Projects under way such as the Voluntary Carbon Markets Integrity Initiative are making progress, but in general policy approaches across governments remain "extremely fragmented" making voluntary carbon markets hard to **navigate**. (The Australian, 2024)

Beyond steps, this type of metaphor also depicts the carbon market itself as a path or route. By comparing the market to broad *avenues* (25, 26), news discourse highlights its function as a clear channel for mobilizing climate finance and reducing emissions. At COP27, Rwanda's Environment Minister called the carbon market a "promising avenue" for climate finance, stressing its importance for a country targeting a 38% emissions cut by 2030 and carbon neutrality by 2050 in the face of limited public funds. In Mexico, Fibra Uno's move into the voluntary carbon market similarly presented it as a pathway for offsetting emissions within a wider decarbonization plan that combines reductions, renewable deployment, and compensation. Through carbon credit trading, it is portrayed as a practical route for governments and firms to meet climate goals. However, progress along this route is not straightforward. The depiction of fragmented policies as a difficult-to-*navigate* route (27) exposes the barriers and risks of confusion. This is reflected in Australia, where rising demand coexists with fragmented governance and credibility concerns, and where efforts such as the Voluntary Carbon Markets Integrity Initiative have struggled to generate coherence. Without a clear roadmap, advancement becomes highly constrained.

28) We can therefore expect to see carbon trading **taking off** as a tool for businesses to reduce their greenhouse gas emissions by pivoting more towards a circular economy, as opposed to the current linear one, where many products are not repaired, recycled or reused, thereby depleting earth resources, and creating more waste and pollution.
29) Voluntary carbon market **hits record**.

Kinetic vocabulary reinforces the journey metaphor by depicting the market as active and evolving. Describing carbon trading as *taking off* (28) signals the start of movement rather than stasis. In Singapore, this wording was linked to ESG pressures and investor expectations, presenting carbon trading as accelerating the shift from a linear to a circular economy, even as many firms remained unprepared. The metaphor conveys speed and momentum and marks the opening of a new exploratory phase. Although *breaking records* (29) is not a conventional journey metaphor, it fits the frame by indicating the market has reached a new peak or waypoint. For instance, in Australia in 2022, the voluntary carbon market recorded unprecedented trading volumes and cancellations of carbon credits, reflecting corporations' growing demand and marking a milestone that elevated the market to a new stage of maturity.

Overall, the journey metaphor and its related sub-metaphors construct a purposeful narrative of the carbon market. They transform a complex policy instrument into a journey moving toward set goals. By portraying governments and firms as travellers moving along the same route, they reinforce confidence in the market's trajectory.

4.4 Goldmine

The GOLDMINE metaphor belongs to the category of ontological metaphors. Literally, a goldmine denotes underground deposits of precious metal that can be extracted for profit. Owing to its associations with hidden wealth and exploitation, this metaphor often represents opportunities that yield high economic returns. In the context of the carbon market, the goldmine metaphor highlights its economic value and potential for financial gain. It frames the market as a resource-rich domain, presenting carbon credits and trading schemes as exploitable assets similar to mineral deposits. Through this imagery, abstract ideas of financial opportunity become tangible as concealed wealth awaiting discovery. A total of 34 instances of the goldmine metaphor appear in the dataset, demonstrating its role in shaping perceptions of the carbon market as a lucrative enterprise.

30) Carbon markets were one of the key focuses at the inaugural Africa Climate Summit held

in Kenya this September, at which President William Ruto described African carbon sinks as an "**unparalleled economic goldmine**". (The Standard (Zimbabwe), 2023)

31) For him, carbon markets are the **ticket** to fixing something that ought to be fixed anyway. (The New York Times, 2024)
32) In the meanwhile, Indian offset generators, especially those operating in the community space, are well-placed to draw rich dividends from the **ballooning** voluntary carbon market. (The Economic Times, 2022)

The GOLDMINE metaphor most directly links the carbon market to untapped natural wealth. For example, African carbon sinks are explicitly described as an *unparalleled economic goldmine* (30), positioning them as a treasure capable of generating substantial financial returns. This framing was promoted at the 2023 Africa Climate Summit and mirrored in Zimbabwe's $1.5 billion UAE deal, though critics questioned whether benefits would reach local communities. Similarly, referring to the carbon market as a *ticket* to solutions (31) suggests its ability to open the door to hidden wealth and opportunities, as reflected in U.S. post-wildfire offset projects (NYT, 2024), where carbon credits were framed as the entry pass to fund ecological restoration that otherwise lacked resources. The notion that Indian carbon credit producers can reap substantial dividends from a *ballooning* (32) market further reinforces the imagery of wealth extraction, which noted that community-based projects were positioned to capture rising global demand and higher offset prices after COP26.

33) Part of the solution, as obtained in other climes, is to **unlock the vast potential** of carbon markets. (The Punch, 2022)
34) Through USAID's Enterprises for Development, Growth, and Empowerment (EDGE) Fund, the United States will invest $2.5 million into Acorn's Cooperative Carbon Finance Fund as a first loss tranche, thereby de-risking investment in carbon finance, **unlocking access** to the voluntary carbon market……… (Indian eGov Newswire, 2023)

Within the framework of the GOLDMINE metaphor, the value of the carbon market is portrayed as potential waiting to be unlocked and developed, linking its immense value to a locked treasure, stimulating the reader's imagination. Expressions such as *unlocking vast potential* (33) and *unlocking access* (34) reinforce the hidden quality of the goldmine, suggesting that this value is not readily accessible but requires specific actions and investments to be realized and utilized. For instance, the Africa Carbon Markets Initiative launched at COP27 explicitly framed African credits as potential to be "unlocked," while the U.S. investment through Acorn's Cooperative Carbon Finance Fund in 2023 was described as unlocking access for smallholder farmers. In this way, the carbon market is depicted as a resource that must be actively explored and developed, much like the search for and extraction of an untouched mineral deposit.

35) The carbon market presents an **opportunity** for the country to generate funds and address

deforestation and forest degradation. (Business Weekly, 2023)

36) By ensuring transparency, clear information, and fair market practices, the carbon market becomes an **ideal setting** that fosters the emergence of green projects and smooth carbon trading. (Daily News Egypt, 2024)

37) 'Securities firms are definitely looking to the carbon market as a **future source of growth**. (Korea Times, 2023)

38) The issues of transparency and integrity are only going to become more important as the carbon market **expands**, he noted. (The Straits Times (Singapore), 2024)

39) On the other hand, Tomás Araújo, a consultant at Cushman & Wakefield, offers a more optimistic view, stressing the positive impact that the voluntary carbon market can have on **revitalizing** abandoned and poorly managed land in Portugal. (CE Noticias Financieras English, 2024)

Beyond being portrayed as a static treasure, the GOLDMINE metaphor extends to depict the carbon market as a dynamic system capable of generating ongoing value and growth. Describing the market as an *opportunity* to generate funding (35) likens it to a tool that continuously produces returns, as illustrated by Tanzania attracting over US$20 billion investment in carbon offset projects in 2023. Under conditions of transparency and fairness, the carbon market is considered able to foster the emergence of green projects, presenting it as an *ideal setting* (36) that nurtures new value, emphasising in the Arab Federation of Capital Markets report highlighting the role of exchanges in Egypt and Dubai in building transparent platforms. Similarly, characterizing the market as a *future source of growth* (37) highlights its value as sustainable, developing and expanding over time rather than being exhausted after a single use, a perspective evident in Korea where securities firms view the voluntary carbon market as a blue-ocean opportunity. The notion of *expansion* (38) likewise conveys the idea of market growth, resonating with the image of enlarging reserves or extending the extraction range of a goldmine, as shown by Singapore’s CAD Trust expanding to cover 85% of the global voluntary carbon market. Finally, portraying the carbon market as capable of *revitalizing* degraded land (39) expands its value beyond the financial domain to broader social and environmental benefits, as noted in Portugal where experts argue that the voluntary market could restore abandoned land while contributing to fire prevention.

Taken together, the goldmine metaphor and its derivative rhetorical devices construct a profitable narrative of the carbon market. They transform a complex policy instrument into a clear symbol of wealth and opportunity. From goldmine to ticket, from unlocking potential to reaping dividends, this set of metaphors effectively translates abstract market activities into concrete and appealing images of wealth. In doing so, they attract the attention of investors and policymakers and shape the carbon market as a solution capable of delivering substantial economic benefits and supporting sustainable development.

4.5 Spatial movement

Spatial movement metaphor belongs to the category of orientational metaphors. Spatial orientation, such as up and down or forward and backward, is a fundamental aspect of human experience and is frequently projected onto abstract domains to express change and progression. In this metaphorical framework, fluctuations and developments are understood through visible movements in space. In the context of the carbon market, spatial movement metaphors capture its volatility and operational dynamics. Expressions such as "rise," "fall," "move forward," or "stagnate" map institutional and market changes onto shifts in spatial position or direction. By portraying development as motion through space, this metaphor makes complex institutional processes more concrete, highlighting momentum, stages, and instability in ways that are intuitively accessible. A total of 10 instances of spatial movement metaphors were identified in the dataset.

40) The unregulated voluntary carbon market, which grew to $2bn in 2021 has since **slumped** to $500m this year, according to Barclays, but forecasts say the market could reach tens of billions of dollars in the years to come to fund climate change mitigation. (The Guardian (London), 2023)
41) Brazil's voluntary carbon market **shrinks** in 2023. (CE Noticias Financieras English, 2024)
42) In recent weeks, governments and voluntary initiatives have tried to restore confidence in carbon markets after the volume more than halved in a year, **falling** from $2bn (£1.6bn) to $723m in 2023. (The Guardian (London), 2024)
43) **Ups and downs** of Forest Carbon Markets. (Samriddhi Foundation, 2022)

This type of metaphor employs vertical movement to reflect changes in the value and scale of the market. When the voluntary carbon market is said to have *slumped* (40) after a period of growth, it not only points to the decline in trading volume but also conveys a strong impression of severe market damage. For example, The Guardian (2023) reported that the market fell from $2 billion in 2021 to just $500 million in 2023, a collapse linked to Shell's retreat from offsets and growing doubts about the integrity of credits. Similarly, describing the Brazilian market as *shrinking* (41) or noting a sharp *falling* in trading volume (42) vividly presents the image of market shrinkage and downturn. Brazil's voluntary carbon market, despite major reforestation investments such as Microsoft's purchase of 1.5 million credits, was still characterized as "shrinking" in 2023, underscoring the mismatch between investor optimism and systemic fragility. This rhetorical strategy culminates in the broader expression of *ups and downs* (43), which visualizes market volatility as an unstable and fluctuating trajectory, echoing warnings from scientists in 2024 that the industry must reform or "go out of business" after its trading volume more than halved in a year.Together, these depictions highlight the inherent uncertainty of the market.

44) Although the decree-law was published in January, for the voluntary carbon market to come into force, other conditions need to be created: firstly, a technical monitoring committee for the development and evaluation of methodologies, a platform for registering and transacting credits, and ordinances that define essential criteria for making the system operational. Without the ancillary regulations, the market cannot **move forward**. (CE Noticias Financieras English, 2024)
45) The carbon market language in the Paris agreement, contained in Article 6, outlines two "tracks" for how countries can **move forward** with emissions markets or what the agreement refers to as "internationally transferred mitigation outcomes" (ITMOs). (California Energy & Climate Report, 2015)

In addition to vertical movement, spatial movement metaphors also employ horizontal motion to describe the development of the market. When the Portuguese voluntary carbon market was stalled for nine months until ordinances were published, and commentators noted that without these ancillary regulations the market could not *moving forward* (44), market development is depicted as forward motion being obstructed, vividly illustrating how institutional barriers can lead to stagnation. Similarly, the Paris Agreement's Article 6 framed international carbon trading as a way for countries to *moving forward* (45), presenting forward motion not as blocked but as enabled, thereby providing a clear sense of direction for the expansion of emissions markets.

46) Initiatives of this magnitude are also a **boost** to the emerging voluntary carbon market. (CE Noticias Financieras English, 2022)
47) "The voluntary carbon market is **in a pilot phase**. (CE Noticias Financieras English, 2023)

Spatial metaphors also employ the imagery of momentum and stages to capture the market's evolving character. When large-scale reforestation projects in Spain, such as Fundación Repsol's Motor Verde initiative, were described as a *boost* (46) to the emerging voluntary carbon market, the market is depicted as a body that can be pushed forward by external actions, showing how ambitious forestry schemes help accelerate its momentum and attract investment. Similarly, the Mexican voluntary carbon market was officially referred to as being *in a pilot phase* (47), with government officials stressing that feedback and adjustments would be needed before full implementation, framing the market as an experiment in progress and emphasizing its provisional but expandable nature.

Overall, these metaphors portray the carbon market as an entity in constant motion, with trajectories that include upward and expansive moments as well as downward and stagnant phases. In this way, they effectively transform abstract economic data into vivid and tangible movement patterns, shaping public perceptions of the market's dynamism, volatility, and developmental potential.

4.6 Living entity

Living entity metaphor belongs to the category of ontological metaphors. In everyday understanding, living beings are characterized by birth, growth, maturity, decline, and renewal. These biological processes provide a rich source domain for interpreting abstract systems in terms of vitality, development, and transformation. In the context of the carbon market, the living entity metaphor emphasizes its dynamic and evolving nature. It portrays the market as a life form capable of taking root, growing, and undergoing phases of change. By attributing qualities of vitality and fragility, this metaphor shifts the image of the carbon market from a static mechanism to a living organism whose trajectory reflects both resilience and vulnerability. A total of 11 instances of the living entity metaphor were identified in the dataset

48) The voluntary carbon market in Brazil is generally **in its infancy**, but it is growing. (CE Noticias Financieras English, 2023)
49) On the other hand, the voluntary market is **in its infancy** and faces many challenges ahead, including a lack of capabilities to scale the supply of offsets, wide variations in credit quality, immature carbon market infrastructure, and a lack of regulatory support. The Business Times Singapore, 2022
50) "From what we see about the voluntary carbon market, it is still very **nascent**. (The Straits Times (Singapore), 2024)
51) How to pull the voluntary carbon market out of **adolescence**. (Financial Times (London, England), 2023)
52) Africa is poised to benefit from a **maturation** of the carbon market over the next 18 months," Yakubu said. (China Daily European Edition, 2024
53) The global voluntary carbon market has experienced substantial **growth**, reaching $2 billion, and was anticipated to expand further, ranging between $10 billion to $40 billion,' he said while briefing the Senate Standing Committee on Climate Change. (Dawn (Pakistan), 2023)

LIVING ENTITY metaphor employs vocabulary associated with stages of biological growth to describe the maturity of the market. For example, the Business Times in 2022 noted that the voluntary market in Southeast Asia was still *in its infancy* (48), facing challenges such as lack of capabilities, variations in credit quality, and weak infrastructure, while Brazil's market was likewise described as *in its infancy* (49) but beginning to grow in 2023. Similarly, The Straits Times in 2024 emphasized that the voluntary carbon market remains very *nascent* (50), reinforcing its image as an emerging system in need of nurturing. Further, the Financial Times in 2023 called for pulling the market out of *adolescence* (51), suggesting that it has grown but remains unstable and requires stronger standards. Ultimately, African experts at COP28 argued that the continent is poised to benefit from a *maturation* (52) of the carbon market within 18 months, signalling the prospect of stability and reliability. In this way, the metaphor maps the developmental trajectory of the market onto the growth (53) already evident in its expansion to a $2 billion global scale, with forecasts of $10-40 billion, providing expectations for its future evolution.

54) In the absence of an official mechanism, a voluntary carbon market has **blossomed**. (The Times of India (TOI), 2023)
55) Global climate commitments have jump-started the global voluntary carbon market and it is **blooming a spring** in India. (The Economic Times, 2022)
56) An increase in the supply of high-quality carbon credits, improved market infrastructure and supportive policy and regulatory frameworks are needed for credible voluntary carbon markets to **take root** in the region, a leading expert has said. (Gulf Daily News, 2023)

Beyond life stages, LIVING ENTITY often draw on plant growth to describe the positive development and flourishing of the market. The market is depicted as *blossomed* (54) in the absence of an official mechanism or *blooming* spring under the momentum of global climate commitments in India. Those metaphors that vividly convey a natural and vigorous momentum, suggesting vitality and promise. The imagery of *taking root* (56), as emphasized in the Gulf region with calls for high-quality credits, stronger infrastructure, and policy support, highlights the need for solid foundations and suitable conditions, just as plants require fertile soil to grow.

57) ……."if we don't have rules to ensure that forestry projects last over time, and there are (as there will be) forest fires, if there is no way of managing this risk within the scope of voluntary carbon market projects, what will happen is that the carbon market will not **survive**. (CE Noticias Financieras English, 2024)
58) This coincided with the **evolution** of a carbon market, globally and domestically. (Hobart Mercury (Australia), 2016)

LIVING ENTITY metaphors also focus on the survival capacity and evolutionary process of the market. For instance, the warning that the carbon market may not *survive* (57) survive without rules to ensure forestry projects last over time and manage fire risks depicts it as a fragile organism. Its existence depends on external conditions and regulatory support. At the same time, describing the market's transformation as *evolution* (58) of carbon trading in Tasmania, where conservation efforts and biodiversity management were linked to carbon market activities, portrays it as a dynamic system capable of continuous adaptation and improvement. This image emphasizes its ability to adjust to challenges and achieve long-term development.

Altogether, these examples illustrate how the living entity metaphor conceptualizes the carbon market as a dynamic organism, capable of being born, growing, maturing, evolving, and, under certain conditions, declining or perishing. This metaphor underscores both vitality and fragility, portraying the carbon market as a life form whose trajectory reflects development and dependency rather than permanence or stability. By humanizing and biologizing a complex economic concept, it makes the market more accessible to understanding, while at the same time highlighting both the potential and the risks inherent in treating it as a living entity.

4.7 Machine

Machine metaphor belongs to the category of ontological metaphors. A machine, in its literal sense, is characterized by mechanical operation, precision, and the interdependence of its components. It requires careful design, regulation, and maintenance to function effectively. Because of these properties, the metaphor is often employed to conceptualize abstract systems as tangible mechanisms with operational logic. In the context of the carbon market, the machine metaphor underscores its systemic and functional character. It portrays the market as a constructed mechanism whose components interact to generate outcomes through regulated processes. By framing the market as a machine that requires calibration, oversight, and adjustment, this metaphor makes its institutional dynamics more concrete and highlights the importance of governance and control.

59) The voluntary carbon market can be a **valuable mechanism** for directing investment to developing nations that need help in the fight against climate change. (The New York Times - International Edition, 2023)
60) As a **market-based mechanism** to reduce greenhouse gas emission, carbon trading is an effective **moderator**. (The Business Times Singapore, 2021)
61) It is seen as an **important -supplementary mechanism** to the national Emissions Trading Scheme (ETS), the world's largest carbon market, which regulates more than 2,000 emitters from the power industry. (South China Morning Post, 2023)
62) Carbon markets, she explained, are effective **tools** that incentivize companies to reduce harmful emissions by providing "carbon credits," which can be traded and sold to investors and companies struggling to curb their emissions. (CE Noticias Financieras English, 2024)
63) The statement recalled that "the voluntary carbon market is an **instrument** that allows companies and other entities to offset their GHG emissions by acquiring carbon credits generated by projects that reduce or sequester carbon", detailing that "these credits are generated by projects, which are verified by independent entities to guarantee their validity. (CE Noticias Financieras English, 2024)

The most direct expression of the MACHINE metaphor is the description of the carbon market as a tool or mechanism. It transforms the market from an abstract concept into an object with a clear function. For example, the carbon market is described as a value *mechanism* (59) that channels funding toward developing countries, or as a *market-based mechanism* (60) designed to reduce greenhouse gas emissions while moderating corporate behavior. Such descriptions clarify the purpose of the market. It is also referred to as a *supplementary mechanism* (61) to China's ETS, supporting the world's largest compliance market and an effective *tool* (62) for incentivizing emission reductions through tradable credits, further reinforcing its role as a useful and efficient component within the repertoire of problem-solving solutions. Referring to the market as an *instrument* (63) for offsetting emissions in Portugal's newly established voluntary carbon market law directly conveys its capacity to be employed for specific tasks.

64) This places the carbon market in a prominent position, as a vital **cog** that can drive the transition to a low-carbon economy. (CE Noticias Financieras English, 2024)
65) With global demand for voluntary carbon credits expected to increase 15-fold by 2030 and 100-fold before 2050, carbon markets could become an important **driver** of the shift to a low-carbon economy. (City A.M., 2022)
66) Global climate commitments have **jump-started** the global voluntary carbon market and it is blooming a spring in India. (The Economic Times, 2022)
67) Beijing has moved a step closer to **rebooting** its suspended voluntary carbon market, the China Certi-fied Emission Reduction (CCER) scheme, a part of its plans to develop a more **comprehensive market mechanism** to support greenhouse gas emissions goals. (South China Morning Post, 2023)
68) Malaysia, which has committed to reducing 45 per cent of its greenhouse gas emissions by 2030, is set to **launch** a voluntary carbon market for businesses by the end of this year. (The Straits Times (Singapore), 2022)
69) In Brazil, the voluntary carbon market is **up and running**, while the regulated market is still being built. (CE Noticias Financieras English, 2023)

Beyond being a tool, the MACHINE metaphor also employs dynamic vocabulary to depict the driving force and operational state of the market. This language presents the market as active and effective. For example, it is described as a *cog* (64) and an important driver (65) of the low-carbon transition, suggesting its role as an engine capable of propelling major change. In India, global climate commitments have *jump-starting* (66) the voluntary carbon market, bringing rapid expansion and renewed momentum, vividly illustrating the essential role of external forces in initiating its operation. Likewise, in China the suspended CCER scheme is being *rebooted* (67) as part of a comprehensive mechanism to support emission goals, while Malaysia is preparing to *launch* its own voluntary carbon market to meet 2030 climate commitments. In Brazil, the voluntary market is already *up and running* even as the regulated system is under construction, highlighting how the metaphor emphasizes both activation and continuity. Collectively, these expressions reinforce the image of the carbon market as a machine in motion, capable of being started, restarted, and sustained to drive the low-carbon transition.

70) Government commitment to scale the voluntary carbon market, which could **channel** tens of billions of urgently needed dollars toward our climate goals.

The essence of the MACHINE metaphor lies in its purposive character. The carbon market is portrayed as a *channel* (70) that directs billions of dollars in funding, as emphasized by the 2024 U.S. voluntary carbon market principles, which frame the market as capable of mobilizing tens of billions of urgently needed dollars toward climate goals. It is also depicted as a moderator (60) that balances and manages greenhouse gas emissions, as described in Singapore's framing of carbon trading as a market-based mechanism. In these descriptions, the market is consistently presented as a system with clear objectives and functions, carefully designed to achieve climate goals in the most effective manner.

Collectively, these examples present the carbon market as something machine-like, with built, set in motion, and keeping running through human design. The metaphor brings out ideas of precision and interconnection, showing the market as a system, that channels flow and produces outcomes when it is properly maintained. At the same time, it suggests dependency: like any machine, the market needs regular adjustment, regulation, and calibration to keep functioning. In this way, the discourse portrays the carbon market as an engineered device—steady and productive when cared for, but prone to malfunction if left unmanaged.

4.8 Others

In addition to the dominant categories, there are metaphorical expressions that resist clear classification but nonetheless play a meaningful role in framing the carbon market in news discourse. In this dataset, eight such cases were identified. These metaphors highlight diverse rhetorical dimensions, including visibility, competition, initiation, challenge, and responsibility demonstrating the fluidity of metaphorical framings beyond the main conceptual clusters.

71) Carbon market has once again become a global **buzzword** with increased focus on net zero goals by corporations, and with countries firming up their climate commitments under the Paris Agreement. (The Economic Times, 2022)
72) What we found was there is much that needs to be done...The carbon market should be a real market and **not a secret** pact between buyer and seller," said Sunita Narain, director general, CSE, referring to findings of the investigation. (The Times of India (TOI), 2023)
73) In other words, the "carbon market is a kind of **zero-sum game** in which a global reduction in greenhouse gas emissions is achieved by buying and selling the right to emit". (CE Noticias Financieras English, 2024)
74) China's ETS market, which **made its debut** on July 16, is believed to be the world's largest carbon trading market. (China Daily (Hong Kong Edition), 2021)
75) Finding data for the voluntary carbon market is like **collecting corn**: it's very difficult. (CE Noticias Financieras English, 2025)
76) The **hare** of the carbon market is now **at full gallop**; (The Herald (Glasgow), 2023)

77) The voluntary carbon market has **witnessed remarkable growth** in recent years, with businesses and individuals increasingly recognizing the importance of taking responsibility for their carbon footprints. (CE Noticias Financieras English, 2023)
78) "It's up to the APA and the ICNF to make the voluntary carbon market **happen**," said Nuno Lacasta, president of the APA - Portuguese Environment Agency, in what was his last public intervention in this position, which he will leave on January 31st. (CE Noticias Financieras English, 2024)

In example (71), referring to the market as a global *buzzword* frames it as a fashionable linguistic trend rather than a concrete entity. This was evident in India's 2022 reporting, where the carbon market was described as a "buzzword" amid growing corporate net-zero pledges, signalling both its popularity and its superficiality. Similarly, the phrase a real market and *not a secret pact* (72) raised by CSE in its 2023 investigation in India, criticizes the opacity of voluntary carbon markets, suggesting they resemble covert deals benefiting project developers rather than transparent institutions serving communities. Meanwhile, the *zero-sum game* metaphor (73) portrays the market as a competitive arena in which one party's gain necessarily entails another's loss, emphasizing the adversarial character of emissions trading. Another set of metaphors personifies the market with human or animal qualities, stressing both its actions and the effort required to sustain it. Describing the market as *making its debut* (74) notably in 2021 when China launched the world's largest carbon trading market, anthropomorphizing its entry as if it were a staged performance, dramatizing its institutional launch. By contrast, the difficulty of gathering market data was likened in 2024 to the *collecting corn* (75) with CE Noticias reporting that finding reliable voluntary carbon market data was "like collecting corn," underscoring the technical difficulty and lack of transparency. Likewise, depicting the market as a fast-running *hare* (76) conveys a dynamic image of energy and momentum, yet also implies a pace that may prove difficult to sustain. Finally, some metaphors focus on the forces that sustain the market's existence and growth. The statement that the voluntary carbon market has *witnessed remarkable growth*, personifying it as a subject capable of perception and experience, reported in 2023 coverage of Latin America and other regions, personifies it as a subject capable of perception and experience, reflecting its vigorous expansion as an economic phenomenon. By contrast, the formulation in example (78), that it must be made to happen, voiced in 2024 by Nuno Lacasta in Portugal, directly underscores the decisive role of regulators. This shows that the carbon market is not a self-sustaining system; its existence and success depend on the deliberate promotion and continuous management of policymakers and regulatory institutions.

5 Discussion

This chapter shows the pervasive presence of ontological and structural metaphors in news on carbon markets in English news coverage of carbon markets. These metaphors translate abstract institutional logic into concrete, process-oriented expressions. Media coverage further exhibits a marked duality. Carbon markets are simultaneously portrayed as both an effective tool for advancing climate policy and mobilising resources, and as an institutional practice fraught with uncertainty and risk. The discussion addresses three sub questions mentioned above:

1. *What are the most common metaphors used in English-language news articles about the carbon market?*
2. *How do these metaphors conceptualize the carbon market?*
3. *What are the implications of these metaphorical framings for public understanding and engagement with the carbon market?*

Finally, I will reflect on the theoretical framework and methodology.

5.1 Dominant Metaphors and their the Conceptualization of the Carbon Market

To address the first two research questions, this study identifies dominant metaphors that together shape the public image of the carbon market. Structural metaphors (49.79%) and ontological metaphors (41.91%) occur far more often than orientational metaphors (4.15%). This distribution suggests that news discourse relies on stable, operational schemas to explain complex governance mechanisms rather than directional or spatial ones (Dijk, 2013). Overall, two interwoven yet sometimes contrasting frames emerge.

The carbon market as a reliable governance tool. In this frame the market is depicted as functional, stable, and operable. MACHINE and STRENGTH metaphors underscore its rationality and practicality as a policy mechanism, aligning with accounts of the market as a market-based instrument (MBI). References to strength (e.g., prop up, cornerstone) stress a foundational role in climate governance, conveying stability and significance. These metaphors both simplify institutional logics and symbolically construct legitimacy.

The carbon market as a field of opportunity and risk. Here the market appears as a space of value and danger. GOLDMINE, ENGINE, and DRIVER highlight value creation and capital mobilization, while JOURNEY (e.g., step, milestone) presents gradual development from inception to maturity. By contrast, PITFALL metaphors such as WILD WEST, POLITICAL GRAVEYARD, and CAN OF WORMS emphasize disorder, unpredictability, and systemic flaws. These figurations challenge the image of a stable governance tool and foreground inherent uncertainty and vulnerability.

Beyond economic or technological views, cognitive and cultural factors shape public images of carbon markets. As Moser (2022) demonstrates how culturally embedded cognitive biases, such as hierarchy-egalitarianism and communitarian-individualism, affect how people interpret and accept climate-related policies. Legitimacy thus depends not only on cost-effectiveness or technical feasibility but also on cultural values and cognitive frames. As with decision-making more broadly, no single rational narrative suffices; carbon markets are constituted through multiple institutional, cultural, and political discourses (Knox-Hayes, 2009; Paterson, 2012; Simon, 1957).

Journalists and policymakers together construct a dynamic, contested discursive arena shaped by diverse interpretive lenses. Both groups deploy culturally resonant metaphors to navigate uncertainty. By invoking retrospective anchors (e.g., CORNERSTONE) and forward-looking imaginaries (e.g., JOURNEY, GOLDMINE), discourse grounds the market in a credible past while projecting possible futures. Evidence from Johnstone et al. (2024), who found that framing climate change as CLIFF EDGE or MINEFIELD heightens perceived urgency; when such metaphors emphasize human agency, they can temper fear or fatalism. Similarly, Asplund (2012) observed that Swedish agricultural journals used GREENHOUSE, WAR, and GAME to render abstract environmental risks tangible, offering emotionally resonant reference points amid uncertainty. In climate policy, where outcomes remain uncertain, metaphors function as essential cognitive tools that enable public understanding and engagement.

5.2 Functions of Metaphors for Public Understanding and Engagement

This study answers the third research question by identifying three communicative functions of metaphors in public discourse.

First, metaphors work as explanatory tools. Metaphors map abstract institutions onto familiar domains and lower cognitive barriers. Carbon pricing, quota allocation, and credit trading are rendered as tangible objects (Lövbrand & Stripple, 2011; Paterson, 2012). For example, describing the carbon market as a bedrock conveys stability, while the MACHINE metaphor highlights design, adjustment, and maintenance. These uses clarify how the system works and support policy communication through simplification. Furthermore, metaphors act as instruments of legitimation. Terms such as pillar and bedrock imply reliability and justify institutional construction. Describing the voluntary carbon market as a cog highlights its role within a larger governance machine that transmits force, maintains coordination, and raises efficiency. This framing reinforces the market's status as a market-based instrument (MBI) and strengthens perceptions of rationality and necessity.

Finally, metaphors serve as Mobilizing Devices, facilitating resource mobilization by shaping public and investor expectations. Metaphors shape expectations and aid resource mobilization. GOLDMINE and DRIVER stress economic potential and depict a space of value creation and growth. These narratives align with cap-and-trade logics in Emissions Trading Systems (ETS), often presented as a tool or mechanism for cost reduction and the green transition (Ellerman, 2010; Paterson, 2012). In this way, metaphors not only reduce cognitive distance but also provide symbolic support for the market's mobilizing power and institutional legitimacy.

In sum, Metaphors in news coverage are constitutive of public communication and legitimation. They explain, legitimate, and mobilize. They shape public views of the carbon market and influence policy acceptance and institutional evolution. These findings extend Conceptual Metaphor Theory by showing that cross-domain mapping operates as both a cognitive and political practice in public governance..

5.3 Reflection on the Theoretical Framework

The theoretical framework for this study draws on Conceptual Metaphor Theory (CMT) and literature on how the carbon market is framed within environmental governance. CMT states that people understand abstract concepts through mappings from familiar source domains (Lakoff & Johnson, 1980b). In this study, news texts map the carbon market onto familiar domains such as tool, journey, goldmine, and pitfall. This indicates that metaphors help explain a complex institutional system. The results therefore support the core view of CMT that metaphors are necessary for understanding abstract ideas. However, when compared with the findings, CMT shows limitations. While CMT focuses on the cognitive role of metaphors, it does not account for how they are used strategically in public discourse. The results show that media do not use all metaphor types equally. Ontological and structural metaphors are dominant, while orientational metaphors are rare. This uneven pattern suggests selective use rather than neutral cognitive mapping. Metaphors in public reporting therefore act not only as cognitive tools but also as strategic frames that emphasize certain aspects and obscure others. Future theoretical work could combine CMT with discourse and framing theory to better explain how metaphors operate in institutional contexts.

MBIs aim to reduce emissions at lower social cost by using pricing and incentive mechanisms (Pirard, 2012; Shen et al., 2023). Compared with command-and-control regulation, MBIs are more flexible and can stimulate innovation (Pirard, 2012). The results show that metaphors such as tool, mechanism, and instrument reflect these policy logics. This indicates that metaphors both help explain MBIs and reinforce their institutional role. In this way, metaphors lower the threshold for understanding and at the same time support institutional legitimacy.

These results also highlight limits of the theoretical approach. CMT centres on cognition and gives limited attention to political and legitimacy functions. The findings show that metaphors help build the public image and perceived legitimacy of institutions (Charteris-Black, 2004). Future research could therefore link CMT with governance communication or critical discourse analysis to better explain metaphors' roles in environmental governance.

5.4 Reflection on the Methodology

This study combines the Metaphor Identification Procedure (MIP) with the Gioia method. MIP provides a structured and transparent process for identifying metaphorical expressions. The Gioia method connects these expressions to broader discursive patterns through first-order concepts, second-order themes, and aggregate dimensions. This combination allows detailed identification while retaining attention to wider narrative structures.

The methodology has several limitations. The corpus consists only of English-language news from a limited number of outlets. This reduces the scope of the findings and limits their relevance across cultural contexts. Previous comparative work on climate-related reporting shows that metaphor use varies by culture and political setting. For example, China Daily tends to use WAR and CONSTRUCTION metaphors to highlight government action, whereas The New York Times uses BUSINESS and DISASTER metaphors to focus on economic concerns and uncertainty (Huang & Liu, n.d.). Similar contrasts may exist in carbon-market reporting. Future research could therefore broaden the dataset to include other languages and regions. The event-driven and conflict-focused nature of news reporting also presents limitations (Bell, 2006; Dijk, 2013). News coverage often highlights crisis and controversy, which may increase the visibility of critical or negative metaphors. Institutional framings may therefore be under-represented. Including policy documents, corporate reports, and academic texts in future research may help reduce this bias.

This study relies on qualitative analysis. This is suitable for examining the cognitive and narrative role of metaphors, but it does not assess how audiences interpret them. Whether metaphors influence public understanding remains unclear. Further work could include surveys, experiments, or audience interviews. Large-scale text-mining and automated metaphor detection could also be used to validate metaphor patterns across broader datasets.

6 Conclusion

This study seeks to clarify two issues: which metaphors describe the carbon market in English-language news, and how these metaphors shape public understanding. Three analytical directions address this aim. The analysis first identifies the most frequent metaphorical expressions. It then explains how these metaphors interpret the carbon market by mapping this abstract institutional arrangement onto familiar domains. Finally, it evaluates their broader effects, including possible shifts in public cognition, perceived legitimacy, and willingness to engage.

The first main finding is that ontological and structural metaphors dominate. They are not decorative language but cognitive devices. They make an abstract policy instrument with political intent visible, assessable, and debatable. Journalists and commentators rely on such metaphors to make the market intelligible. This outcome supports the central claim of Conceptual Metaphor Theory (Lakoff and Johnson, 1980): metaphors act as necessary tools for understanding complex and abstract domains. The second finding is that news reporting maintains a tension between two coexisting narratives. One narrative depicts the carbon market as useful because it mobilizes resources, creates economic opportunities, and supports climate governance. The other presents it as unreliable and risky, marked by uncertainty and contested legitimacy. This dual stance creates a persistent, contested narrative space where opportunity and doubt coexist. This pattern aligns with governance literature: markets can enable climate action but remain vulnerable to political, economic, and ethical challenges. The third finding indicates that metaphors do more than simplify; they also support communication. Some metaphors describe the carbon market as a cornerstone or pillar of climate action, reinforcing its legitimacy. Others frame it as a source of value creation or a driving engine, motivating actors. These framings influence expectations among investors, policymakers, and the public. Metaphors thus shape the social meaning of policy instruments rather than functioning neutrally.

This study has several limitations. The corpus consists only of English-language news, which narrows cultural and linguistic coverage. Metaphors in other languages and contexts remain unexplored. Media texts focus on conflict and uncertainty, which may amplify biased narratives and downplay technical and institutional details. Moreover, qualitative analysis helps identify metaphor patterns but cannot directly reveal how readers interpret them or whether these metaphors affect behaviour. Future research should examine multiple genres (e.g. policy documents, corporate reports or NGO reports), compare different cultural and linguistic contexts, and incorporate the surveys to capture public responses.

Despite these constraints, this study contributes to two respects. Theoretically, it provides empirical support for the relevance of CMT in environmental governance by showing that metaphors bridge policy logic and public understanding. Practically, it highlights that media language influences how society interprets specific policy tools, which matters for policymakers and science communicators.

7 Reference

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Appendix 1

Extract Python code

```
import pandas as pd
import re
from pathlib import Path
import ace_tools as tools

# Setup
input_path = Path("File name")
xl = pd.ExcelFile(input_path)
sheets = [pd.read_excel(xl, sheet_name=sn, header=None) for sn in xl.sheet_names]
df = pd.concat(sheets, keys=range(len(sheets)))

# New keywords
keywords = [
    'carbon market', 'carbon markets',
    'carbon offset market', 'carbon offset markets',
    'carbon sink market', 'carbon sink markets',
    'carbon trading'
]
pattern = re.compile('|'.join(map(re.escape, keywords)), flags=re.IGNORECASE)

# Sentence splitter
sent_split = re.compile(r'(?<=[\。 \?!？！ \.;； ])\s+')

results = []
for (sheet_idx, row, col), cell in df.stack().items():
    if pd.isna(cell):
        continue
    text = str(cell)
    sentences = sent_split.split(text)
    for s in sentences:
        if pattern.search(s):
            results.append({
                "sheet": sheet_idx + 1,
                "row": row + 1,
                "col": col + 1,
                "sentence": s.strip()
            })

out_df = pd.DataFrame(results)

# Save
output_path = Path("/mnt/data/carbon_market_sentences_v2.xlsx")
out_df.to_excel(output_path, index=False)

# Preview
tools.display_dataframe_to_user("Sentences with updated keywords", out_df.head(20))

output_path.name
```