Gordon L. Clark*

Mobilising knowledge for corporate environmental performance and innovation in the context of global warming and net zero

https://doi.org/10.1515/zfw-2025-0047
Received March 5, 2025; accepted October 7, 2025;
published online November 14, 2025

Abstract: Corporations are increasingly held to account for their environmental performance given the looming climate crisis and its local and global footprints. It is observed that mobilising knowledge for superior environmental performance is challenging given the disputed authority of corporate officers, the variable value of expertise, and the ambivalence of investors as to the costs and benefits of such commitments. Not surprisingly, major corporations are beset by conflict over the allocation and use of scarce management resources. Recognising the challenges of mobilising knowledge to give effect to net-zero, this paper deploys Meric Gertler's classic papers on codified and tacit knowledge to better understand the nature and scope of corporate environmental management and innovation. Focusing upon Anglo-America corporations, implications are drawn with respect to the challenges facing multi-product and multi-jurisdictional corporations in adapting the emerging world of net-zero.

Keywords: climate change; corporations; knowledge; management

1 Introduction

Climate change is *the* fundamental challenge facing humanity and is apparent in the media attention it attracts and the efforts of younger generations to be effective before it is too late (see Baker et al. 2018). Since the Paris COP 21, successive meetings have amplified the significance of the issue, have sought commitments from countries like India and China, and have mobilised public opinion to encourage corporations to honour their commitments to holding global warming to +1.5 °C by 2050 (Otto 2020; Stoddart et al. 2023).

Global warming is accelerating not slowing (Forster et al. 2025; Hansen et al. 2025). Reports indicate that 'we' will overshoot the 2050 +1.5 °C target by +1.2 °C and this will be irreversible.[1] At +3 °C, global population losses could be like the 17th century ice-age but on an enormous scale (Parker 2017, Ch. 4). There is also evidence that the climate is increasingly unstable with "rapid temperature flips" that wreak havoc on "natural and socio-economic systems" (Wu et al. 2025, 1). The results of climate research are being taken up and amplified by global investors who have, in part, held major corporations to account for ESG and related investment policies (Clark and Dixon 2023). Company annual general meetings have also become battlegrounds over commitments to decarbonize, investment in alternative sources of energy, and meeting 2050 goals.

Nonetheless, media commentaries are awash with stories of corporate evasion on commitments, obfuscation as to what counts when measuring carbon footprints, and double-dealing – counting on the realisation of future commitments on one hand while on the other hand remaining silent on investments that go against commitments to net-0 in 2050. Witness the Financial Times LEX column (15th March 2024, p. 24) headed "Corporate backsliding on climate pledges falls far short of what is needed". Perhaps not surprisingly, corporations that make products reliant upon carbon are increasingly subject to campaigns of 'naming and shaming' for their evasion about public commitments.

If the media holds corporations to account for stated objectives on climate change, these same outlets emphasize corporate performance in relation to short-term stock market price appreciation and returns to shareholders. Some outlets acknowledge the tension between corporate short-term performance (profits and share prices) and long-term commitments (investment and growth) with respect to global carbon targets. Other media outlets are not so circumspect about the tension between short-term and long-term commitments. These issues have been exploited

***Corresponding author: Gordon L. Clark**, University of Oxford School of Geography and the Environment, Oxford, UK,
E-mail: gordon.clark@ouce.ox.ac.uk.
https://orcid.org/0000-0003-3159-7674

1 https://www.irishtimes.com/environment/climate-crisis/2025/06/19/only-two-years-left-to-limit-global-warming-to-15-degrees-target-scientists-warn/.

by those seeking headlines even if their efforts to influence the trajectory of global climate change are lamentable (Stern 2023).

This paper focuses on the management of Anglo-American corporations recognising that they both use and produce the environment over the short-term (pollution) and the long-term (carbon emissions). While Nordhaus (2019, 2011) acknowledged corporate "governance is a central issue in dealing with global externalities", like other commentators he was more concerned with the pricing of externalities and the role of markets in promoting technological innovation consistent with long-term eco-efficiency. Missing from his blueprint was a conceptualisation the 'management problem' in relation to the production of goods and services, competitive strategy, and the climate emergency.

Informed by Meric Gertler's (2001, 2003) project on the nature and use of knowledge, the paper focuses on Anglo-American corporations wherein innovation and management are the lifeblood of success (*contra* Chandler 1990). In doing so, I identify the challenges of realising environmental objectives given the contested authority of managers, information asymmetries, and scarce resources. As such, it is assumed that "*conflict* is pervasive in organizational decision making" and "the nature of authority relations may have a large impact on the way decisions are made" (Shapira 1997, 5). It is also acknowledged that Anglo-American corporations have distinctive forms and functions in relation to continental European traditions (see Bathelt and Gertler 2005; Hall and Soskice 2001).

Gertler's elaboration of Polanyi's (1967) insights has found favour in economic geography where it is argued that the deployment of knowledge in companies is often locationally bound if not entirely locationally determined (Bathelt and Glückler 2018). It has also been observed by Amin and Cohendet (2004) and Bathelt and Glückler (2011) amongst others that how companies mobilise organisationally- and spatially-embedded knowledge for competitive advantage is an important building block of long-term success. The formation, deployment, and management of knowledge is also at the heart of recent research on technological innovation and wealth creation in advanced economies (see Aghion et al. 2021; Akcigit and Reenen 2023).

Analytically, the paper focuses on three types of Anglo-American corporation: integrated, hub-and-spokes, and portfolio-based firms and the challenges involved in mobilising knowledge to realise environmental objectives. Much is written about the various types of the Anglo-American corporation often privileging shareholders over stakeholders and the interests of host nations over communities (witness Chandler 1990). This can exclude other ways of conceptualising the Anglo-American corporation and other countries' models of the firm and their implications for understanding, for example, the degree to which corporations are embedded in national regulatory regimes (see Christopherson 2018; Doremus et al. 1998).

This paper is an analytical treatment of the nature and scope of corporate environmental management focusing on the organization of Anglo-American firms rather than idealised models of the firm that privilege profit maximisation over stakeholders' interests (compare Christophers 2025). As such, the paper is about 'way of thinking' about corporate form and environmental performance in the Anglo-American world of corporate governance (compare Porter and Linde 1995). As such, I follow the lead of Thrift (2005) and Howard-Grenville and Lahneman (2021) and others in focusing on the 'performance of management' in context rather than idealised models of management that draw their inspiration from economic principles applied to the firm.

The paper highlights the contested nature of corporate management including the ways of realising value whether expressed in terms of earning profits or in discounting current and expected carbon footprints. As such, the paper is less about textbook models of the firm and is more about the problematic nature of coordination and management given the challenges associated with environmental assets and liabilities (compare Spulber 2019). Like related research in economic geography, the paper echoes Chandler's (1979) focus on the 'visible hand' *in* context rather than idealised models of the firm shorn of agency problems. To do otherwise would be to return us to models of the firm that ignore the cultural and institutional foundations of models of management (see Knox-Hayes 2016).

The historical relationship between economy, geography, and the environment is sketched in the following section, referencing the use-value of the environment in US industry and related regional-complexes. It is noted that governments' regulatory regimes have evolved being increasingly aimed at integrating the environment into the price of goods and services just as the financial industry has sought to value environmental liabilities in terms of corporate securities. This is followed by a version of the corporate management 'problem' and three models of Anglo-American corporate management and the ways in which the environment is treated therein. In the penultimate section of the paper, it is argued that the environment is increasingly valued for its scarcity in the face of

global warming. As such, a new regime of accumulation is emerging wherein corporate environmental management may become the bedrock of 21st century capitalism.

Insights as to the nature and management of knowledge in Anglo-American firms are based upon advisory and research engagements by the author and colleagues with companies operating in the UK and Europe, North America, and around the world. Informed by close dialogue, this experience sustains the argument of the paper (Clark 1998). Just as Gertler (2001, 2003, 2010) used field work to develop an analytical framework about innovation and knowledge, experience with major corporations is used to propose an analytical framework for understanding Anglo-American corporate environmental management with respect to 2050 carbon targets. As such, the paper is not about best practice nor does it focus on exemplars of a 'new' regime of corporate governance. Rather, it provides a set of analytical and conceptual tools grounded in economic geography and management for research about the corporate environmental management 'problem' in relation to 2050 carbon targets.

2 Environment – assets and liabilities

Textbooks of economic geography once included maps of natural resources linking the location of industrial and manufacturing hubs with region-specific resources such as coal, iron ore, and water (see Miller 1962). Being US-centric, the rise of Pittsburgh and the cities of northeastern Ohio and the Midwest manufacturing belt were explained by the availability of resources as inputs to production. Given the costs of transport and the spatial-fixity of natural resources, these types of industrial-regional complexes dominated the economic landscape of many OECD countries for much of the 20th century (Clark 1993).

Transport networks sustained the integration of regional production systems – steel produced in Pittsburgh was an integral part of automobile production in Detroit and oil refining in the south (Huallachain 1984). If local resources anchored industry production systems, the environment was both an input and an output in that waste generated from production found its way into air, ground, and water pollution. Few textbooks focused on these 'externalities' which were borne by the communities and regions that were hosts to related companies and industries (Miller 2001). In effect, a Faustian bargain was struck wherein environmental degradation and its effects on human health and welfare were the unaccounted costs of earning a living.[2]

The long-term costs of exploiting the environment were either entirely ignored or were imposed on communities, states, and latterly national governments (Miller 2001). Remediation and the containment of environmental pollution was typically framed in terms of human health not climate change or sustaining the use-value of the environment. Given the geographical scope and scale of these sites of production, responsibility for the costs of toxic dumps were often devolved to state and local governments overseen by federal regulatory agencies such as the US EPA. Given the health-related costs of ground-water contamination, sites of production were often abandoned rather than managed – reinforced by corporate restructuring designed to shift these costs to the public sector.

In any event, aluminium, autos, chemicals, oil and gas refining, and steel companies faced increasing costs of environmental remediation at a time when domestic markets were opening to foreign competition during the Reagan and Clinton administrations. These industries carried plant and equipment that were outdated relative to foreign competition and were financial and managerial burdens on corporate innovation and strategy. As such, the problems facing General Electric (for example) over the past 30 years can be found (in part) in the burden of inherited plant and equipment and the inability of corporate management to break free from the past (see Gelles 2022; Gryta and Mann 2022). Being embedded in time and space, sunk costs matter (Clark and Wrigley 1995).

Investors also came to appreciate the significance of environmental liabilities given the absence of willing buyers for related plants and equipment. The Anglo-American market for corporate control relies upon transparency as regards the nature and scope of corporate liabilities and management plans to meet the requirements of local, state, and national regulators. As environmental testing procedures have become more sophisticated, are more sensitive to rare and toxic chemicals, and are more responsive to scientific findings regarding the efficacy of site-based remediation, these costs have increased significantly over the past 3 decades. Not surprisingly, financial investors are rarely

2 A Faustian bargain obtains when a person or a community trade something of value like long-term wellbeing for short-term benefit (Pavel 2014). These bargains often involve the wilful denial of costs wherein those who benefit impose costs on others. See https://www.britannica.com/topic/Faustian-bargain accessed 5th April 2024.

willing to incur unlimited environmental liabilities for the past, present, and future.[3]

One response was to discard and/or isolate environmental legacies through their 'sale' to specialised managers and/or their 'transfer' to government agencies via abandonment or leasing arrangements that run years into the future. Corporate boards and senior managers have also sought to insulate themselves from the past by shifting on to others the environmental costs of doing business arguing their responsibilities are properly about global corporate competitiveness and shareholder value rather than managing the past. In many cases, companies have been unwilling to bear the full cost of business believing that Faustian bargains were struck to enhance corporate success in the national interest and in the interests of shareholders.

Another response was to invest in industry- and firm-specific production systems that minimize environmental costs and maximise the reuse of environmental resources like air, raw materials, and water through eco-efficient production systems (Porter and Linde 1995). These management strategies seek to neutralise the environment as a factor in the market value of major corporations. Instead of addressing climate change directly, boards and senior executives typically use CAPEX and managers' discretion to innovate and thereby 'neutralise' environmental liabilities rather than get ahead of industry norms. As such, there is an increasing premium on company- and industry-specific knowledge of the use of the environment in production.

A more ambitious project was to broaden the purpose of the corporation to one that embraces stakeholder interests including those related to environment, social, and governance (ESG) matters (Robertson 2024). In doing so, it has been assumed that long-term stock-price performance is driven, in part, by a commitment to value whether found in environmental management and/or in social and economic objectives that are linked to the 'social licence to operate' (Clark and Dixon 2023). In practice, ESG strategies are often justified by investors as a commitment to shareholder returns on the assumption that stakeholders rarely have a voice in how profit is planned, managed, and realised in practice (Saad 2023).

3 The management problem

While it is difficult to judge the long-term significance of events such as +50 °C days in the Gulf states of the USA, enormous fires in the Canadian northwest and California, and increasing numbers of catastrophic weather events across the world, the science of climate change increasingly focuses on extreme events and the global climatic system in disequilibrium. It Is unlikely that incremental responses to global warming via business practices and products and/or carbon pricing through financial markets will be sufficient to dampen or hold at bay global warming (Christophers 2025; Hepburn et al. 2020).

Engagement with corporations on decision-making, innovation, and investment related to climate change suggests there are four impediments to effective corporate actions on the nature and scope of climate change. These impediments are systemic attributes of the Anglo-American market for corporate control recognising the co-existence of competing and overlapping models of corporate control in Asia, continental Europe, and Latin America. While nation-states may regulate corporate form and functions, I am sympathetic to arguments to the effect that governments have limited influence over the financial imperatives driving the Anglo-American market for corporate control (Spulber 2019).

Corporate managers typically focus upon short-term profit and loss statements, stock price appreciation, and compensation. Whereas short termism is associated with listed corporations, short-term metrics of performance often hold sway in private corporations given the ever-present temptation to go public. Successful corporate managers tend to play a short-term game *and* a long-term game in that the former is often the basis of the later for managers who expect to be with their firm over the longer-term. What counts as the short term is typically quarter-to-quarter and year-to-year whereas the long-term tends to be year-to-year via cycles of capital raising and deployment that can take five years or so to realise value. Effective climate change investment programmes are less about the short-term and more about the long-term wherein capital raising and its deployment often involves a quest for increasing carbon efficiency.

Senior managers also face challenges from investors and employees, expectations as regards responsible decision making at home and abroad, and the interests of communities affected by investment and disinvestment decisions. Adding to the cacophony of voices, local and national governments have adopted climate-related goals and objectives with limited consultation as to their impact assuming corporations in their jurisdictions will honour related commitments. Underpinning these initiatives, governments and civil society organisations have increasingly onerous disclosure requirements notwithstanding the legitimacy of

3 See John Plender in the Financial Times 14th August 2024, p. 23 where he noted "most investors believe that stock market pricing inadequately reflects climate change realities."

conventional models of corporate governance that suppose business units compete for capital from their parent corporations and the market.

Across the Anglo-American world, legislation and the regulation of corporations are framed by two important principles. First, and notwithstanding widespread acceptance of profit-making as the objective of the corporation, the purpose of the corporation is often ambiguous being subject to the interests of its' owners and sponsoring jurisdiction(s). Whereas it is assumed that profit-making is the purpose of the corporation, this 'principle' is rarely found in enabling legislation and corporate codes of practice. Second, much of corporate legislation and regulation is focused on the rights of shareholders while accepting laws and regulations related to commercial contracts and agreements. In this respect, contract law is oftentimes as important as corporation law. Given the importance of the corporation and its legal entitlements and obligations, there remains ambiguity as to the purpose of the corporation notwithstanding attempts to prioritise profit (Shavell 2004).

There is often an appreciable gap between the stated purpose of a corporation as in its articles of incorporation and the interests of shareholders *given* the on-going responsibilities of company officers, employees, and suppliers. In many cases, the everyday life of the corporation involves routine functions and tasks that are difficult to locate in public statements of corporate purpose, shareholders', and stakeholders' interests. Mobilising the corporation through the actions and intentions of its employees with respect to making a profit is often-times quite problematic given ambiguity as to the link between intended actions and their desired effects. Managing the corporation is as much a problem of *sustaining* collective action as it is a problem of *acting* in accordance with its stated purpose as articulated in public-facing goals and objectives (Kay 2024).

To summarise, when a company makes a product for sale in local, national, and international markets it does so by drawing upon three resources and/or sites of knowledge in the firm. In the first instance, it applies a blueprint for production that comes with the design and/or purchase of related machinery. In the second instance, it uses trial and error to establish and maintain the parameters governing the optimal use of production systems that rely upon materials, labour, and capital. In the third instance, it relies upon the experience of its workers to realise the expected performance of capital equipment and machinery and, in doing so, ensure that production processes are both stable and efficient in terms of the resources deployed by senior managers.

In this respect, the 'management problem' is about combining codified knowledge of the design and operation of production systems with the tacit knowledge of employees and managers regarding how things work. In doing so, managers seek to realise short-term production-related goals *and* adapt to long-term imperatives such as changing market conditions. As Gertler (2001, 2003) intimated, short-term performance is often sustained by managing-through-targets via a known combination of labour and capital whereas long-term value is created through the mobilisation of knowledge in favour of adaptation and innovation in response to changing market conditions.

4 Corporate form and functions

Commentary on corporate environmental performance tends to blur differences between companies by size, function, and industry. Likewise, differences between corporations by jurisdiction of incorporation and the nature and spatial extent of networks of suppliers are often elided in favour of 'stylized' representations of the modern firm. In doing so, textbook models of firm behaviour and investment take pride-of-place thereby discounting significant differences due to jurisdiction, legal form, and functions (witness Lipczynski et al. 2009).

Analytically, 3 models of production can be used to represent the Anglo-American firm.[4] One model that was commonplace through the 1950s to the 1980s and remains significant in some industries more than others is the large *integrated* corporation which dominates markets or segments of markets such that they can set prices and reap higher returns than otherwise available. These companies are important in manufacturing such as autos, chemicals, and steel. To the extent that these companies have relationships with smaller companies they do so either through companies that produce specialised components or products which leading companies cannot produce and/or because the transaction costs of managing their own production systems are more than the costs of coordination and contracting with external entities.

In principle, the *integrated corporation* relies on senior executives to manage the firm in two dimensions – from the board through to the senior executive group and ultimately each part of the empire *and* from the core of the

4 It should be acknowledged that there are differences between the US and the UK (for example) in how these two countries and sub-national jurisdictions regulate corporations. A deeper analysis would take these differences seriously especially as regards the status of Delaware in the US market for corporate governance. See Saad (2023) and Strine (2025).

company and its operations and production teams through to each department or unit of the company. As such, it can be conceptualised as a command-and-control system where reported corporate sales and profits are the result of setting plans, allocating resources, monitoring their implementation, and solving problems along the way (witness General Electric in its heyday; Gelles 2022). But it is only as good as the effective use of knowledge of how products are produced and the relative costs and benefits of allocating scarce resources between competing claims for priority. These systems of allocation come with significant challenges including, for example, mediating systemic misinformation and competing claims as regards the benefits of product and process innovation.

As Jensen (1998, 312) noted, "centralised decision-making systems in large, complex organisations run a risk of failure that turns on their inability to utilise knowledge effectively." He quoted Hayek to the effect that centralised organisations often concentrate authority for decision-making notwithstanding their inability to "utilise valuable bits of diffusely held knowledge." He argued that decentralising decision-making with those who have domain-specific information and knowledge is, in the long-term, more efficient and effective in realising intended outcomes locally and globally. Nonetheless, this model of management requires both the resources to realise intended outcomes and a level of accountability and transparency such that 'local' decision-makers are subject to the over-arching objectives of the organisation (see also Garud and Shapira 1997).

The *hub-and-spokes* corporation governs networks of suppliers from an executive hub located in the home-region of the corporation notwithstanding geographically-extensive networks of suppliers found beyond the home-base of the corporation. For example, North American and European automobile industries have evolved from site-specific and centralised systems of production to continental networks of internal and external suppliers focused upon assembly plants that serve domestic and international markets. This type of firm relies on transport networks that connect suppliers with corporate production hubs governed via exacting standards of performance and coordination whose costs are less than the long-term costs of production at one site within the company and across the industry (Holmes 2000). These systems have evolved to become global in scope notwithstanding the persistence of jurisdiction-specific environmental regulations (see Lee et al. 2011).

In principle, the *hub-and-spokes company* is an effective way of managing the firm wherein key functions such as setting strategy, allocating resources, and holding to account units and businesses are the responsibility of the senior executive group. It may be the case that this type of firm has an 'identity' in that it can be advertised as (for example) a food and beverages company, a consumer products company, and/or an automobile company. But in this type of company, each unit has its own management team, its own profit and loss statement, and its own consumer-facing reputation and strategy. These types of companies' may spin-out units whose activities compromise the public integrity of the whole.

A third type of firm is the market-centred or *portfolio company*. This type is important in consumer-product industries such food and beverages wherein the headquarters of these firms are geographically separate from their products, markets, and production systems. The choice of internal versus external suppliers is driven, in part, by market expectations of short-term rates of profit and stock price valuations. Corporate headquarters tend to locate close to financial markets whereas production sites and systems are located close to materials and resources as well as suppliers. Producing internally as opposed to externally is resolved by reference to the efficiency of one over the other *and* the costs of holding assets as opposed to contracting with external parties.

Here, *portfolio firms* may hold businesses that are different from one-another and are neither identified as nor are reliant upon the reputation of the holding company. This type of company is driven by its brands rather than its corporate identity. It 'out-sources' the environmental performance of its units assuming 'local' managers better understand the environmental risks borne by each unit- and the profit-related management systems that seek to realise a premium on brand-name management *and* reputation. As such, it is a portfolio of profit and loss statements and is more like an investment company that manages a portfolio of risk and returns than it is a company committed to certain industries and regions (see Sharpe 2007 on the principles of portfolio management).

5 Management of environmental performance

The integrated corporation is typically a top-down command and control system of resource allocation led by division heads answerable to senior executives and to the board. In many cases, it has an identifiable culture and system of incentives and sanctions not dissimilar from large organisations found in government and in the military. This

type of organisation looks outwards and inwards drawing on financial institutions and markets for investment in productive capital and related capabilities while, at another level, ensuring that its divisions meet production targets and planned rates of return on a continuing basis. In these companies, internal reporting systems are governed by codified and target-driven metrics.

One of the virtues of the integrated company is that it can manage streams of revenue against the profit-related expectations of investors. Whereas production costs are also managed against these targets, revenue flows to the centre of the company. In this type of company, information about the nature and expected performance of each production unit flows up to the senior executive group and the board. Product and process management is less about the mobilisation and use of tacit knowledge at the level of the plant and/or the division and is more about the use of technology and reporting via codified systems of information and management throughout the company. Witness the challenges involved in managing General Electric (see Immelt 2021).

These types of companies focus on risk management in relation to capital market expectations. To the extent that the environment is an important input to production, it is treated as a flow of material just as it is treated as a flow of costs to be managed through the production process and beyond. When these flows are interrupted and when management systems unexpectedly fail, the company responds with dispatch to solve these problems. Risk management systems can fail. And these companies can be thrust into the public spotlight by failure. Solutions to these types of problems often require the mobilisation of codified *and* tacit knowledge at the point of production. This can be challenging given the centralisation of control and the limited discretion available to the heads of business units locally and globally.

The costs and consequences of global warming for production and revenue can be challenging on three counts. First, since initiatives typically come from senior management board commitments to financial targets can dampen investment in environment-dependent products and processes that involve discarding fixed capital and its replacement with machinery that requires 'local' innovation in control and operating procedures. Second, senior managers' reliance upon codified knowledge of products and processes can mean they are ill-equipped to bring forward innovations in companies' plant and operating systems consistent with minimising carbon footprints. Third, reaching out to product managers knowledgeable of how and where to innovate may be confounded by an unwillingness to share control over production processes consistent with a meaningful change in companies' carbon footprints (see generally Gertler 2005).

At the highest levels of the corporation, competition for control between boards and senior executives can result in incremental decision-making notwithstanding the need for long-term commitments of capital to realise climate change objectives. Equally, to the extent that senior executives are rewarded according to short-term stock price appreciation, they may be tempted to compromise on long-term innovations that sustain corporate environmental capabilities and resources. In any event, given the asymmetrical distribution of knowledge in these types of firms, it may be difficult to do anything other than rely upon blueprints of how production systems work notwithstanding the premium on *in situ* innovation when seeking to discount carbon emissions.

Portfolio companies have certain advantages over integrated corporations. These types of companies normally decentralise responsibility for performance to 'local' executives. In doing so, they seek to realise the benefits of being close-to-the-action and plant-specific and process-specific tacit knowledge. In effect, they use management systems to enhance 'local' productivity and efficiency while dampening the carbon footprints of related products and services. Whereas integrated corporations often face problems reconciling publicly-stated commitments to environmental responsibility with instances of poor performance, portfolio firms can be better at managing their businesses, products, and reputations viz-a-viz public expectations without imposing the costs of failure on the whole corporation (other than when things go spectacularly wrong; witness the BP disaster in the Gulf of Mexico.[5]

Whereas the integrated corporation packages and distributes information to the market on the performance of its products and services, the information presented is typically framed by market expectations wherein the ultimate audience for this type of information are investors external to the firm (Quigley and Walther 2024). By distinguishing holding companies from their constituent companies' brands, products, and reputations portfolio companies manage themselves subject to capital investment from the parent firm which may enhance their market position through brand performance and earned income. In these companies, two types of information are created and

5 There have been numerous corporate environmental disasters that have claimed global attention for their size and significance. Explanations of these events tend to focus on rogue behaviour, lack of corporate over-sight, and lack of focus on the dangers in operations out-of-sight and out-of-mind. See https://www.cfr.org/timeline/ecological-disasters.

co-exist with one-another. The holding company collects internal information which is then re-framed in terms of external market expectations.

What of hub-and-spokes companies? In these types of companies, coordination is *the* means of production just as coordination is the means of realising value and hence profitability. Whereas the hub has oversight of production systems and has the authority to intervene to sustain the production of goods and services, the hub *relies* upon geographically-distributed internal and external suppliers to fulfil their production mandates on a continuing basis.

In managing this type of company, authority is found in systems of production such that decisions made at the 'local' level sustain the whole. When operating effectively, production processes are seamless in time and space – realised repeatedly such that products and services get to market on time and without imperfections at the point of delivery that could or would disrupt the system. In major automobile companies, this type of production system can also provide 'customised' products via certain plants and in certain jurisdictions without necessarily disrupting the flow of production over time and space.

There are three aspects of this type of production system that bear upon the long-term sustainability of production systems. First, when operating effectively, there is little room for the 'spokes' to separately and/or together to make substantial modifications to their part of the production process. The premium on coordination in time and space is so significant that errors of innovation can have significant costs for the efficiency of the entire system. Second, to the extent that gains can be made in terms of eco-efficiency through changes in the spokes' use of energy and the environment, these gains are likely to be modest and incremental in nature given the costs of disrupting the production system. Third, in any case, innovation is likely to be incremental since sunk costs are significant and are a constraint on product-specific innovation.

These types of companies can be successful in providing high-quality products that have wide appeal. But these companies can be inward looking given the premium on coordination and may be unable to adapt quickly to external claims for eco-efficiency in the design and production of products. It is a system that works well within rather than without. Consequently, these companies can lose touch with changing markets and public expectations and regulation, witness the momentum behind public expectations as regards corporate environmental sustainability.

6 Emerging (environmental) regime of accumulation

The Fordist era of western prosperity was underwritten by the systematic exploitation of the environment. This took various forms including the discounted value attributed to non-renewable resources, the under-priced costs of environmental externalities, and the health and welfare costs of pollution in major cities. As suggested in the opening sections of this paper, the Fordist regime of accumulation privatised the benefits of environmental exploitation and left the public sector to deal with its costs and consequences. As the recipe for 20th century economic growth, it underwrote corporate profits and employment at home and abroad given context-specific forms and functions (Hall and Soskice 2001).

Notwithstanding early warnings about the link between carbon emissions and global warming, corporations developed various models of management to exploit the environment. The three models of management that are the focus of this paper were tailor-made by industry and by size of firm to realise the benefits of capital investment in plant and equipment and thereby capture the value of increasing levels of labour productivity while broadening the geographical scope of corporate activities. In parallel, the extraordinary growth of financial assets under management since the early 1970s transformed the market for corporate governance and has reinforced the exploitation of nature, labour, and communities worldwide (Clark and Wójcik 2006).

If cast in the negative, these developments had extraordinary consequences for global economic growth and, in general terms, the prosperity of far-off cities and regions that hitherto were at the periphery of the global economy. Even so, global convergence in financial markets has not resulted in a uniform price of capital or indeed a common corporate form or model. The institutional form of finance and the institutional form of the corporation remain the products of globalization *and* the governmental or institutional heritage of countries and regions (Christopherson 2002; Gertler 2010).

The costs of global economic and financial integration are also expressed in the emerging 21st century map of environmental risk which transcends the three models of management that were the basis of the previous discussion. This can be illustrated in a variety of ways. In the first instance, global warming has been, and will be increasingly, accompanied by national- and region-specific

environmental hazards such as droughts, fires, and storms. If these sound innocuous, regions such as the Mediterranean basin, the west coast of the USA, and central Asia are drying out and, as a result, are increasingly subject to fires and systemic environmental degradation. These types of risks are normally uninsurable for individuals, corporations, and government.

In the second instance, the environment is increasingly valuable for its use value (e.g. crops and food) and for its place in the production of goods and services (e.g. apparel, automobiles, and housing). While local environments are at risk to global warming, their importance in providing human clothing and shelter (for example) is increasing through population growth and increased levels of economic activity. Whereas environmental risk is normally conceptualised and priced in terms of its idiosyncratic characteristics, global warming overlays, reinforces, and accentuates the risks to human health and welfare in ways that are difficult to for governments to manage. At the limit, these costs may be impossible for humanity to avoid.

In the third instance, the environment has become too valuable to simply use and discard. Whereas environmental resources were once thought ubiquitous and priced accordingly, clean water, clean air, and systems of reparation and re-use are at a premium. It is increasingly difficult if not impossible for Anglo-American corporations to use, abuse, and discard the environment in the rush to maximise short-term profits. Indeed, just as there is an increasing premium on human resources and access to capital for underwriting the competitiveness of the corporation, there is a growing long-term premium on access to, and control over, the environment in its many forms.

As a result, there is increasing debate over which model of management is consistent with being a long-term custodian of increasingly scarce corporate environmental resources. Is the integrated corporation better at managing the environment than a hub-and-spokes company and/or a portfolio company? Does the *form* of a corporation matter more than its *functions* when it comes to sustaining long-term environmental performance? What about the increasing premium on expertise in the long-term corporate management of the environment as opposed to its short-term exploitation? In the 21st century world of corporate environmental performance, the increasing risks of mediocre performance and the increasing premium on long-term access to environmental resources, suggest that the form of the corporation may an important ingredient in realising a viable future for humanity (Kay 2024).

If the form of the Anglo-American corporation is important so too is the location of expertise and knowledge of the environment in the management of production and the allocation of corporate resources. For many years, senior managers of Anglo-American corporations came from within and from without – that is, from key businesses and functions of the parent corporations and from capital markets and related investors whose expertise was used to bridge business processes with the interests of investors. By contrast, environmental expertise is often 'local' rather than 'global' in that it is often hidden in engineering and production management. In terms of meeting public expectations regarding environmental responsibility, it may be important to locate this type of expertise with senior management and corporate boards. This may require significant changes in corporate culture wherein substantive knowledge trumps the premium on making decisions and the resolution of conflicts over the allocation of resources.

To sustain such changes may require investment in process-related and environmental knowledge from the margins of the company (including suppliers) through the timely allocation of resources. Again, the precise form of the Anglo-American corporation may be an important ingredient in mobilising process-related codified and tacit knowledge on behalf of long-term corporate environmental sustainability. At one level, the premium on long-term sustainability could be best realised via top-down models of governance whereas portfolio firms may be ill-equipped to mobilise the requisite knowledge on a continuing basis and in response to moments of crisis. There is an increasing premium on organisational innovation that can bridge the short-term with the long term throughout the modern corporation.

Whatever the model of management, mobilising process- and product-related knowledge in the interests of long-term capital investment in environmental sustainability requires innovation in corporate form and management systems. Not surprisingly, major consulting companies have come to market touting this expertise along with new kinds of information systems that allow for real-time and comprehensive intra-corporate environmental reporting whatever the model of management. In part, these companies have responded to the momentum behind government policies aimed at improving carbon disclosure. Equally, boutique consulting companies have demonstrated the growth and significance of this market for intra-corporate information-management.

Whether the Anglo-American corporation and its current form and in the three models of management sketched in this paper can thrive remains to be seen. The geographical and organisational footprint of climate change

is accelerating. Innovation in corporate governance and management is an essential ingredient in the future of the corporation.

7 Implications and conclusions

In this paper, it is noted that the environment has been, for many companies, an under-priced and poorly regulated input to production. As such, the long-term value of the environment has often been discounted and used by governments to subsidise industrial and manufacturing companies across countries and regions leaving the related environmental costs to nature, communities, and future citizens. These costs are now found, in part, in the threats to humanity posed by global warming.

An analytical framework was presented focusing on corporate decision-making for environmental performance recognising that failure has many causes but is often found in the governance and management of firms. Drawing upon Gertler's (2001, 2003) distinction between codified and tacit knowledge and his commitment to representing organisations and decision-making in context (Gertler 2010), it is argued that an important policy and research topic in economic geography and beyond in the form and functions of Anglo-American corporations. In doing so, the paper focused on three types of corporations: whether it is a top-down/bottom-up integrated management system, whether it is a hub-and-spokes system of centralised authority and decentralised responsibility, and whether the firm is a portfolio of businesses wherein constituent companies compete for management commitment and resources.

It is shown that the integrated corporation is simultaneously a top-down system of resource allocation and control and a bottom-up system of resource-claims, risks, and opportunities. These types of companies are notoriously costly to manage given scarce resources including the time and expertise of senior executives. Things can go wrong, out-of-sight and out-of-mind. Hub-and-spokes corporations can become battlegrounds for influence when the short-term over-whelms the management of long-term environmental liabilities given the asymmetrical distribution of knowledge in these types of companies. By contrast, portfolio companies often favour the expectations of financial markets over local knowledge about how products are produced locally and globally for corporate value.

As the costs and consequences of climate change accelerate over the coming decade, eco-efficiency and long-term sustainability may be front and centre in models of corporate governance. As such, an issue of policy and research is whether the Anglo-American firm is a means through which to realise our collective interest in slowing global warming or is, in fact, the enemy of a viable future global environment. Equally, it is important to ask whether there are forms of the firm embedded in other regulatory traditions that are better able to integrate short-term management with long-term commitment to slowing global warming via effective capital investment and flexible systems of corporate management.

At issue is whether some country-specific traditions or models of corporate governance are able to 'invest' in solutions to climate change through corporate investment and strategies. This question has been largely ignored in the literature on corporate governance which tends to focus on differences in models of management according to differences in political and social systems of markets and societies. If subject to the influence of global financial markets, the European corporation has been deemed sufficiently 'different' in form and function from Anglo-American corporations that it is better able to incorporate jurisdiction-specific social and political obligations that come with incorporation (Pistor 2021). Whether this could be translated into long-term eco-efficiency and superior rates of carbon-management remain to be seen.

Much of the literature on systems of corporate governance work best at a high level of abstraction distinguishing between 'systems' rather than specific jurisdictions. For example, whereas the US corporation is typically the reference point for research on Anglo-American corporate governance, this focus tends to elide differences in corporate governance and obligations related to issues such as the environment between countries (comparing the US with Australia, Canada, and the UK). It also elides differences between US states on similar matters just as there are pressures on Delaware to soften its regime of corporate governance on environmental reporting in the face of competition for incorporation from states such as California and Texas.

At the same time, there are significant risks in essentialising the purpose of the corporation thereby distinguishing between jurisdiction-specific systems of corporate governance. For example, it is often supposed that Anglo-American corporations are required in statute and regulation to maximise profits and shareholder value notwithstanding the rarity of such imperatives in the enabling legislation underpinning incorporation. These imperatives are often invoked by scholars seeking to sustain arguments about best practice corporate governance and competitive strategy in the face of board and executive enrichment, featherbedding, and complacency (see Michael Jensen's 1998 critique of the US corporation). And these imperatives

can drive the market for corporate control. But only in textbooks do these imperatives take centre-stage.

Too much is made of system-wide differences in corporate purpose and performance, and too little is made about how to realise a range of related objectives including environmental integrity. As such, this paper was framed by reference to experience with large Anglo-American corporations whose 'performance' is the product of mobilising investors, capital, managers, and workers to achieve a set of related goals and objectives wherein the environment is a constituent element *in* the production process. Given the acceleration in global warming, managing towards superior environmental performance is both integral to the long-term realisation of value and the reproduction of capitalism.

The models of management used in this paper to represent the challenges of mobilising knowledge for corporate performance are part of an ongoing research programme on how to engage with the most important issue facing humanity in the 21st century. It is a material challenge for our children and their children as well as being an intellectual challenge in terms of how we conceptualise models of management in this context.

Acknowledgments: The author has led Oxford University Smith School engagements with global consumer products, energy, and financial services companies on corporate environmental innovation and performance. The author has also been an advisor on the design and implementation of ESG and responsible investment programmes on both sides of financial markets. In all matters related to the research programme, university protocols and policies were followed. The author is pleased to thank Jennifer Sabourin for her assistance and is solely responsible for the content and argument of this paper.

Research ethics: Not applicable.

Informed consent: Not applicable.

Author contributions: Not applicable.

Use of Large Language Models, AI and Machine Learning Tools: No such tools were used in any stage of the research process and in writing or revising the paper.

Conflict of interest: No conflicts.

Research funding: No research funding to be reported.

Data availability: Not applicable.

References

Aghion, P., Antonin, C., and Bunel, S. (2021). *The power of creative destruction*. Harvard University Press, Cambridge MA.

Akcigit, U., and Reenen, van (Eds.) (2023). *The economics of creative destruction*. Harvard University Press, Cambridge MA.

Amin, A. and Cohendet, P. (2004). *Architectures of knowledge*. Oxford University Press, Oxford.

Baker, H.S., Millar, R.J., Karoly, D.J., Beyerle, U., Guillod, B.P., Mitchell, D., Shiogama, H., Sparrow, S., Woollings, T., and Allen, M.R. (2018). Higher CO2 concentrations increase extreme event risk in a 1.5°c world. *Nat. Clim. Change* 8: 604—608.

Bathelt, H. and Gertler, M.S. (2005). The German variety of capitalism: forces and dynamics of evolutionary change. *Econ. Geogr.* 81: 1—9.

Bathelt, H. and Glückler, J. (2011). *The relational economy*. Oxford University Press, Oxford.

Bathelt, H. and Glückler, J. (2018). Relational research design in economic geography. In: Clark, G.L., Felman, M.A., Gertler, M.S., and Wójcik, D.S. (Eds.). *The new oxford handbook of economic geography*. Oxford University Press, Oxford, pp. 179—195.

Chandler, A.D. (1979). *The visible hand: the managerial revolution in American business*. Harvard University Press, Cambridge MA.

Chandler, A.D. (1990). *Scale and scope: the dynamics of industrial capitalism*. Harvard University Press, Cambridge MA.

Christophers, B. (2025). *The price is wrong*. Verso Press, London.

Christopherson, S. (2002). Why do national labor market practices continue to diverge in the global economy? The "missing link" of investment rules. *Econ. Geogr.* 78: 1—20.

Christopherson, S. (2018). Outside regional paths: constructing an economic geography of energy transitions. In: Clark, G.L., Felman, M.A., Gertler, M.S., and Wójcik, D.S. (Eds.). *The new oxford handbook of economic geography*. Oxford University Press, Oxford, pp. 732—745.

Clark, G.L. (1993). *Pensions and corporate restructuring in American industry: a crisis of regulation*. Johns Hopkins University Press, Baltimore.

Clark, G.L. (1998). Stylised facts and close dialogue: methodology in economic geography. *Ann. Assoc. Am. Geogr.* 88: 73—87.

Clark, G.L. and Dixon, A. (2023). Legitimacy of global finance and the extraordinary growth in ESG measures and metrics. *Environ. Plan. A* 56: 645—661.

Clark, G.L. and Wójcik, D. (2006). *The geography of finance*. Oxford University Press, Oxford.

Clark, G.L. and Wrigley, N. (1995). Sunk costs: a framework for economic geography. *Trans. Inst. Br. Geogr.* 20: 204—223.

Doremus, P.N., Keller, W.W., Pauly, L.W., and Reich, S. (1998). *The myth of the global corporation*. Princeton University Press, Princeton.

Forster, P.M., Smith, C., Walsh, T., Lamb, W.F., Lamboll, R., Cassou, C., Hauser, M., Hausfather, Z., Lee, J.Y., Palmer, M.D., et al (2025). Indicators of global climate change 2024: annual update of key indicators of state of the climate system, and human influence. *Earth Syst. Sci. Data* 17: 2641—2025.

Garud, J. and Shapira, M. (1997). Aligning the residuals: risk, return, responsibility, and authority. In: Shapira, Z. (Ed.). *Organisational decision making*. Cambridge University Press, Cambridge, pp. 238—256.

Gelles, D. (2022). *The man who broke capitalism: how Jack Welch gutted the heartland and crushed the soul of corporate America—and how to undo his legacy*. Simon and Schuster, New York.

Gertler, M.S. (2001). Best practice? Geography, learning and the institutional limits to strong convergence. *J. Econ. Geogr.* 1: 5—26.

Gertler, M.S. (2003). Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there). *J. Econ. Geogr.* 3: 75—99.

Gertler, M.S. (2005). Tacit knowledge, path dependency and local trajectories of growth. In: Fuchs, G., and Shapira, P. (Eds.). *Rethinking regional innovation and change: path dependency or regional breakthrough?* Kluwer Academic Publishers, Amsterdam, pp. 23—41.

Gertler, M.S. (2010). Rules of the game: the place of institutions in regional economic change. *Reg. Stud.* 44: 1—15.

Gryta, T. and Mann, T. (2022). *Lights out: pride, delusion, and the fall of GE*. Houghton, Mifflin & Harcourt, New York.

Hall, P.A., and Soskice, D. (Eds.) (2001). *Varieties of capitalism: the institutional foundations of comparative advantage*. Oxford University Press, Oxford.

Hansen, J.E., Kharecha, P., Sato, M., Tselioudis, G., Kelly, J., Bauer, S.E., Pokela, A. (2025). Global warming has accelerated: are the United Nations and the public well-informed? *Environ. Sci. Policy Sustain. Dev.* 67: 6—44.

Hepburn, C., Stern, N., and Stiglitz, J. (2020). Carbon pricing. *Eur. Econ. Rev.* 127: 103440.

Holmes, J. (2000). Regional economic integration in North America. In: Clark, G.L., Feldman, M.S., and Gertler, M.S. (Eds.). *Oxford handbook of economic geography*. Oxford University Press, Oxford, pp. 651—670.

Howard-Grenville, J. and Lahneman, B. (2021). Bringing the biophysical to the fore: re-envisioning organizational adaptation in the era of planetary shifts. *Strateg. Organ.* 19: 478—493.

Huallachain, B.O. (1984). The identification of industrial complexes. *Ann. Assoc. Am. Geogr.* 74: 420—436.

Immelt, J. (2021). *Hot seat: hard-won lessons in challenging times*. Hodder and Stoughton, London.

Jensen, M.C. (1998). *Foundations of organizational strategy*. Harvard University Press, Cambridge MA.

Kay, J. (2024). *The corporation in the 21st century*. Profile Books, London.

Knox-Hayes, J. (2016). *The cultures of markets*. Oxford University Press, Oxford.

Lee, J., Veloso, F.M., and Hounshell, D.A. (2011). Linking induced technological change and environmental regulation: evidence from patenting in the US auto industry. *Res. Pol.* 40: 1240—1252.

Lipczynski, J., Wilson, J.O.S., and Goddard, J. (2009). *Industrial organization: competition, strategy, policy*, 3rd ed.. Prentice Hall, New York.

Miller, E.W. (1962). *Geography of manufacturing*. Prentice Hall, Englewood Cliffs.

Miller, E.W. (2001). Fundamentals of economic geography. *Prog. Hum. Geogr.* 25: 120—140.

Nordhaus, W. (2019). Climate change: the ultimate challenge for economics. *Am. Econ. Rev.* 109: 1991—2014.

Otto, F. (2020). *Angry weather*. Greystone Books, Berkeley CA.

Parker, G. (2017). *Global crisis: war, climate change and catastrophe in the seventeenth century. Abridged and revised edn*. Yale University Press, New Haven.

Pavel, C. (2014). Making a Faustian bargain work: what special interests can tell Us about representation in the WTO. *Georgetown J. Law Publ. Pol.* 12: 471—491.

Pistor, K. (2021). *The code of capital*. Princeton University Press, Princeton.

Polanyi, M. (1967). *The tacit dimension*. Routledge & Kegan Paul, London.

Porter, M.E. and Linde, C.V.D. (1995). Toward a new conception of the environment-competitiveness relationship. *J. Econ. Perspect.* 9: 97—118.

Quigley, D. and Walther, A. (2024). Inside and outside information. *J. Finance* 79: 2667—2714.

Robertson, I. (2024). *A framework for responsible investment with a particular focus on proxy voting*, DPhil Thesis, Oxford University.

Saad, A. (2023). Corporate technocracy: ESG governance beyond shareholder democracy or managerialism. *Columbia Bus. Law Rev.* 2023: 825—892.

Shapira, Z. (1997). Introduction and overview. In: Shapira, Z. (Ed.). *Organizational decision making*. Cambridge University Press, Cambridge, pp. 3—8.

Sharpe, W.F. (2007). *Investors and markets*. Princeton University Press, Princeton.

Shavell, S. (2004). *Foundations of economic analysis of law*. Harvard University Press, Cambridge MA.

Spulber, D.F. (2019). *The theory of the firm*. Cambridge University Press, Cambridge.

Stern, N. (2023). Harnessing creative destruction to the tackling of climate change: purpose, pace, policy. In: Akcigit, U., and van Reenen, J. (Eds.). *The economics of creative destruction: new research on themes from aghion and howitt*. Harvard University Press, Cambridge MA, pp. 365—397.

Stoddart, M.C., Tindall, D.B., Brockhaus, M., and Kammerer, M. (2023). Conference of the parties meetings as regularly scheduled critical events for global climate governance: reflecting on COP 26 and the Glasgow climate pact. *Soc. Nat. Resour.* 36: 442—450.

Strine, L.O., Jr. (2025). Ignorance is strength: climate change, corporate governance, politics, and the English language. *J. Law Econ.* 5: 170—220.

Thrift, N.J. (2005). *Knowing capitalism*. Sage, London.

Wu, S., Ming, L., Lau, G., Zhang, W., Wang, L., Liu, Z., Lin, L., Wang, J., Ge, E., Li, J., et al. (2025). Rapid flips between warm and cold extremes in a warming world. *Nat. Commun.* 16: 1—12.