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Bet on innovation, not Environmental, Social and Governance metrics, to lead the Net Zero transition

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Abstract

The conventional Net Zero perspective with its emphasis on Environmental, Social and Governance (ESG) metrics represents linear cause-and-effect thinking. That is, implementation of the metrics will then change company behaviour with the eventual effect of a successful Net Zero transition. Different perspectives are presented, rooted in systems thinking. Numerous company examples explain why innovation, not ESG metrics, will be the prime mover in achieving Net Zero. The crux of the argument for systems thinking is that a company like Honeywell, currently given an 'F' ESG score, is delivering stellar innovations that will enable its customers to significantly reduce their greenhouse gas emissions. As to behaviour, boards of directors should demand new information from management with particular attention to returns on capital versus the cost of capital under scenarios that include a price (tax) on carbon. The integration of corporate finance principles with systems thinking will improve decision-making and facilitate an efficient Net Zero transition.

KEYWORDS

ESG, innovation, linear thinking, Net Zero, systems thinking

1 | INTRODUCTION

In 1987, the United Nations defined sustainable development as meeting the needs of present generations without compromising the needs of future generations. Today, the top priority for sustainability is the transition to Net Zero, that is, Net Zero greenhouse gas (GHG) emissions. Carbon dioxide, a GHG, is a major contributor to global warming.

Three different perspectives about Net Zero are presented. The first is the widespread, conventional perspective that Environmental, Social and Governance (ESG) metrics will lead the way to a successful transition to Net Zero. The second utilizes systems thinking to better describe the complexity of navigating a path to Net Zero and highlights the critical role of innovation. The third promotes systems thinking for boards in order to improve decision-making and accelerate innovation and adaptation in a fast-changing Net Zero world.

2 | PERSPECTIVE 1—ESG METRICS

With pressure from institutional asset managers, a current top priority for firms is navigating a path to Net

Zero.[1] As metrics keyed to the 'E' of ESG and specifically related to GHG emissions proliferate, investors are increasingly using ESG scorecards as part of their decision-making. At the beginning of 2022, exchange-traded, ESG-focused funds exceeded $2.7 trillion. Moreover, regulatory bodies continue to make this kind of data mandatory in corporate reports. Consequently, management and boards of directors are motivated to take actions that can make their firms look good via ESG metrics.[2]

The objective is for firms to reduce their GHG emissions. The current default reporting methodology is the GHG Protocol: Scope 1 emissions are directly produced from a firm's operations, for example, from driving owned and leased vehicles; Scope 2 emissions are from facilities that generate electricity bought and consumed by a firm; Scope 3 emissions originate from upstream operations in a firm's supply chain and from downstream use by the firm's customers and end-use consumers. The GHG Protocol methodology is criticized as lacking in accuracy and verifiability (primarily Scope 3) with the same emissions reported multiple times by different firms. Robert Kaplan and Karthik Ramanna have proposed an innovative solution that recognizes the integrated nature of pollution activities across the economy. A firm's existing accounting system and cost-accounting infrastructure would record the GHG units emitted during operations as an *E-liability* (Kaplan & Ramanna, 2021). All along the supply chain, firms transfer the E-liability associated with goods delivered and record their end-of-period E-liability. This method eliminates duplicative counting of emissions in the conceptually flawed Stage 3 method and minimizes opportunities for greenwashing gamesmanship.

The conventional perspective with its emphasis on ESG metrics represents linear cause-and-effect thinking. That is, a logically tight path is assumed to exist from implementing ESG metrics to incentivizing firms to take actions to improve their ESG scores, eventually leading to a successful Net Zero transition. Interestingly, those who embrace this perspective invariably do appreciate the complexity and messiness of the climate change problem reflected in the interrelatedness that brings together political, economic, ecological, and social issues with multiple causes generating multiple effects often separated in time and space (Holling, 2001).

Linear cause-and-effect thinking frequently leads to promoting overly simplistic means to achieve goals. Why? This is because written and verbal communications are perceived as persuasive when key points are presented in a logically tight *linear* manner. Today's leaders frequently prefer confident conclusions, rather than the humility shown by systems thinkers. Why not put systems thinking front and centre because it facilitates the use of alternative ways of seeing the world that can overcome more narrow perceptual processes often driven by rigid and ossified assumptions (Abdelkafi & Tauscher, 2016)? To embrace systems thinking is to continually question key assumptions; organize feedback (especially from experiments); and appreciate, and actively seek, diverse points of view, along with a *sustained curiosity* about mapping the intricacies of interrelationships in a complex system (Hahn et al., 2014). Such alternative perspectives can reveal faulty assumptions and lead to expedited learning that helps identify key constraints and leverage points in order to improve system performance. Easier said than done.

The linear cause-and-effect choice appears sensible to many because promoting a pure systems thinking approach means a journey full of surprises and the need to adapt and deal with unforeseen problems, while making mistakes along the way as a necessary part of learning about system complexity. Some may perceive this as a journey to climb a mountain that has no top, that is, the complete understanding of the climate system with all the interrelatedness with other systems, hence the preference to minimize future surprises and to take the easier route laid out by ESG metrics. However, leading systems thinker Michael Jackson cautions those who opt for simplicity in dealing with our complex world:

> What help can decision-makers expect when tackling the 'messes' and 'wicked problems' that proliferate in this age of complexity? They are usually brought up on classical management theory that emphasizes the need to forecast, plan, organize, lead, and control. This approach relies on there being a predictable future environment in which it is possible to set goals that remain relevant into the foreseeable future; on enough stability to ensure that tasks arranged in a fixed hierarchy continue to deliver efficiency and effectiveness; on a passive and unified workforce; and on a capacity to take control action on the basis of clear measures of success. These assumptions do not hold in the modern world, and classical management theory provides the wrong prescriptions ...

[1]For especially comprehensive analyses, see the annual reports prepared by the United Nations Intergovernmental Panel on Climate Change (IPCC). For a succinct summary of the issues, see Gates (2021).

[2]Berg et al. (2021) argue that data providers have been changing their ESG ratings to make them more correlated with returns so that the ESG ratings are more marketable to those that they want to sell the data to.

> managers are left to persevere with their favorite panacea ... systems thinking [is] the only appropriate response to complexity (Jackson, 2019, p. xix).

3 | INTERRELATEDNESS ON THE PATH TO NET ZERO

The interrelatedness of GHG emissions with geopolitical risk is readily apparent with Russia's invasion of Ukraine beginning in February 2022 coupled with the dependency of many European countries on imports of Russian oil, gas, and coal. European policy makers concerned with their energy security began reassessing increased fossil fuel usage from non-Russian sources, including liquified natural gas from the United States. A related geopolitical risk is China's increasing influence over Taiwan. Under this scenario, those countries who actively oppose such influence could find their supply of Chinese rare earth minerals (needed for electric vehicle batteries) suffering a long-term disruption.

A critical component of batteries is lithium. One of the world's largest deposits of lithium has been discovered in Nevada's Thacker Pass. A mining permit was issued in February 2022 after a lengthy battle with US environmentalists who support green energy but are adamantly opposed to mining in the United States. They have filed additional lawsuits to stop this mining operation. Keep in mind that batteries for electric vehicles contain a witches' brew of metals—lithium, nickel, cobalt, copper, and rare earth metals (e.g., neodymium and dysprosium). The current mining process results in substantial environmental degradation, which will only worsen because of accelerating demand. US mining of these metals (replacing a portion mined outside the United States) would entail highly regulated processes that, from a global system perspective, would yield a net environmental improvement and reduce the risk of supply disruptions for US electric vehicle manufacturers.

Solar panels, wind turbines, battery-powered electric vehicles, and the retirement of coal-burning power plants are the face of decarbonization for the general public. However, these initiatives are insufficient to achieve Net Zero. Complexities abound. Solar and wind are intermittent sources of electricity, needing to be transported over an old and inefficient electric grid, plus their intermittency requires carbon dioxide-emitting natural gas powerplants (assuming declining nuclear and retired coal plants) to even out supply and demand. In addition, intermittent renewables do not address hard-to-electrify sectors like steel, cement, and air travel.

There is a growing global consensus that hydrogen is required to achieve Net Zero (Acar & Dincer, 2019). Thirty countries have announced hydrogen transition strategies. Let us consider some key technical details that are important for systems thinking. Hydrogen stores energy and offers a low-cost means for transport as a gas via pipelines and as a liquid via trucks and ships. Hydrogen can be blended with natural gas and delivered via many of today's existing natural gas pipelines. Most hydrogen is currently produced using natural gas. Because carbon dioxide is emitted, this is labelled grey hydrogen. Blue hydrogen is produced when the carbon dioxide is captured and not released into the atmosphere, and green hydrogen is produced from renewables.

Electrolysers take in water and electricity to produce hydrogen gas as an output. A notable technical advancement with high potential has been developed by a US firm, Heliogen. Their closed-loop electrolyser system continually adjusts mirrors to optimally direct sunlight as an energy source to generate cost-effective hydrogen without fossil fuels. Fuel cells are energy converters that take in hydrogen (or natural gas) and produce electricity as an output. Expect sharply declining prices for electrolysers and fuel cells as hydrogen adoption accelerates—in the language of systems thinking, a positive feedback loop. As to hydrogen-powered vehicles, the longer the trip and the heavier the vehicle, the more competitive they become versus electric battery-powered vehicles. Also, the time to refuel hydrogen-powered vehicles is substantially less than the time to recharge electric vehicles.

A further boost for hydrogen could emerge from hydrogen production using small modular (nuclear) reactors (SMRs) being developed in the United States by NuScale Power and TerraPower. SMRs could power electrolysers that generate hydrogen absent carbon dioxide emissions. SMRs are currently being considered as a replacement for coal-fired plants. After electricity is generated by SMRs, the existing infrastructure could be used to deliver electricity. Also, the coal plant's employees could transition to operating the SMRs. Proponents of SMRs make a strong point that total GHG emissions for solar (including production of solar panels) are four times that of nuclear (Fillat & Miller, 2021).

Marco Alvea, CEO of Snam, Europe's largest gas pipeline and storage company and hydrogen first-mover, summarizes:

> I realized that hydrogen's true mission was to help us harvest sunlight and wind where they were in plentiful supply, transport them cheaply, and get them into our airplanes, factories, and homes. Just 1% of the Sahara Desert gets enough sunlight to power the

> whole world, and hydrogen could finally give us a way to unlock that potential and decarbonize the hard-to-electrify sectors at the same time ... There is a growing consensus that hydrogen could account for up to a quarter of our energy needs in 2050 ... On land, highly compressed hydrogen offers long range and fast refueling. It could be the most effective fuel for trucks, buses and taxi fleets, and it may well compete with batteries for passenger cars, too. (Alvera, 2021, pp. 6, 7, and 167)

Businesses worldwide would be impacted by the hydrogen transition. Consider geopolitics and the gain in economic power by major exporters of hydrogen, including Australia, Chile, the Middle East, and North Africa. Major importers of hydrogen would include Japan, South Korea, and Central Europe. Finally, the economic leverage currently wielded by Russia would plummet in lockstep with a decline in its exports of oil, gas, and coal.

Let us take a step back from diving deeper into interrelated subsystems that make up the emergent climate change system. Is there a better starting point than ESG metrics for thinking about Net Zero? Yes. Clarity about the purpose of the firm is the preferred starting point.

4 | THE PURPOSE OF THE FIRM

An application of systems thinking is the *Pragmatic Theory of the Firm* (Madden, 2021). It asserts that maximizing shareholder value is the result of a firm successfully achieving its four-part purpose. The components of the firm's purpose include the following:

- *Communicating a vision* that can inspire and motivate employees to work for a firm that is committed to behaving ethically and making the world a better place.
- *Surviving and prospering* through continual gains in efficiency and sustained innovation, which depend on a firm's knowledge-building proficiency. Importantly, nothing works long term if a firm fails to earn at least the cost of capital.
- Working continuously to sustain *win–win relationships* with all of the firm's stakeholders.
- *Taking care of future generations*. Management and the board need a genuine commitment to the sustainability of the environment, with particular attention to the design of products and manufacturing processes to minimize waste and pollution, which depends on a firm's knowledge-building proficiency.

The theory concludes that a firm's knowledge-building proficiency is the key determinant of innovation that drives long-term performance and connects a firm's performance to its market valuation via a life cycle framework.

An advantage of the four-part purpose is its emphasis on four oars in the water that need to work in unison in order to effectively generate progress. Importantly, the core message of finance is spotlighted: to survive and prosper requires a firm to earn at least its cost of capital—a message often overlooked in discussions of plans to get to Net Zero. Viewed through the lens of the *Pragmatic Theory of the Firm*, the Net Zero transition is an integral part of the firm's purpose, as is the Circular Economy for eliminating waste (e.g., nonrecyclable plastics) (Geissdoerfer et al., 2017). To sum up, a firm's purpose is an integral part of a *causal mechanism*. In other words, all else being equal, better alignment of a firm's strategy, organizational structure, compensation, culture, and governance with its four-part purpose improves long-term performance (Roome & Louche, 2016). ESG and Corporate Social Responsibility metrics, the triple bottom line, the Net Zero Economy, and the Circular Economy tabulate how well firms succeed in achieving particular components of their four-part purpose. By focusing on a firm's four-part purpose, innovation moves to the centre stage because it ultimately determines a firm's financial performance track record.

Missing from the United Nations definition of sustainability is the recognition that innovation led by firms is required for *sustainable progress* (perhaps a more useful term than *sustainability*) that generates a rising standard of living that substantially improves the lives of future generations.

5 | PERSPECTIVE 2—INNOVATION IS CRITICAL TO ACHIEVING NET ZERO

Complex systems have an emergent characteristic that invariably upsets the plans of those who extrapolate the future based on what is known today (Sterman, 2001). Hence, management and boards should give top priority to monitoring innovation developments and utilizing adaptable plans for the Net Zero journey (Hahn et al., 2015).

Expect firms that produce significant Net Zero innovations to include both out-of-the-box-thinking start-ups and established firms with proven capabilities, substantial financial resources, and motivation to lead the Net Zero transition. In his 2022 Blackrock letter to CEOs, Larry Fink noted:

> The next 1,000 unicorns will not be search engines or social media companies, they'll be sustainable, scalable innovators—startups that help the world decarbonize and make the energy transition affordable for all consumers. ... With the unprecedented amount of capital looking for new ideas, incumbents need to be clear about their pathway succeeding in a net zero economy. And it's not just startups that can and will disrupt industries. Bold incumbents can and must do it too. Indeed, many incumbents have an advantage in capital, market knowledge, and technical expertise on the global scale required for the disruption ahead.

Let us highlight some of the Net Zero activities of three large established firms. Honeywell currently receives an 'F' overall grade for GHG disclosures/targets/reductions by As You Sow (Shugar et al., 2022). Weyerhaeuser is a timber REIT and is not customarily viewed as a source of significant innovation. Occidental Petroleum is a large oil producer and certainly not revered by environmental activists.

Honeywell's businesses focus on aerospace, building technologies, performance materials/technologies, and safety/productivity solutions. Given the firm's deep knowledge of customer needs coupled with its innovation skill, you might expect that management's decision to commit 60% of its R&D budget to customer–ESG improvements would yield significant results. You would be right.

Here are a few highlights of important Honeywell innovations that advance Net Zero. The use of Honeywell's Solstice line of low-global-warming refrigerants, propellants, and solvents results in the equivalent of removing millions of cars from the road. The firm is developing a green jet fuel that would replace petroleum jet fuel. Honeywell's green diesel fuel reduces GHG emissions by 80%. The firm's unique flow battery technology is on a path to enable large-scale renewable energy storage. Honeywell's core business of control/automation of building and factory operations continues to excel in enabling customers to attain higher sustainability performance.

For 120 years, Weyerhaeuser has been growing, harvesting, and regrowing forests on a continuous cycle. Weyerhaeuser has historically been a sustainability leader and is carbon negative because trees absorb carbon dioxide. The firm meets 70% of its energy needs using renewable biomass. Weyerhaeuser is well positioned to promote and seize a big opportunity for engineered 'mass timber' (glued together wooden pieces) to replace concrete and steel in new building construction. This can lead to lower construction costs and buildings that are atheistically beautiful; plus GHG emissions are substantially reduced versus the status quo. Also, Weyerhaeuser is well positioned to lease portions of its 11 million acres of US timberland for wind and solar production and to participate in the carbon offsets market. The firm has a unique opportunity for high-return-on-investment (ROI) projects by using selected land parcels with the right geological formation to store carbon dioxide. Oxy Low Carbon Ventures, a subsidiary of Occidental Petroleum, will use Carbon Engineering's Direct Air Capture (DAC) technology on Weyerhaeuser land to capture and permanently sequester carbon dioxide from the atmosphere.[3] This planned one-million-ton annual capacity plant will be the world's biggest DAC facility, and the aerospace leader Airbus has signed up for 400,000 tons of carbon removed credits.

From a corporate finance valuation perspective, Occidental Petroleum has a problem and an opportunity that is typical of large oil and gas companies. Keep in mind that the firm's total market value represents the sum of the net present value of net cash receipts from existing assets and future investments. Investors with a sharp pencil subtract the estimated value of existing assets from the known total market value of equity plus debt, thereby deriving the implied investor expectations of the value of future investments. This tends to be substantially negative for many large oil and gas companies because investors are forecasting ROIs on future investments to be less than the cost of capital. The flip side of this problem is an opportunity to gain substantial market value by giving investors reasons to forecast ROIs at least equal to the cost of capital on future capital expenditures. The key here is to be making new investments that can meet the cost-of-capital criterion at scale—new, big market opportunities. These opportunities exist in hydrogen, SMRs, carbon capture/storage, hard-to-decarbonize sectors, and new ways to utilize carbon dioxide and avoid releasing it into the atmosphere. Occidental Petroleum is investing in most of these areas and utilizing its core competency in carbon dioxide management. The above-mentioned DAC plant is one example.

To sum up, the rate of progress in getting to Net Zero critically depends upon innovation at the firm level; specifically, how management adapts and leverages existing capabilities to seize Net-Zero-related opportunities for innovation. Hence, a deeper understanding of how firms create value in today's economy can provide a lens to better see Net Zero progress at ground level as opposed to

[3]For a summary of leading-edge approaches to carbon capture, see Vaughan (2022, pp. 20–21).

high-level goals for GHG emissions and related ESG metrics. That lens has two components: first, an appreciation for the New Economy that has spawned ecosystems, which increasingly offer a path to shared value, and second, the life cycle framework that provides insights about a firm's long-term financial performance keyed to the cost of capital criterion.

6 | THE NEW ECONOMY AND ECOSYSTEMS

The New Economy is often described as intangible assets becoming more important than the tangible assets recorded on accounting statements, and the power of platforms and networks is well documented as a major value-creating part of the New Economy. In addition, a firm's performance increasingly is impacted by business ecosystems. James Moore forecasted the importance of ecosystems in 1993:

> Successful businesses are those that evolve rapidly and effectively. Yet innovative businesses cannot evolve in a vacuum. They must attract resources of all sorts, drawing in capital, partners, suppliers, and customers to create cooperative networks ... I suggest that a company be viewed not as a member of a single industry but as part of a *business ecosystem* that crosses a variety of industries. In a business ecosystem, companies co-evolve capabilities around a new innovation. They work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations. (Moore, 1993)

Business ecosystems are communities of firms continually learning how to exploit enhanced connectivity to both collaborate and compete in value-creating ways not possible by stand-alone firms. A firm that creates and orchestrates the advancement of an ecosystem may secure sustained competitive advantage. Ecosystems have a high capacity to evolve in surprising ways. For ecosystems, systems thinking is more useful than traditional linear cause-and-effect thinking.

Ecosystems can be classified as problem solution or transaction facilitation. The Apple iPhone initially originated as a solution ecosystem that coordinated app developers, telecom providers, and firms supplying components. Later, Apple's App Store facilitated the purchase of apps. Meanwhile, reminiscent of Old Economy thinking, the BlackBerry phone rapidly lost market share with its focus on data security while paying minimal attention to the needs of app developers.

Discovery is an insurance firm based in South Africa with a vision to make people healthier and enhance and protect their lives through its life and health insurance policies. Management recognized the mutual benefits achievable by incentivizing its customers to change their behaviour in order to live longer and healthier lives. Skilled in behavioural economics and clinical science, Discovery connects (apps and wearable fitness monitors) with customers in ways to motivate healthier lifestyles, including weight and exercise goals, and healthier food. The firm's large and expanding database is a gold mine for behavioural research to continually improve the healthy living process. The resulting ecosystem includes suppliers of healthy food, exercise facilities, and other insurance firms now partnering with Discovery.

Today, there are industries in which competitors need to march arm in arm and build *for-the-greater-good ecosystems* (Sagawa & Segal, 1999). Food retailers have joined such an ecosystem—the Global Food Safety Initiative—because food safety should never be a competitive advantage.

Countries can collaborate via for-the-greater-good ecosystems in order to progress on especially difficult challenges far more productively than working independently (Dougherty & Dunne, 2011). A case in point is the usefulness of a carbon price—a price per ton of carbon dioxide equivalent gas emitted. An alternative is to set targets for emissions. But targets ignore the costs incurred. In contrast, specification of a carbon price facilitates decision-making that balances costs and benefits, including the use of less-carbon-intensive alternatives. Most economists agree that the carbon price should reflect the social cost, that is, the total economic damages associated with each ton emitted. There are complex implementation issues involved with the choice of a direct tax versus a regulatory limit on allowable emissions and allowing trading (cap-and-trade), plus the government handling of carbon-derived revenues.

A global ecosystem focused on implementing a carbon price addresses the free-rider problem in which politicians seek what they perceive to be in their own national interests. Solving this problem would be a significant (perhaps the most significant) step towards achieving Net Zero. For workability, such an ecosystem could penalize nonparticipants with tariffs on nonparticipant exports to member countries. This for-the-better-good ecosystem can overcome the free-rider dilemma at the root of why the voluntary commitments associated with the Paris Accord and the Kyoto Protocol did not work as intended (Nordhaus, 2018).

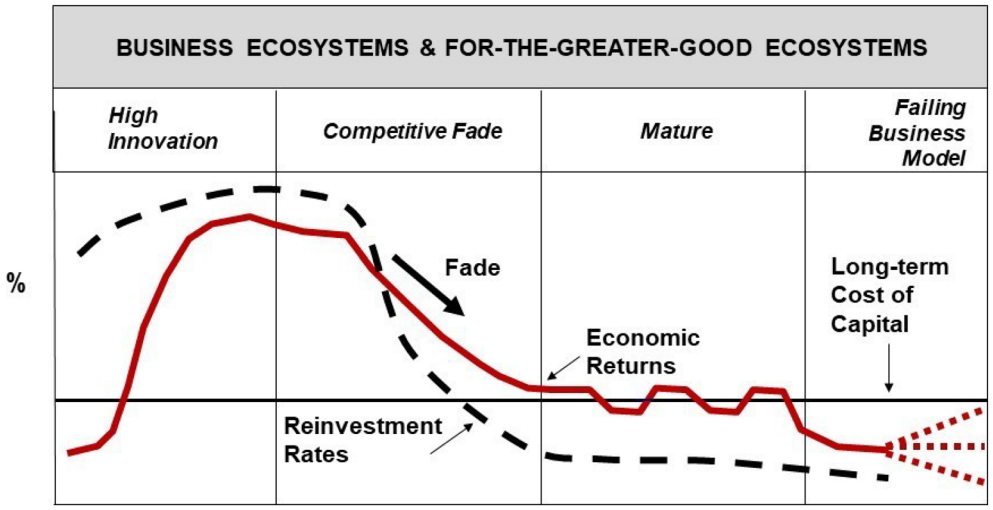

FIGURE 1 Life cycle framework *Source*: Madden (2020) [Colour figure can be viewed at wileyonlinelibrary.com]

7 | GUIDEPOSTS TO VALUE CREATION—LIFE CYCLE TRACK RECORDS

Figure 1 illustrates a firm's transitional stages over a life cycle reflecting the dynamics of a firm's profitability and growth. As noted above and depicted in Figure 1, firms operate in an environment that increasingly involves ecosystems.

At the *high-innovation* stage, management of a start-up needs to quickly confirm or refute its core business model assumptions. Economic returns (returns on capital) well above the cost of capital are the hallmark of a business model's successful commercialization. If the business can scale, high reinvestment rates are observed. Other firms are motivated to duplicate and improve upon a successful start-up's business model, especially when high reinvestment rates indicate a big market opportunity.

At the *competitive fade* stage, economic returns fade towards the cost of capital and reinvestment rates (organic growth) fade towards an economy-type growth rate. A management that delivers sustained economic returns well above the cost of capital (favourable fade) typically has cemented a knowledge-building, pro-innovation culture coupled with win–win partnerships with all stakeholders. They continually build or acquire new capabilities that expand their firm's investment horizon.

Eventually, the firm enters the *mature* stage and earns approximately the cost of capital returns, and its reinvestment rates slow considerably. Management needs to adapt early to change and faces a tough task. They need to continually improve the efficiency of existing businesses while innovating in new areas that might even compete with business units that currently pay the bills.

A reliable signal of a firm entering the *failing business model* stage is a business-as-usual complacency with an attendant bureaucratic culture wherein the future is seen as a mirror image of the past. Purging a business-as-usual culture should be the top priority.

Management, boards of directors, and investors can benefit from utilizing the life cycle framework. Let us analyse a leading Net Zero innovator using a life cycle lens. Cummins designs, manufactures, distributes, and services diesel, natural gas, electric, and hybrid powertrains and related components. The firm has the market-leading position in diesel engines for trucks and other industrial applications. A better appreciation of the micro-innovation processes taking place at Cummins (see Figure 2) and other firms can improve our understanding of how the global aggregate of these types of innovations emerges as macro-innovation that drives economic growth (Gaziulusoy et al., 2013).

In the top panel, Cummins' economic returns are calculated as cash-flow-return-on-investment (CFROI), which are adjusted for inflation and other biases (e.g., R&D outlays are capitalized) (Holland & Matthews, 2018; Madden, 2020). Inflation adjustments are necessary to more accurately measure levels and trends over long time periods. The benchmark, inflation-adjusted cost of capital is shown as a horizontal line at 6%.[4] Cummins was losing market share for diesel engines as reflected in CFROIs at or below the cost of capital from 1997 to 2003. Tim Solso became CEO in 2000 and systematically orchestrated productivity improvements while substantially increasing R&D outlays. Importantly, those R&D investments generated innovations that enabled Cummins' diesel engines to meet new EPA

[4]The inflation-adjusted cost of capital for US public companies was estimated at 5.95% in Fama and French (1999).

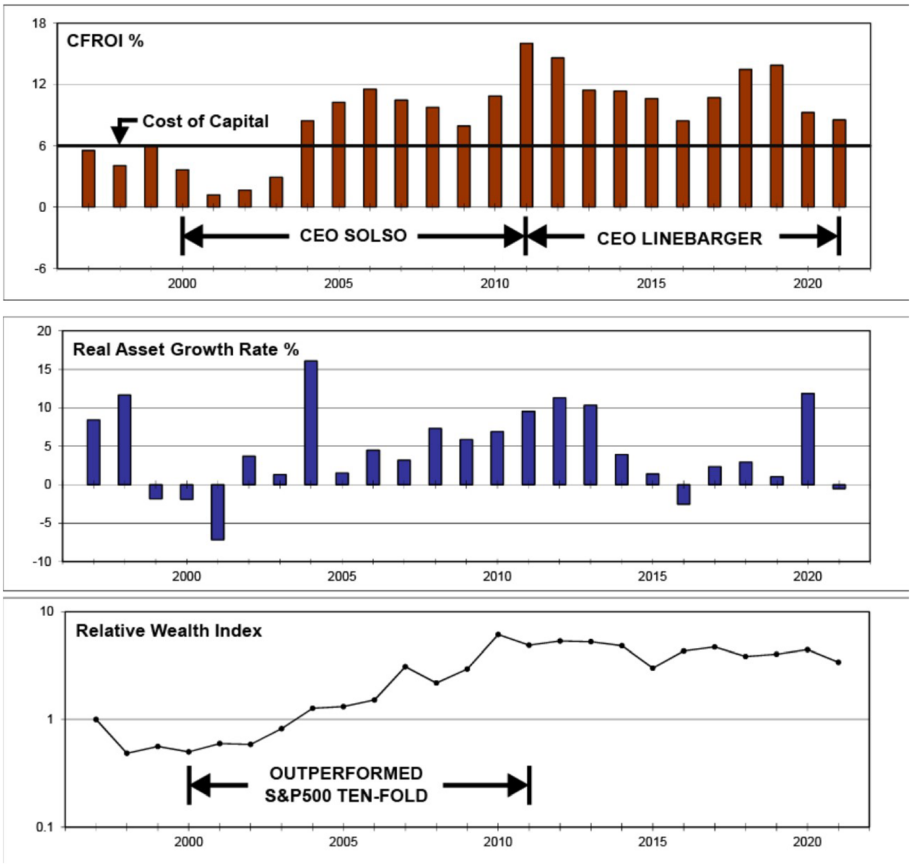

FIGURE 2 Cummins life cycle, 1997 to 2021 *Source*: Based on data from Credit Suisse HOLT global database [Colour figure can be viewed at wileyonlinelibrary.com]

emissions standards without compromising fuel efficiency—a significant competitive advantage. The resulting multiyear improvement in market share and profitability was not anticipated by investors in the early years of Solso's tenure as CEO. As Figure 2 displays, cyclical CFROIs surged above the cost of capital and were maintained at that value-creating level, whereas reinvestment rates (middle panel) remained solid. Thereafter, investors continually ratchetted up their expectations for a favourable fade of future CFROIs, and Cummins stock outperformed the S&P 500 approximately 10-fold from 2000 to 2011. This is shown by the relative wealth index (Figure 2, bottom panel), which plots total shareholder return less the S&P 500 return.

Solso was building Cummins for the long term. He greatly expanded the firm's global footprint in the spirit of win–win partnerships. The hallmark of Cummins' foreign joint ventures is the development of products specifically attuned to local markets and the development of local talent to assume leadership roles.

Tom Linebarger became CEO in 2012 and sustained the superior performance of his predecessor (see Figure 2, top panel). Based on the strategies he has implemented and the resource allocation decisions he has made, Linebarger can be described in two words—systems thinker. Systems thinkers appreciate how complex systems evolve in nonlinear and hard-to-forecast ways. They understand the significant inaccuracies in forecasts of how complex systems will behave in the future and, in turn, avoid dogmatic strategies, which are ill-suited to a fast-changing world.

The complexity facing Cummins and other manufacturers is seen as an emergent phenomenon: technologies compete as to efficiency and costs, infrastructure develops, regulations change, and value as perceived by customers changes—all of which are interrelated and impacted by the pace of adoption of technology solutions. To no surprise, Linebarger has Cummins immersed in leading-edge technological developments with an eye on learning what technologies and related infrastructure will provide the best value for customers.

Expect warnings that Tesla and others will be very successful with electric-powered trucks (short haul and even long haul), thereby evaporating Cummins' dominant position in truck engines *because* electric is green. This represents linear cause-and-effect thinking. In addition, 'electric is green' ignores the previously noted emissions and environmental damage from manufacturing turbines, solar panels, and batteries, plus fossil-fuel-generated energy used to make up the shortfall from intermittent wind and solar. Moreover, a counter-argument begins with 12 million owners of trucks

powered by Cummins diesel engines. Cummins has earned the trust of these customers who benefitted from its continual stream of innovations. Earned trust. This reflects the potential advantage of innovative incumbents noted in the earlier Larry Fink quote. Specifically, Cummins has a unique incumbent advantage due to serving a broad array of customers with diverse technologies—diesel, natural gas, propane, hydrogen, fuel cell, and battery systems.

Linebarger is positioning Cummins to be a leader in the Net Zero transition with a range of solutions tailored to customer needs. He has acquired firms with hydrogen, fuel cell, and battery expertise. The recent acquisition of Meritor, a leader in axle and brake technology, will facilitate the delivery of integrated powertrain solutions across combustion and electric power applications. The New Power division is tasked with commercializing green alternatives to the existing diesel engine business. Meanwhile, engineers work to improve the efficiency of diesel engines, including the use of cleaner fuels such as hydrogen, as an integral part of the Net Zero transition. Notably, Cummins has achieved a series of firsts for significant hydrogen milestones: Florida's first green hydrogen plant using Cummins electrolysers, the world's largest electrolyser in Canada, Europe's first hydrogen-powered passenger train, the first large-scale hydrogen refueling station in Belgium, and the largest polymer electrolyte membrane (PEM) plant in the United States.

Linebarger sums up his view of the Net Zero transition: 'I look at decarbonization and say that's a growth opportunity for Cummins, because now innovation is going to matter a lot. Innovation is what we do' (Ohnsman, 2022, p. 40).

Cummins illustrates the main takeaway of this paper—the real action in the Net Zero transition takes place with innovation that can easily be missed (especially in the early stage) by ESG metrics. Game-changing innovation at the firm level is how society truly benefits from free-market capitalism.

How has Cummins performed in terms of the previously discussed firm's four-part purpose? Cummins' *vision* of making people's lives better by powering a more prosperous world through innovation is inspiring to employees because their work is exactly about implementing this vision and, in so doing, making the world a better place. As to *surviving and prospering*, the substantial (and sustained) CFROI improvement to above-cost-of-capital level is a testament to both Cummins' innovation skill, under Solso and Linebarger, and the means to finance the investments required to accelerate the Net Zero transition. Cummins is widely respected for working to sustain *win–win relationships* with employees, customers and other stakeholders. Finally, as to *taking care of future generations*, that is an apt description of the operating (how we do things) culture at Cummins.

The Net Zero world showcases a common denominator for firms of any size, ranging from high-tech smaller firms like Heliogen with its innovative fossil-fuel-free electrolyser and NuScale Power's SMRs to large firms like Cummins with a global and diverse customer base. That is, the Net Zero transition puts a premium on sustaining a knowledge-building culture that drives innovation and is central to achieving the firm's four-part purpose, which is the ultimate responsibility of the board of directors to which we now turn.

8 | PERSPECTIVE 3—BOARDS OF DIRECTORS, SYSTEMS THINKING, AND VIABILITY TESTS

The Net Zero transition puts a premium on boards motivating, compensating, and monitoring management consistent with long-term value creation, including sustaining a pro-innovation culture with the potential to gain a competitive advantage. Surely, innovative ways will be developed to reduce emissions from firms' internal processes. However, expect best practices that are widely implemented by industry competitors to emerge. Hence, there is no competitive advantage here. However, opportunities to earn ROIs well in excess of the cost of capital on large-scale capital outlays will also emerge from products and services that are uniquely suited to meet customer needs in the Net Zero world and are difficult for competitors to duplicate at the scale of the innovators, for example, Honeywell and Cummins (Porter et al., 2019).

Compensation plans in shareholder proxy documents frequently utilize *short-term* (3 years or less) plan horizons absent any returns-on-capital comparison to the cost of capital. To repeat, nothing works *long term* if the firm steadfastly fails to earn the cost of capital. Compensation plans should be designed as part of a system focused on long-term value creation, not as an isolated document that compensation consultants craft with simplistic quartile rankings and short-term thinking (Clieaf, 2020). Boards would benefit from having directors with systems thinking expertise. The more attention to systems thinking, the more apparent becomes the inadequacy of the information provided to boards, which is typically orchestrated by CEOs (especially when the CEO also serves as the board's chairperson).

Boards receive information that principally focuses on budgets, strategic reviews, resource allocations and, in today's world, presumably plans to navigate the Net Zero transition. Michael Jensen has repeatedly made a strong

case that boards need to control the flow of information required to fulfil their oversight responsibilities:

> The mindset of boards must move from one of careful review to one of insatiable curiosity ... Question assumptions ... Boards should take personal responsibility for understanding how traditional budget processes and stretch goals frequently inculcate a lack of integrity in an organization and destroy value ... Rarely do board members have the kind of information they need to assess accurately the progress of the corporation. Getting that information requires boards to overhaul the process by which they get substantive information about corporate performance from one controlled by the CEO to one in which the board has ready access to relevant information. (Jensen & Fuller, 2003)

Consider an ideal environment where the board is fully engaged with management who provides the information that the board believes is needed. What might that look like beginning with resource allocation decisions for the firm's business units? An advantageous information choice for the evaluation of business unit investments is a life cycle track record that displays the business unit's historical performance (similar to Cummins' track record shown in Figure 2) juxtaposed with a forecast of future life cycle performance. The forecast's plausibility could be judged by a comparison to the business unit's historical track record and to track records for competitors. Note that a life cycle track record can be condensed into economic value added (EVA) data displays.[5] A particularly important advantage of life cycle thinking is in providing guideposts, as previously discussed, as to top priorities depending upon a firm's (or business unit's) life cycle stage.

With systems thinking, the interrelatedness of the compensation plan becomes more apparent. On the one hand, the compensation plan focuses on *what* is measured as to financial performance and should incentivize long-term value creation. On the other hand, *how* these results are achieved matters. This ties back to the degree of success in sustaining a knowledge-building culture that facilitates the training, support and motivation of employees at all levels to be problem solvers and innovators eager to excel in building teamwork and collaboration (Schreiber, 2021). An integral part of an innovative, well-functioning culture is the development and promotion of leaders who have the right skills for the job. The higher one goes in the management ranks, the more important becomes their systems thinking skill. This line of thinking is echoed by Paul Polman, former CEO of Unilever, who has a stellar track record in leading a large firm that created substantial value for stakeholders while being uniquely successful in promoting sustainability:

> I truly believe that future leaders will be systems thinkers. It is inconceivable that anyone will successfully steer companies, or countries, through our volatile world without understanding the interdependencies between the systems on which we depend. (Polman, 2014)

The culture described above is the bedrock of an innovation process that, when successful, shows up as a favourable fade in life cycle track records. Consequently, the ideal compensation plan is long term oriented and has two well-designed and complementary components: financial performance and culture performance.

Systems thinking encourages the questioning of assumptions and soliciting of diverse views that may elucidate how to solve specific problems or even to reorganize how the firm is managed. When the CEO and board are fully engaged with systems thinking, major changes can be expedited because of a shared goal to improve the performance of the overall system (firm) and a willingness to disrupt business as usual. Management and boards clinging to a business-as-usual mindset coupled with greenwashing communications about emission reductions will surely lag in the new Net Zero world.

A board's fiduciary duty concerning its firm's long-term survival and prosperity suggests that directors periodically evaluate their firms' past and likely future long-term financial performance. This viability test should include a comparison of *returns-on-capital* versus *the cost of capital* and address not only a status quo scenario of no carbon tax but also multiple scenarios addressing a range of plausible future carbon taxes (per ton of carbon dioxide equivalent gas emitted). This viability test may necessarily lead to large-scale changes in strategy and/or restructuring of business units.

9 | CONCLUDING THOUGHTS

Excessive focus on looking good in the short term via ESG metrics can be at cross-purposes with a long-term

[5]Madden (2020, pp. 176–177) summarized the pros and cons of life cycle versus EVA data displays and discussed the challenge of incorporating intangibles into financial performance metrics in Chapter 5. Also, see Frigo and Madden (2020, pp. 33–39).

planning horizon keyed to innovation. A sizable portion of a firm's major innovations may not move the needle much as to ESG metrics but may score high in the eyes of customers as to value creation (and quite possibly improve their customers' ESG performance). Recent research reveals a tendency during quarterly earnings conference calls for those managements who have reported weaker-than-expected profits to talk less about financial results and more about their ESG progress (Flugum & Southern, 2021). Keep in mind that innovation is the key to *sustainable progress* that jointly delivers on financial performance and takes care of future generations through environmental improvements.

Expect the most significant innovations that advance the Net Zero transition to be delivered by managements that question assumptions, experiment, expand their firm's knowledge base, and continually adapt their business models to a fast-changing world—resulting in high ROIs achieved on new investments.

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