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How Can (Green) Industrial Policy Serve Human and Natural Flourishing?

Critiques, Concepts, and Tools

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Abstract:

Following decades of marginalization in economic policy debates, industrial policy has regained prominence as a tool for achieving a 'green transition.' However, real-world experiences of 'green' industrial policy have tended to approach the green transition narrowly, often as a process of expanding production of 'green' goods or as the reduction of greenhouse gas emissions in certain sectors (energy, transportation, and some heavy industries) (Section 2).

By contrast, emerging critiques of green industrial policy, as well as literature in related fields of inquiry —(innovation systems theory, development economics, political economy, ecological and biophysical economics, and planetary science scholarship)— see the green transition as a multifaceted process of systemic, whole-economy transformation, motivated and intertwined with ecological and social challenges that extend well beyond greenhouse gas mitigation (Section 3).

We bridge these 'green' literatures with the humanist development scholarship and structuralist economics to propose a normative and analytical framework that conceptualizes green industrial policy —and industrial policy in general— more holistically as a set of measures to transform production and provisioning systems in line with one overarching mission: To fulfill human needs more fully and equitably, and in balance with ecosystem needs and boundaries (Section 4).

Our framework proposes a set of 20 necessities for human and natural flourishing, along with the enabling structural economic conditions that make it possible. (Table 1). It then outlines the industrial policy imperatives that follow from each of the 20 necessities.

Additionally, we offer some heuristic principles and practical policy design tools to operationalize our 'eco-humanist' framework in concrete policy design. These include (i) a taxonomy of industrial policy and planning tools, (ii) criteria for industrial targeting; and (iii) a set of questions to guide industrial policy design and evaluation.

Keywords: Industrial Strategy, Industrial Policy; Green Industrial Policy, Sustainable Industrial Policy; Human Capabilities Approach, Structural Transformation, Ecological Economics; Ecological Transformation, Economic Transformation, Green Transformation; Climate; Biodiversity; Toxic Pollution; Economic Diversification.

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1. INTRODUCTION

After decades on the margins of mainstream policy debates, industrial policy has regained prominence as a tool for achieving a 'green transition'. At the narrative level, from the United States to the European Union to Latin America and beyond, policymakers have made 'the green transition' a priority and embraced the use of industrial policy as a strategic tool for green economic transformation.

In the abstract, the rise of the green industrial policy (GIP) is a positive shift that acknowledges the existential urgency of the ecological crisis and the need to tackle it through commensurately ambitious policy action. It also marks a welcome recentering of the productive sphere —the 'real economy'— as a critical domain of economic analysis and policy following decades of near-exclusive focus on 'the market'.[2] But, what exactly do governments mean *in practice* when they talk about 'green transitions' and 'green industrial policy'? Who gets to define what 'green' means? And what are the consequences?

In section one, we argue that current real-world policy experiences predominantly understand the green transition too narrowly as a process of reducing greenhouse gas emissions in the energy sector, transportation, and some heavy industry sectors, like steel and cement. Or, even more narrowly, they view it as the promotion of manufacturing products related to renewable energy production networks (e.g., electric vehicles, solar panels, wind turbines, batteries, transition minerals).

This contrasts with emerging critiques of green industrial policy, as well as work in related fields of inquiry (innovation systems theory, development economics, ecological and biophysical economics, planetary science, and political economy) which see the green transition as a multifaceted process of systemic, whole-economy transformation, motivated by ecological and social challenges that extend well beyond greenhouse gas mitigation.

In section two, we review six emerging lines of critique of green industrial policy, all of which point to a lack of systems thinking in today's real-world industrial policies: (1) the need to overcome ***carbon reductionism*** in the conceptualization of the 'green transformation' to more fully address critical environmental challenges beyond greenhouse gas emissions, (for example, biodiversity loss, toxic pollution, and resource attrition and degradation); (2) the ***system boundaries*** critique which warns against attempts to solve 'green' challenges at a subsystem level when higher-order system solutions are required (for example attempting to solve transportation emissions by making cars electric, rather than transitioning to mass transit to reduce material intensity and lifecycle environmental impact); (3) the need to better align 'green' objectives with other, ***'non-green' public interest objectives*** (satisfaction of basic needs, quality jobs, racial justice, etc.), both on principle and for pragmatic political economy considerations; (4) the need to connect industrial policy to broader ***economic planning*** to manage the manifold

[2] Ha-Joon Chang's "Hamlet without the Prince of Denmark" (2010) describes this phenomenon and its consequences for economic policy. See also Andreoni and Chang (2016).

challenges of green transformation and the satisfaction of human needs; and (5) the need to better balance ***national and global*** interests in national policies —particularly in the global North.

Building on those critiques, section three proposes **a normative and analytical framework that bridges the humanist development scholarship, structuralist economics, and various 'green' literatures (**from ecological and biophysical economics, planetary science, and innovation theory) to conceptualize green industrial policies as a set of measures to holistically transform production systems to fulfil human needs, aspirations, and desires more fully and equitably, while respecting ecosystem needs and boundaries. **Drawing from those literatures, we propose a set of 20 necessities for human and natural flourishing to guide the design of industrial policy and outline corresponding industrial policy imperatives and offer some practical conceptual tools to operationalize the framework in policy analysis and design**.

2. A VERY BRIEF OVERVIEW OF TODAY'S GREEN INDUSTRIAL POLICIES

The concept of 'green industrial policy' remains in flux. If, at a high level of abstraction, 'industrial policy' refers to government efforts to shape production —to change what and how societies produce and create value—, then 'green industrial policy' refers specifically to efforts to change production systems to achieve some 'green' objective (we return to definitional questions in section 4). In theory, a wide range of policies can fit within the category of 'green industrial policy' — from regulatory caps on heavy industry pollution to public procurement policies that favor sustainable, healthy food, to the transformation of car factories into train factories. In fact, as we discuss in later sections, a coherent green industrial strategy should harness a broad set of policy tools and direct them toward well-defined green transformation goals. However by and large, policymakers have used the category of 'green industrial policy' far more narrowly to promote policies that seek to reduce greenhouse gases from energy and transportation, and to some extent, heavy industry (e.g., steel, cement, chemicals), or, even more narrowly, to policies that expand the manufacturing of products related to certain renewable energy production networks (e.g., electric vehicles, solar panels, wind turbines, batteries, transition minerals).

Take for example the most salient 'green industrial policy' in recent years: The United States' 2022 Inflation Reduction Act (IRA), widely framed as the major green industrial policy initiative of the Biden administration. In terms of sectoral composition, the IRA is fundamentally an energy bill, with over $250 million of the bill's $394 billion in appropriations devoted to the energy sector (see Estevez and Schollmeyer, 2023, for more detailed breakdowns). Across sectors, the IRA's 'green' investments are, with few exceptions, normatively geared toward one predominant mission: Reductions of greenhouse gas emissions —and especially reductions that

can be achieved through the expansion of certain kinds of domestic 'green' manufacturing. That legislative mission is mirrored in executive actions on green industrial policy, such as the Biden administration's Buy Clean government procurement initiative, which sought to harness procurement power to expand demand for 'low-carbon' materials from energy-intensive heavy industry sectors (Estevez and Schollmeyer, 2023; The White House, 2022). Broader forms of pollution reduction and sustainable resource use are not targeted in these policies, nor are other economic sectors within the procurement market (such as food procurement).

A similar approach is at play in the EU's 'Green Deal Industrial Plan' and the 'Net-Zero Industry Act' which target the energy sector and zone in on greenhouse gas emissions as the core problem to be mitigated through an expansion of 'green' manufacturing. The technologies singled out as strategic to the green transition (batteries, windmills, heat pumps, solar, electrolysers, carbon capture and storage technologies[3]) are explicitly selected to meet climate neutrality goals (European Commission, 2023).

As we discuss in later sections, despite their narrative framing as 'decarbonization' initiatives these policies do not necessarily optimize for decarbonization. Their emphasis on the expansion of certain kinds of domestic manufacturing (e.g., EVs) is often in tension with faster decarbonization pathways based on Chinese green tech imports, expansion of alternative domestic sectors (e.g. rail transport in lieu of EVs), or tighter regulatory measures to curb industrial pollution. They also seldom contemplate lifecycle environmental footprints across their value chain.

Green industrial policy is also (re-)emergent in the global South.[4] In Latin America, following an industrial policy revival in the 2000s and 2010s (Estevez, 2022; Dominguez and Ciara, 2016; Ayala-Chauvin et al., 2021), today's industrial policy renaissance has coincided with the rise of climate change as a global priority —and policy initiatives and discourse reflect this shift. Recent publications from the UN Economic Commission for Latin America have emphasized the need to reconcile structural change and industrialization with environmental sustainability (Marquet et al., 2020; Gligo et al., 2020). Colombia's 2023 'Re-industrialization Plan'[5] and Brazil's 2024 'New Industry Brazil'[6] initiative both center sustainability priorities.

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[3] These are the technologies highlighted in the "Green Deal Industrial Plan." https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023DC0062
The Net-Zero Industry Act prioritizes the following technologies: Solar photovoltaic and solar thermal technologies; onshore and offshore renewable technologies; battery/storage technologies; heat pumps and geothermal energy technologies; electrolysers and fuel cells; sustainable Biogas/Biomethane technologies; carbon Capture and storage (CCS) technologies; grid technologies: https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en

[4] We use the terms "global North" and "global South" to distinguish between wealthy countries in geopolitically strong positions and low- to middle-income countries in geopolitically weaker positions.

[5] https://www.mincit.gov.co/prensa/noticias/industria/politica-reindustrializacion-presentacion-a-medios

[6] https://www.gov.br/planalto/en/latest-news/2024/01/brazil-launches-new-industrial-policy-with-development-goals-and-measures-up-to-2033
https://www.gov.br/mdic/pt-br/composicao/se/cndi/plano-de-acao/nova-industria-brasil-plano-de-acao.pdf

Unlike global North initiatives, which almost exclusively center renewable energy and heavy industry, these plans also feature transformation in the agriculture sector, more sustainable management of natural resources and agriculture, conservation, and even tie green industrial objectives to broader social or 'development' goals. Unlike the Inflation Reduction Act, however, these plans are mostly yet to be implemented, not least due to uneven access to financing, fiscal constraints, and limitations on policy autonomy enshrined in trade and investment agreements as well as challenges of coordination, cross-sectoral planning capacity, and domestic and global political pressures from economic actors attached to the status quo (Estevez and Riofrancos; 2025; Rocha et al. 2024; Andreoni et al. 2019).

It is against this backdrop of these concrete policies that critiques of 'green industrial policy' have emerged.

3. EMERGING CRITIQUES OF GREEN INDUSTRIAL POLICIES

Critiques of GIP —much like the policies themselves— are nascent. In this section we review six emerging types of critiques that speak to shortcomings in the ability of emergent green industrial policies to promote human and natural flourishing objectives: (1) the ***carbon reductionism*** critique, which calls for a more complete conceptualization of 'green transformation' to inform policies that more fully address critical environmental challenges beyond greenhouse gas emissions; (2) the ***system boundaries*** critique which warns against attempts to solve 'green' challenges at a subsystem level when higher-order system solutions are required (for example, attempting to make transportation sustainable merely by making cars electric, rather than transitioning to mass transit to reduce material intensity); (3) the need to better align 'green' objectives with other ***public interest*** objectives (satisfaction of basic needs, redistribution of power, quality jobs, racial justice, etc.); (4) the need to connect industrial policy to broader ***economic planning*** to manage the manifold challenges of green transformation and satisfaction of human needs; and (5) the need to better balance ***national and global*** interests in national policies —particularly in the global North.

The 'Carbon Reductionism' critiques: Carbon emissions are not the only pressing ecological challenge for industrial strategy

The question of what makes industrial policy 'green' is essential to policy design (we return to this in later sections). It can be extremely difficult —often impossible— to produce useful things without an environmental footprint, but it is also risky to apply the 'green' brand liberally: Many have noted that the prevailing concepts of 'greenness' in today's industrial policies is unnecessarily reductive and lacking in ambition. Though scholars grounded in the traditions of

ecological economics, planetary science, and post-growth have thus far largely abstained from engaging directly in debates on emerging green industrial policies, some emerging critiques resonate with the core ideas of their traditions.

One set of critiques of emergent green industrial policies points to the need to more holistically conceptualize the nature of the ecological threats posed by our current production systems (Chang et al. 2024; Estevez and Schollmeyer 2023; Kassem and Estevez 2022; Paulson 2021). Paulson (2021) draws attention to the need to consider biodiversity loss as a challenge as urgent as climate change and warns that some green industrial policy proposals exacerbate biodiversity destruction —for example, the pressures to expand renewable energy infrastructure on federal lands, which would destroy habitats (and which, as recent studies have shown (Bozuwa et al. 2024)), is easily avoidable with better land use- and site-planning). Kassem and Estevez (2022) zone in on the need to redesign green procurement policies to consider toxic emissions, biodiversity impacts, and other environmental side-effects of heavy industry production at the source point and the supply chain. In *Problem Analysis for Green Industrial Policy,* Estevez and Schollmeyer (2023) use an innovation systems framework to argue that today's emergent green industrial policies are hindered by an incomplete understanding of the core problem they seek to solve: If the primary function of green industrial policy is to change production systems to preserve a livable planet, such policies need to pursue a process of industrial transformation that addresses all threats to the planet's livability —not just the threat of greenhouse gas emissions and climate change. If green industrial policy is designed with only one environmental parameter (e.g. greenhouse gases) in mind, this can easily lead to industrial policies that improve that single parameter at the expense of other critical parameters (e.g. biodiversity, toxic emissions), unwittingly locking in new technologies that yield an overall *net negative* impact on the primary objective of preserving a livable planet.

The authors draw from the UN Sustainable Development agenda, itself grounded in planetary science scholarship, to more fully characterize the relevant ecological 'problem set' for green industrial policy:

1. **Biodiversity loss.** Rapid ongoing biodiversity loss threatens the resilience of life on earth, which depends on the preservation of diverse forms of life to sustain ecosystems capable of adapting to changing environmental circumstances. Biodiversity loss is due to various factors including the two challenges below.
2. **Natural resource attrition and degradation,** such as deforestation and the degradation of productive soil which threatens access to food.
3. **Dangerous levels of waste and several types of pollution.** This includes pollutants severely harmful to humans, other forms of life, and ecosystems include a host of air emissions —including and *beyond* greenhouse gases— as well as various forms of toxic and ecosystem-threatening land pollution and water pollution. In addition to causing systemic problems like climate change and ocean acidification, these cause direct harms to life forms, and threaten biodiversity (Estevez and Schollmeyer 2023, p. 6).

This line of criticism resonates with the 'planetary boundaries' critiques of authors like Kate Raworth (2017) who have critiqued standard economics frameworks but have yet to engage directly in industrial policy discussions.

The 'System Boundaries' critiques: Choosing the wrong system boundaries for green transformation leads to suboptimal or counterproductive outcomes

The system boundaries critiques warn against attempts to solve 'green' challenges at a subsystem level when higher-order system solutions are more efficient. Many of these critiques have focused on the erasure of system-wide material efficiency and demand reduction as part of green transformation — that is, as part of the means of tackling unsustainable resource use and finding more resource-efficient ways to fulfill human needs.

Riofrancos et al. (2023), for example, show how a pivot from a transportation model based on personal electric vehicles to one that privileges the expansion of mass transit in the US (when coupled with right-sizing EV batteries and improving recycling) could decrease material demand for lithium by up to 92 per cent by 2050, limiting damage to the water sources and livelihoods of Indigenous communities impacted by mining. Similarly (Flores et al. 2024) argue that policies for steel decarbonization in the US need to be complemented by initiatives that reduce the demand for steel (for example through recycling).

These critiques of green industrial policies resonate with the core insights of the ecological economics tradition —in particular their more holistic understanding of the many dimensions of the environmental crisis and its emphasis on social metabolism (see for example Fischer-Kowalski et al., 2014; Krausmann et al. 2009), the need to reduce throughput (the consumption of energy and materials) to avoid overshooting planetary boundaries (Raworth 2017; Steffen et al. 2015; Rockström et al., 2009) and to better manage biophysical flows (Capellán-Pérez et al 2020). The solutions that stem from this analysis are commonly construed as a 'reshaping of provisioning systems' to fulfill human needs by increasing certain productive activities, decreasing others, and distributing resources more equitably to prevent gratuitous overconsumption by a privileged few at the expense of the deprivation of others.[7] Concrete recommendations include, for example, the elimination of programmed obsolescence and the right to repair (Fitzpatrick, Parrique & Cosme 2022) — neither of which have been centered in emergent green industrial policies.

[7] In developing country contexts this kind of systemic thinking is especially relevant: By reshaping the consumption patterns that are at the origin of the production of ecological degradation, it is possible to reduce some of the pressures on the balance of payments, thereby liberating resources for industrial development. The authors thank Baptiste Albertone for raising this point.

The 'Public Interest' Critiques: Green industrial policies are misaligned, or in conflict, with broader public interest goals

The 'public interest' critiques of green industrial policy are perhaps the most prolific —particularly in the United States. Even as the Inflation Reduction Act was being negotiated, many civil society actors (recalling the absence of public interest guardrails in the 2009 economic recovery package), urged the inclusion of 'sticks' to ensure that climate investments (the 'carrots') would be better aligned with public interest goals[8], such as the protection of workers' rights, full employment, elimination of hunger and poverty, and equitable distribution of the returns on public investments.[9] Many also argued for environmental conditionalities to halt the expansion of fossil fuel infrastructure and to curb biodiversity loss and unsustainable resource use, as well as for an explicit broadening of the objectives of the legislation to center goals like the investment in marginalized communities and environmental justice (for example, see the THRIVE Act, Section 2(b) ('Policy Goals') and section 5(d)(3) "High-Road Labor, Equity, and Environmental Conditions" (THRIVE Act 2021; Estevez 2023a).

However, most of these conditionalities were not included in the Inflation Reduction Act and their exclusion has prompted calls for more purposeful design of green industrial policy to safeguard the public interest. This includes proposals to explicitly address racial and socio-economic inequities, such as the concentration of industrial pollution (and the cumulative impacts from different sources of pollution) in poor and minority communities, to exercise stronger discipline on private sector recipients of public funds through corporate guardrails that limit profit-seeking, and proposals to use a diversity of labor, environmental, and equity standards and guardrails as 'investment shaping tools' to forge policies multi-solve for a range of 'green' and 'non-green' societal challenges (Estevez, 2023a, Mazzucato and Rodrik 2023; IRA Cross-Cutting Standards Letter 2023; Gunn-Wright 2023; Gabor and Braun 2023; Palladino and Estevez, 2022).

Equitable governance and accountability also features as a theme in public interest' critiques of green industrial policies concerned with economic and political power asymmetries, inequality, and economic democracy. Mechanisms like multi-stakeholder governance of public investment institutions, Community Benefit Agreements, participatory and community-based investment planning have been proposed as potential solutions (Bozuwa et al. 2024; Shams et al. 2023, Estevez 2023a; Omarova 2022; Estevez, Beachy & Gunn-Wright 2020).

[8] Note that this critique also resonates with long-standing critiques of industrial policies and 'development' experiences in the global South (Albertone 2025; Estevez 2023b; Estevez 2022).

[9] See BlueGreen Alliance 2021; and the Green New Deal Network (GNDN) 2021. (The THRIVE Act marker bill, promoted by the GNDN, contains a broad list of investment conditionalities backed by a range of environmental, labor, and racial justice organizations.) See also, "IRA Cross-Cutting Standards Letter" signed by 175 groups on February 15, 2023 regarding the implementation of that mandate: https://www.sierraclub.org/sites/www.sierraclub.org/files/2023-02/IRA-standards-oversight-letter-OMB-GAO-FINAL-20230215.2.pdf

The public interest critiques of green industrial policy also have a foil among commentators who posit that existing environmental regulations and new standards, guardrails, and accountability mechanisms can slow down the deployment of green industrial policy to the detriment of the core mission of greenhouse gas mitigation. While plausible in theory, and no doubt accurate in some cases, these critiques have also been undercut by empirical work on the concrete dynamics of renewable energy deployment, which suggest that building in stronger equity objectives and accountability can, in practice, accelerate renewables deployment by testing for and building community buy-in (Bozuwa et al. 2024; Bozuwa and Mulvaney 2023; Pleune 2023; Gunn-Wright and Karlsson 2023).

The 'Nationalism' Critiques: Green Industrial Policy Should be More Globally Responsible[10]

The rise of global North policies like the European Carbon Border Adjustment Mechanism (CBAM), the EU Deforestation-Free Products Regulation (EUDR), and the Global Arrangement on Sustainable Steel and Aluminum have sparked accusations of 'green protectionism' —or the use of environmental regulations to protect national markets at the expense of trading partners.[11] Some critiques are narrow —they call into question the *deceptive* use of environmental regulations to protect the domestic market— and propose more transparent science-based approaches.[12] Others are more fundamental: Noting the historically cumulative nature of emissions and their impacts, they call into question the legitimacy of the imposition of carbon fees on the products of developing countries that have contributed little to climate change, unlike global North countries which have historically emitted the vast majority of CO_2, in part due to much higher levels of consumption.[13] This line of argument resonates with analysis from the ecological economics and post-growth traditions, which point out that the systemic effects of reducing domestic and global inequality could make major contributions to decreasing carbon emissions (Millward-Hopkins 2022; Gössling & Humpe 2023).

Another set of 'nationalism' critiques chastise global North countries for delaying the green transition in order to grow their own domestic 'green' industries. The Biden administration's imposition of a tariff of 100% on imported Chinese electric vehicles (Blenkinsop 2024) was a salient example of this practice. Such aggressive trade measures have also driven a resurgence of a long-running line of criticism of global-North industrial policy: As has been extensively documented in the development and economic history scholarship, wealthy countries have a long track record of using aggressive industrial policy measures —during and after

[10] The authors thank Amir Lebdioui for bringing to our attention the framing of 'globally responsible' industrial policy.
[11] https://brazilian.report/liveblog/politics-insider/2024/02/14/brazil-decries-green-protectionism/
[12] https://brazilian.report/liveblog/politics-insider/2024/02/14/brazil-decries-green-protectionism/
[13] Though it bears noting that his line of argument abstracts away from the local, non-climate environmental and health impacts of heavy industry production.

industrialization— while at the same time proscribing the use of industrial policy in poorer countries and relegating them to mere markets and sources of raw materials and cheap labor Ha-Joon Chang's classic texts *Kicking Away the Ladder* (2002) and *Bad Samaritans* (2007) provide a synthesis of the historical and case study scholarship of this dynamic. Chang et al. (2016) and Andreoni et al. (2019) provide overviews of how trade and investment rules enshrined in WTO and 'WTO plus' bilateral and multilateral agreements restrict industrial and development policy space (see Appendix 4 for a summary).

Notwithstanding asymmetries in policy autonomy, it bears noting that, although US strategy is singularly shaped by its competition with China for the leading spot in the world economy, the 'nationalism' critiques point to a challenge that afflicts all countries: The need to balance the domestic goal of fostering new domestic productive capabilities and economic self-reliance in critical sectors with the goal of shifting as cheaply as possible to a greener economy by adopting the most price-competitive 'green' products and capital goods already on the market. This is the 'green edition' of the well-known Lin-Chang debate on whether or not countries should seek to defy their existing comparative advantages to develop new industrial capacities (Lin and Chang 2009).

The 'Whole-economy' Critiques: Green industrial policy should encompass all economic sectors—not just energy

Green industrial policies have thus far centered the energy sector, and to a lesser extent, transportation and heavy industry (specifically 'industrial decarbonization' in greenhouse-gas-emissions-intensive sectors like steel, cement, aluminium and petrochemicals).

However, many have pointed out that to address the 'green' challenges of production systems, green industrial policy should be cross-sectoral. Proposals from advocacy groups, think tanks, and academia have called for economy-wide approaches to industrial policy, arguing for the inclusion of essential sectors like food, housing, and the care economy (Weber and Schulken 2024; Kahn 2024; Estevez 2023a; Beachy 2021; Palladino and Gunn-Wright 2021; Chang, Lebdioui, and Albertone, draft), but concrete policy measures have yet to adopt an economy-wide paradigm.

The 'Planning' Critiques: Better planning is needed to achieve green transformation

Finally, the 'planning' critiques of industrial policy point to the need to harmonize industrial policy goals with broader economic planning to ensure desired outcomes.

Some critiques zone in on the difficulties of achieving green economic transformation in the context of private-sector-led economies. This includes issues like coordination challenges across economic sectors, geographies, and levels of government, counter-productive price incentives, and the low profitability of renewables deployment —all of which point to stronger

public-sector leadership, the use of public enterprises, and 'whole-of-government' 'whole-economy' planning as a means of achieving green transformation (Bozuwa et al. 2024; Algers, 2024; Estevez et al., 2024; Christophers, 2024, Brusseler 2023, Omarova, 2020; Estevez et al., 2020).

Some highlight the need to embed green industrial policy in broader development planning processes (Estevez 2023a; Omarova 2020) and to develop industrial policy that serves priority social missions like the elimination of poverty (Estevez 2023a, p.5; Estevez 2023b).

Others highlight the need for planning to manage the relationship between the micro- and macroeconomic dynamics of green transformations more carefully to prevent shocks like uncontrolled price volatility and disruptions in supply chains that could threaten access to essential products—including essential products for the green transition itself (Weber and Schulken 2024).

All six of these emerging lines of critique can help inform more holistic and systemic frameworks for green industrial policy analysis and design.

4. TOWARD ECO-HUMANIST (GREEN) INDUSTRIAL POLICY

In this section, we combine the critiques of green industrial policy and the adjacent 'green' scholarship discussed above with humanist and structuralist development scholarship to propose (1) a working definition of green industrial policy, (2) a set of general design principles, and (3) a table of categories to help conceptualize how green industrial policies can be designed to serve human and natural flourishing.

Defining 'industrial policy' and 'green industrial policy'

Industrial policy can be defined in many different ways and can be deployed toward various ends, with different levels of ambition —from ramping up mask production during a pandemic to turning poor countries into rich, industrialized ones by transforming their productive capabilities. For the purposes of this article —to encourage more holistic approaches to GIP— we define industrial policy at a high level of generality as the deployment of any policy tool to shape production systems (see Appendix 2 for a taxonomy of commonly used tools). This includes (i) **production**: how a society creates value—that is, *what* goods, services, and infrastructures it produces and builds, and *how* it produces and builds—; and/or (ii) **provisioning**: the distribution or delivery of value to people to meet human needs (this includes, but is not limited to consumption).

Green industrial policy, in turn, refers most generally to efforts to deploy industrial policy tools toward some kind of 'green' objective. As discussed in earlier sections, current real-world

policies see that objective as 'tackling climate change by reducing or offsetting greenhouse gas emissions', or 'promoting the manufacturing of renewable energy inputs.' By contrast, building on Estevez and Schollmeyer (2023), we propose that a coherent concept of 'green industrial policy' should understand its 'green' objective more holistically as **the effort to reshape production and provisioning systems to tackle the full range of environmental challenges that threaten the livability of the planet, including biodiversity loss, natural resource attrition and degradation, and dangerous levels of waste and pollution that contribute to both systemic problems like climate change and direct harms to human and natural life** (Estevez and Schollmeyer 2023). These efforts should be guided by the insights from ecological and biophysical economics, planetary science scholarship, and many other traditions that seek to better understand social metabolism, limits to consumption, planetary boundaries and concrete proposals experiments with demand reduction, and circular economy (Capellán-Pérez et al., 2020; Raworth, 2017; Steffen et al. 2015; Rockström et al., 2009). **Aspirationally, green industrial policy can also seek out solutions that not only *minimize* the environmental harm involved in producing useful things, but also *expand and restore* biodiversity, natural spaces, and other forms of natural flourishing (Schollmeyer and Ariyur 2023).**

However, as many critiques of emergent industrial policy above highlight, even a green industrial policy that is 'holistically green' can easily neglect and even be antithetical to 'non-green' societal objectives that are also directly affected by changes in production systems, such as decreasing poverty and inequality (we return to this below). **This is why concrete green industrial policies should be developed as part of a broader policy framework guided by a holistic range of societal objectives that serve as the guidepost for *all* policy interventions (not just for industrial policies)**.[14] Working from a holistic normative framework enables the design of all industrial policies to be simultaneously guided by green, social, and economic objectives (to 'multi-solve') and to more clearly identify and creatively manage potential tensions and trade-offs between them.

Opportunities to multi-solve don't always exist and trade-offs are not always solvable, but the efficiency imperative means that the possibility of multi-solving and resolving tensions between competing goals needs to be explored to maximize the positive impacts of policies and minimize negative side-effects (see Estevez 2023a for a longer discussion of the analysis and management of trade-offs in industrial policy and in the innovation and management theory literature).

But what should that holistic normative framework for industrial policy encompass? What should be the overarching mission of industrial policy?

[14] National development plans, for example, often include such frameworks.

‘Good’ industrial policy *is* eco-humanist: It serves human and natural flourishing

The specifics of normative policy objectives are, of course, context-dependent. They are —ideally— defined by the priorities that emerge from democratic processes in specific polities. But one useful holistic normative framework can be found in the humanist development tradition, which asserts the centrality of human flourishing as the ultimate objective of all policy interventions (Estevez, 2022, p.1, Andreoni et al. 2021; Sen, 1989; Nussbaum, 2003 Robeyns 2017).

Strictly speaking, human flourishing can be thought of as a subcategory of natural flourishing insofar as humans are part of the ‘nature’ that ought to flourish; and, conversely ‘human flourishing’ necessarily requires at least some level of ‘natural flourishing’ insofar as the latter supports for the former. However, elevating the two objectives to the same level gives way to a cohesive framework, which is well summarized in the imperative embraced by the ecological economics and post-growth traditions (among others[15]): ‘fulfilling human needs within ecosystem boundaries’ or paraphrasing Klaunig (2022) ‘balancing what humans need from earth with what the earth needs from humans.’ The point of ‘industrial’ or ‘economic’ systems, after all, is to provide human necessities. And the point of green transformation is to make sure that those necessities are provided sustainably.

If we take the imperative of ‘fulfilling human needs within ecosystem boundaries’ as the guidepost for all policy interventions, the relevant question for *industrial* policy becomes: ‘How can industrial policy be designed to better fulfill human needs within ecosystem boundaries?’

Moving from such a high level of abstraction to concrete policy is not straight-forward. The concrete linkages between industrial policies, production systems, ecosystems, planetary dynamics, human flourishing and natural flourishing are manifold and complex.

Yet, efforts to tease out those relationships and make them concrete abound. This includes countries and multilaterals adopting new metrics of progress that better reflect human flourishing (see Stiglitz, et al. 2019; Coyle 2015); academics working with cities and companies to translate ecological economics principles into concrete policy and firm-level experiments (for example, the work of Kate Raworth's ‘Doughnut Economics Action Lab’); biophysical economists seeking to make integrated assessment models of climate change more grounded in the material economy (Capellán-Pérez et al. 2020); a diversity of works in the human flourishing, post-growth, and psychological well-being traditions that seek to structure an understanding of essential human needs (see Estevez 2022, ch. 2; Alkire et al 2020; Hirai 2018; Nussbaum 2003) and their relationship to planetary boundaries (Hickel and Sullivan 2024; Vélez-Henao and Pauliuk 2023; Millward-Hopkins 2022); and much more.

[15] Other related traditions include eco-development (the developmentalist predecessor of sustainable development). We thank Baptiste Albertone for bringing this to our attention.

In recent years there has been a proliferation of scholarship specifically seeking to make sense of what 'economic policy for human flourishing' should look like (Di Vito and Lusiani 2024; Estevez 2022; Bueno 2022; McGranahan, 2020; Weidel, 2018). Estevez (2022), for example, connects the humanist scholarship to the structuralist development scholarship to argue that structural economic transformation (with industrial policy as the key instrument for transformation) is essential for commodity-dependent countries to diversify their productive structures and build the economic capacity and resilience necessary to sustainably fulfill essential human needs, expand human capabilities, and offer opportunities for fulfilling work. This includes creating a techno-productive base —the collective productive capabilities— capable of producing and capturing sufficient per capita income to procure essential necessities.[16] McGranahan (2020) argues that "meaningfulness in the workplace cannot be addressed without critically examining the formal ownership and management structure of businesses," and that the proliferation of employee-owned and democratic businesses should be centered in human development strategy (p. 389). Di Vito and Luisani (2024) examine how tax code reform can be reconceived from a human wellbeing perspective. These are only a few examples of abundant efforts to connect structural economic change to personal flourishing.

This broad and evolving scholarship and practical experiences contain many useful insights, principles, and lessons. For the specific purpose of examining and designing industrial policies for human and natural flourishing, we propose a simple framework that distills some of the most relevant insights from these traditions.

In terms of definitions, we propose that *good* industrial policy — industrial policy that serves *human and natural flourishing* (or an 'eco-humanist' industrial policy) is about transforming production and provisioning systems to fulfill human needs more fully and equitably, in line with ecosystem boundaries. Such policies should (i) improve the livability of the planet — ideally, expanding the ability of the planet to flourish; and (ii) satisfy basic human needs —and ideally, human aspirations and desires— equitably.

From this normative standpoint, 'good' industrial policy is necessarily *green* industrial policy because good industrial policy should seek to ensure the livability and flourishing of the planet. And 'good' *green* industrial policy, even if deployed primarily to ensure the livability and flourishing of the natural world, also needs to strive for coherence with the objective of equitably fulfilling human needs.

Our proposed definition is intentionally expansive to make room for holistic and systemic thinking about green industrial policy. This kind of expansive framework is needed, not just for epistemic coherence but in order to better capture the complex ecological, economic, and human realities that policymakers need to manage to advance and implement effective policy. The challenge, of course, is how to operationalize such an expansive framework.

[16] For countries with per capita income too low to procure human necessities, this necessarily implies achieving sufficient levels of economic growth/income.

An Eco-Humanist Industrial Policy Framework: Essential necessities for human and natural flourishing and the role of industrial policy in achieving them

To expound on our definition, Table 1 proposes a set of basic needs for human and natural flourishing, as well as a set of enabling structural economic conditions, and maps how industrial policy can help societies meet those needs. We derive this list of necessities in part from analysis and normative proposals in the the human flourishing literature (see Estevez 2022, ch. 2, for an overview; Alkire et al. 2020; Hirai 2018; Nussbaum 2003); the planetary boundaries and ecological economics scholarship (see Hickel and Sullivan 2024; Vélez-Henao and Pauliuk 2023; Millward-Hopkins 2022); and the (eco-)development and structuralist economics scholarship (see Albertone 2025; Prebisch 1984; Hirschman 1958; Myrdal 1957). Each of these literatures attempts to capture the human, economic, and ecological conditions for people, economies, and ecosystems to thrive. It also bears noting that most of these normative proposals are not specific to these academic literatures, or to academic literature in general —most are fairly intuitive and also appear in intellectual traditions outside of the academic spaces (see Estevez and Riofrancos (2025) for some examples and discussion of this point).

Table 1. Twenty essential needs for human and natural flourishing and the role of industrial policy in fulfilling them

	Necessity	Function / value (How it meets needs/aspirations/desires)	Undesired human and natural side-effects of producing the necessity	Industrial policy imperative
Material human needs	1. Energy (non-toxic, low-carbon)	Energy is a critical input to produce everything humans need to survive: food, shelter, clothing, and mobility.	Dominant energy systems are causing climate change, biodiversity loss, and the high pollution of air, land, and water. All of these negative effects threaten human and natural health and livelihoods.	Build energy technologies and provisioning systems to support the production of food, shelter, and other human necessities with distributional equity, while minimizing/reversing undesired side-effects.
	2. Healthy food (non-toxic, nutritious)	Healthy, nutritious food is essential for physical, human, and animal health. (For many, it is also a source of enjoyment and creative expression).	Dominant food production systems are causing climate change, biodiversity loss, high pollution of air, land, and water. This threatens the livelihoods and well-being of agricultural workers. They often also fail to produce food that is healthy and nutritious.	Change food production systems to minimize/reverse undesired side-effects and to expand the equitable provision of healthy and nutritious food.
	3. Healthy air, water, soil	Clean air and water, and healthy soils, are	Air, water, and solid are not 'produced' but the	Change production systems to mitigate and reverse the

		critical for the survival, health, and flourishing of human beings.	production systems currently pollute them.	pollution of air and water. Build healthy, sustainable infrastructures for water provisioning.
	4. Shelter	Shelter, (including housing, heating, and cooling systems) provide safety, comfort, and enjoyment.	The dominant methods we use to build shelter and produce its inputs (steel, glass, concrete, etc.) are highly polluting, unhealthy for humans, and unsustainable.	Change the way we build shelter by replacing unsustainable inputs and designs with sustainable ones; transforming the way we produce inputs; reducing material intensity (and increasing material efficiency).
	5. Clothing	Protects human bodies from overexposure to the cold and sun. (Provides opportunities for self-expression).	Much of our clothing is made from fossil fuels and unsustainably produced agricultural products, with exploitative production models that harm workers.	Change the way we produce clothing to decrease material intensity and shift to sustainable inputs and production models that uphold human rights.
	6. Transportation	Provides mobility, allowing people to connect with others, explore, and seek economic opportunities.	Transportation systems are currently lackluster in delivering connectivity and highly unsustainable in terms of energy and material consumption.	Build more mass transit (and its inputs) to expand mobility, and decrease the prevalence of energy and resource-intensive transit models that privilege individual automobiles.
	Necessity	**Function / value (How it meets needs/aspirations/desires)**	**Production-related obstacles to provisioning of the necessity; undesired side-effects of provisioning necessity**	**Industrial policy imperative**
Immaterial human needs	7. Care	Different types of care support the emotional and physical health and resilience of human beings.	Non-commodified care work is not valued as productive work; paid care work is undervalued; exploitative production models leave little time for unpaid care.	Industrial policy for human-natural flourishing can invest in care work and various care infrastructures; create less exploitative production systems (Kahn 2024).
	8. Community, connection, and belonging	Feelings of connectedness and belonging are critical for psychological well-being and human resilience.	Our production systems are atomized and their exploitative nature leaves little time for building human connection outside the workplace (loneliness epidemic).	Foster more collaborative and less exploitative forms of production and build and protect physical spaces for connection and community.
	9. Leisure and play	Human beings need leisure and play to regenerate and enjoy life.	Our exploitative production systems leave little time for leisure and play; provisioning of certain kinds of leisure (e.g. air travel) is unsustainable.	Build less exploitative production systems; build and protect spaces for leisure and play (Bozuwa 2024).
	10. A sense of purpose, dignity,	Emotional health and self-esteem are heavily	The work opportunities offered by exploitative,	Invest in productive activities that provide opportunities for

	and recognition	influenced by one's sense of purpose.	dangerous and health-harming production systems undermine these needs. Overproduction of luxury goods provides the (false) promise of recognition and dignity.[17]	decent and fulfilling work; innovate to eliminate the need for humans to do work that is unhealthy, unfulfilling, and dangerous.
	11. Opportuni -ties to learn and to exercise creativity and imagination	These cognitive needs are important for psychological and emotional well-being, as well as for building personal capabilities to pursue fulfilling work.	Exploitative production systems and under-provision of public goods obstruct opportunities for learning and creativity.	Build less exploitative production systems that increase free time; invest in public resources and infrastructures for learning (e.g., libraries, public education, apprenticeship programs).
	Necessity	**Function / value**	**Production-related obstacles to provisioning of the necessity**	**Industrial policy imperative**
Natural/ planetary /ecosystem needs	12. Stable/ growing biodiversity	Biological diversity ensures resilience of ecosystems.	The production and provisioning systems for material (and some immaterial) human necessities threaten these necessities as described above.	Reshape production (and provisioning) systems for human necessities as described above, actively seeking coherence with the natural necessities outlined in this section.
	13. Healthy climate	Climatic stability allows life to thrive.		
	14. Low pollution	Prevents harms to biological organisms and ecosystems, their health, and ability to flourish.		
	15. Limitation of throughput to planetary boundaries	Ensures the long-term survival of biological organisms on the plant.		
	16. Restoration of harms	Helps to repair damage to the integrity of biological and natural systems that support life.		
	Necessity	**Function / value**	**Production-related obstacles to provisioning of the necessity**	**Industrial policy imperative**
Structural economic conditions for human and natural flourishing	17. A diversified, sophisticated, sustainable productive structure	Ensures that economies are resilient to shocks, sensitive to ecosystem boundaries, and able to create and capture value to provide human necessities.	Inertia/path-dependency of baseline productive capabilities; vested economic interests; lack of investment capacity; restricted policy space.	Deploy policy tools (Appendix 2) to build/sustain diversified, sophisticated, and ecologically sustainable productive structure (see the structural transformation/development scholarship).
	18. Availability	Provides human beings	Inertia/path-dependency of	Invest in productive capabilities

[17] See the psychological welling scholarship on "extrinsic" needs (Hirai, 2018, p.395)

	of decent, fulfilling work	with a fulfilling means of creating value and procuring necessities	baseline productive capabilities; vested economic interests.	that provide opportunities for decent and fulfilling work.
	19. Sufficient per capita income to procure commoditized basic necessities for all	Income allows individuals or governments to procure/provide material/immaterial human necessities.	Inertia/path-dependency of baseline productive capabilities; vested economic interests; lack of investment capacity.	Invest in productive capabilities that provide greater opportunities for value creation and capture in the form of income.
	20. Low levels of inequality	Mitigates misallocation of resources to non-essentials (the coexistence of overconsumption by some and underconsumption by others).	Concentrated economic power and ownership.	Transformative industrial policy often involves breaking up concentrated economic power and ownership of productive capabilities at the national and global level (see Estevez 2023b; Estevez and Riofrancos 2025); industrial policy can also decrease inequality by targeting industries that expand jobs for lower-income workers and using standards that increase their wages.

Operationalizing the framework: Some heuristic principles and tools

The above normative definitions and our table of necessities and industrial policy imperatives can serve as a backdrop for holistic, systemic, and intersectional industrial policy design in specific contexts. But applying a framework such as the one above is, of course, not straightforward.

When embarking on any concrete industrial policy design or analytical undertaking, it can be helpful to clarify the nature of the problem, the goal, and possible solutions through a few simple guiding questions (see Appendix 1). This avoids faulty problem analysis and ensuing faulty solutions. Ideally, a comprehensive industrial policy begins by identifying the key problems that impede human and natural flourishing in a specific context and 'reverse engineers' how industrial policy —through the transformation of production and provisioning systems— can help overcome those challenges.

Inevitably, policymakers and constituents also have to prioritize among possible goals (and their corresponding industries, sectors, and production systems) over others. To that end, they can (and do) use a variety of industrial targeting criteria, ranging from the potential of a particular industry to generate employment and productive linkages, to the opportunities posed by rising demand for green technologies, to the potential to secure buy-in and collaboration from different societal stakeholders, to the possibilities of navigating *de jure* and *de facto* restrictions

on policy space. **Appendix 3 gives an overview of the range of criteria used by policymakers in concrete industrial targeting exercises (for more specific examples, see Estevez, Chang & Schollmeyer 2025).**

In addition to defining priority goals and strategic industries, the policy design process entails examining and choosing from the range of tools that can be deployed to transform them, from public investment and procurement, to trade and investment measures, to procurement and production clubs (Appendix 2). (For more detailed discussion of how these policy tools can (and have) been deployed in practice and some common pitfalls see Estevez, Chang & Schollmeyer 2025; Estevez et. al 2025; Estevez 2023b; Chang et. al 2015)

In navigating the policy design process, it can also be helpful to rely on some simplified, heuristic principles to elucidate some of the principal pathways for transforming production and provisioning systems. Table 2 offers a set of five principles and connects them to the 20 necessities for human and natural flourishing in Table 1.

Table 2. Heuristic principles for industrial policy design[18]	
1. Material efficiency in the delivery of human flourishing	Improve techno-productive systems to deliver more value (satisfaction of necessities, especially for those most deprived) with less energy and material consumption (e.g., through recycling or shifting transportation systems to mass transport)[19] (helps meet necessities 1-16 in Table 1).
2. Mitigation of human exploitation and expansion of human flourishing	Improve techno-productive systems to reduce harms to the human beings who create and deliver value, and improve their ability to flourish (helps meet necessities 1-11 in Table 1).
3. Reduction of pollution (of land, water, air):	Improve techno-productive processes to minimize pollution (greenhouse gases, toxics, etc.) while delivering more value (helps meet necessities 1-3 and 12-16 in Table 1).
4. Reduction of biodiversity and ecosystem harms	Improve techno-productive processes to reduce their impact on biodiversity and sensitive ecosystems (e.g. cut down fewer forests to produce necessities) (helps meet necessities 12-16 in Table 1).
5. Diversification of productive capabilities	Build/sustain a diversified, sophisticated, productive structure to ensure the capacity to produce or procure necessities (helps meet necessities 17-20 in Table 1 directly, 1-11 indirectly)

At the end of the day, to avoid the pitfalls addressed in the above critiques of today's GIPs (Section 3), 'good' green industrial policy— industrial policy that serves human and natural flourishing— should embody certain features and avoid others (Table 3).

[18] These heuristics are only rough approximations that require more nuance. Schollmeyer and Ariyur (2023), for example, distinguish between Type 1, 2 and 3 resources: Type 1: Resources that are free but have a limited rate of availability (sun, wind, geothermal) —every production chain has to go back to these sources of energy if it is to be sustainable in the long-term (similar to biological systems); Type 2: Finite resources, like metals and minerals. These need to be recycled. Energy for the recycling should come from Type 1 sources to make it sustainable; Type 3: Organic matter, including fossil fuels. These should be consumed at a rate that is lower or equal to the rate of regrowth. Optimal management of production processes should *improve* the quality of these resources (e.g. well managed topsoil). Polluting any of these resources is equivalent to using the resource because it renders it unavailable as a non-polluted resource.

[19] These objectives can be achieved by (1) Using alternative materials: Substituting products with highly undesirable human and natural side-effects with healthier alternatives (for example sustainable wood in lieu of steel); (2) Using smaller quantities of materials: When it is impossible to substitute materials, it may be possible to use smaller amounts (for example, some companies have developed stronger types of concrete, reducing the amount of concrete needed in construction); (3) Producing/provisioning with less energy by improving energy efficiency of existing systems; (4) Producing/provisioning with cleaner processes/systems: For example, by transforming a car-dependent transportation model to a mass-transit focused model (Riofrancos et al. 2023), it is possible to provide more mobility with lower throughput.

Table 3. Desirable vs. undesirable features of green industrial policy	
Desirable features	**Undesirable features**
Is environmentally holistic. Seeks solutions that address all pressing environmental problems that undermine the livability of the planet—greenhouse gas emissions, toxic air, water and land pollution, biodiversity loss, etc.	**Is carbon reductionist.** Only tries to solve for carbon mitigation. Ignores the other critical environmental impacts of the production sector. Risks locking in technical solutions that purport to solve for carbon mitigation but exacerbate other environmental problems.
Encompasses both wind-up and wind-down of green and non-green technologies. Accurately assumes that solving the ecological challenges of our production systems require both promoting greener technologies and reducing and/or eliminating the demand/use of dirty technologies.	**Exclusively centers wind-up of green technologies and neglects wind-down of non-green technologies.** Erroneously assumes that increasing supply of certain technologies is sufficient to solve ecological challenges of our production systems.
Is socially and economically embedded. Is coherent with and serves broader societal efforts to improve social and economic wellbeing.	**Ignores intersections with other social and economic priorities.** Abstracts away from how different green transformation pathways can improve or undermine other societal goals, like eliminating poverty, reducing inequalities, achieving industrialization, or reducing inflation.
Redistributes power to reduce asymmetries. Changes production systems in a way that increases the economic and political power of those most negatively impacted by the status quo, i.e working class people around the globe.	**Reinforces power asymmetries.** Changes production systems in a way that leaves power asymmetries unchanged or further concentrates power among established elites. Leaves untouched the enormous carbon footprints of affluent consumption.
Has holistic production-system boundaries. Seeks solutions that factor in the full environmental impacts along the entire value chain and production networks (e.g., by using environmental life cycle analysis). Contemplates all economic sectors.	**Has narrow production-system boundaries.** Seeks solutions that only factor in environmental and social impacts at the source point (for example, only takes into account emissions at steel facilities, omitting environmental and social impacts generated along the value chain by coal, iron ore mining, etc.). Narrow focus on energy, transportation, heavy industry; ignores agriculture and services.
Identifies and manages trade-offs between possible solutions. Is clear and explicit about the real impacts of different types of policies and technological solutions, including the environmental and social impacts of 'green' technologies like the solar or battery supply chain, which depends on large-scale mining pollution and human rights abuses.	**Ignores or mismanages trade-offs between possible solutions.** For example, by over-investing public funds into EV cars and under-investing in mass transit solutions that deliver mobility more efficiently in environmental, social, and economic terms.
Respects policy autonomy. Allows all countries to freely increase labor and environmental standards and to foster the development of local industries.	**Undermines policy autonomy.** For example, 'debt for nature' swaps that privatize the management of development policies; trade and investment rules that make it more difficult to raise environmental standards or to promote local industries.
Builds diversified and sophisticated collective	**Reinforces commodity dependence in poor countries**

productive capabilities, which are essential to foster a thriving, resilient economy at the national and global level.	**and concentration of technological capabilities in rich countries**, undermining global economic resilience and human flourishing.
Fosters cooperation among countries to build co-developmental value chains and production systems that share value equitably.	**Reinforces asymmetric competition and inequitable distribution of value** in global production systems.
Includes workers and communities in decision-making. Ensures that those who are most affected and often most knowledgeable—the communities living near energy projects and the workers who build them—participate in key decisions, resulting in positive policy feedback loops.	**Relies on top-down, exclusionary and technocratic decision-making.** Seeks to govern by fiat, with economic and political elites unilaterally empowered to make key decisions, resulting in poorly designed projects with precarious legitimacy and negative policy feedback loops.
Is thoughtfully planned to simultaneously enable economic transformation and economic resilience.	**Leaves economic coordination of private actors** undercutting economic transformation and resilience.

Source: Adapted from Estevez 2024; and Estevez and Riofrancos 2025.

5. CONCLUSIONS

Governments around the world have made 'the green transition' a priority in their policy discourse and embraced the use of industrial policy as a strategic tool for green economic transformation. In principle, the rise of green industrial policy is a positive shift that acknowledges the existential urgency of the ecological crisis and the need to tackle it through commensurately ambitious policy action. It also marks a welcome recentering of the productive sphere —the 'real economy' — after decades of near-exclusive focus on 'the market' in economic analysis.

However, the concrete policies advanced by governments have been subject to a wide range of critiques that point to shortcomings in the conceptualization, design, and execution of green industrial policy (Section 3):

1. The need to overcome ***carbon reductionism*** in the conceptualization of the 'green transformation' to more fully address critical environmental challenges beyond greenhouse gas emissions, like biodiversity loss, toxic pollution, and resource attrition and degradation;
2. The ***system boundaries*** critique which warns against attempts to solve 'green' challenges at a subsystem level when higher-order system solutions are required (for example attempting to solve transportation emissions by making cars electric, rather than transitioning to mass transit to reduce material intensity);
3. The need to better align 'green' objectives with other, ***'non-green' public interest objectives*** (satisfaction of basic needs, quality jobs, racial justice, democratic engagement etc.) both on principle and for pragmatic political economy considerations;

4. The need to connect industrial policy to broader ***economic planning*** to manage the manifold challenges of green transformation and satisfaction of human needs;
5. The need to better balance ***national and global*** interests in national policies —particularly in the global North.

Inspired by those critiques, we propose an 'eco-humanist' industrial policy framework including a set of definitions, principles, guidelines that can improve (green) industrial policy analysis and design (Section 4).

We propose that 'good' industrial policy is industrial policy that serves human and natural flourishing. This involves the deployment of policy tools to transform production and provisioning systems in a way that fulfills human needs more fully and equitably, while respecting ecosystem boundaries. Such policies should seek to (i) improve the livability of the planet —ideally, expanding the ability of the planet to flourish; and (ii) satisfy basic human needs —and ideally, human aspirations and desires— equitably. Synthesizing various approaches to basic needs research, the humanist development tradition, development and structuralist economics, and ecological economics, our framework outlines a set of 20 necessities for human and natural flourishing that should guide the design of industrial policy and outlines the corresponding industrial policy imperatives, as well as heuristic guidelines and methodologies (Section 4). We conclude with a summary of the features that an eco-humanist industrial policy should embody —and those it should avoid (Table 3).

Though the practical implications of these concepts, principles, and design tools cannot be fully captured within the scope of this paper, these elements can serve as a guide for those seeking to develop more holistic industrial policies.

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Appendix 1.

Table 4. Four Guiding Questions for (Green) Industrial Policy Design and Evaluation

Note: These questions apply to both national-level industrial policy seeking economy-wide transformation and to any other industrial policy endeavor, no matter how small (e.g. a local food procurement policy).

1. Goal check:	Are we clear on the primary goals of this policy? What set of problems does it aim to solve? Faulty problem analysis leads to faulty solutions. Ideally, a comprehensive national industrial policy begins by identifying the problems that impede human and natural flourishing and "reverse engineers" how industrial policy—through the transformation of production and provisioning systems— can help overcome those barriers.
2. Human Flourishing Check:	What are the probable impacts (at home and abroad) of the (potential) industrial policy measures on the various necessities of human flourishing? (Especially for those who most lack them). Key human needs: 1. Energy (non-toxic, low-carbon) 2. Healthy (non-toxic, nutritious) food 3. Healthy (non-toxic) air and water; healthy soil 4. Shelter 5. Clothing, Transportation 6. Care 7. Community, connection, and belonging 8. Leisure and play 9. A sense of purpose, dignity, and recognition 10. Opportunities to learn and to exercise creativity and imagination What can we do to shape this policy in a way that it increases the satisfaction of essential human needs (especially for those who most lack them) and diminishes negative impacts? (See corresponding "Industrial policy imperatives" in Table 1.)
3. Natural Flourishing Check:	What are the potential impacts (at home and abroad) of the (potential) industrial policy measures on natural flourishing? Key natural flourishing needs: 1. Stable/growing biodiversity 2. Healthy climate 3. Low pollution of water and protection of water resources 4. Low pollution of soil 5. Low pollution of air 6. Sustainable consumption of water 7. Sustainable use of soil 8. Limitation of throughput (material and energy consumption) to planetary boundaries 9. Restoration of harms What can we do to shape the policy to increase the satisfaction of essential natural needs and diminish negative impacts? (See corresponding "Industrial policy imperatives" in Table 1.)
4. Structural economic conditions check	What are the probable impacts of the (potential) industrial policy measures on the macroeconomic conditions for human and natural flourishing? Macroeconomic conditions: 1. A diversified, sophisticated, and ecologically sustainable productive structure 2. Availability of decent, fulfilling work 3. Sufficient per capita income to procure commoditized basic necessities for all 4. Low levels of inequality

	How can we shape the policy to improve macroeconomic conditions for human and natural flourishing and diminish negative impacts? (See corresponding "Industrial policy imperatives" in Table 1.)

Appendix 2.

Table 5. Taxonomy of Industrial Policy and Planning Tools
This table outlines a range of commonly used industrial policy and planning tools

CARROTS *Policies that support desired productive activities and practices*	1. **Public investments in strategic industries and infrastructure through:** a. **Grants** b. **Loans:** preferential loans, forgivable loans, and loan guarantees c. **Public banks** to make strategic loans and to coordinate investment d. **Public enterprises** to produce strategic necessities better suited to public sector management e. **Public equity stakes** in private/worker-owned (etc.) enterprises f. **Public venture capital** with fair risk and return sharing g. **Public-private partnerships** with private/worker-owned/etc. companies h. **Tax credits/direct pay** for producers and consumers i. **Government procurement** (e.g. procurement standards or procurement clubs that give preference to/increase demand for sustainable products, incorporation of local content, technology transfer, fair labor practices. etc.) j. **Advance market commitments and strategic stockpiling/buffer stocks of critical goods** such as food k. **Targeted private procurement for publicly-supported projects**: requirements for recipients of public money through loans, grants, etc., to give procurement preferences to sustainable products, incorporation of local content, or fair labor practices l. **Investments in human capital and workforce development** supportive of investments in target industries (education, training, apprenticeships, etc.). m. **Investments in innovation**: research, development, deployment, and demonstration ***Note:*** *These "carrots can" also come with their own "sticks" attached in the form of conditionalities* (Estevez, 2023).
STICKS *Policies that curb undesired productive activities and practices*	1. **Taxation** of undesirable productive activities and practices 2. **Performance standards for producers** at the industry or product level (e.g., pollution caps and reduction targets in heavy industry, agriculture, energy, etc.; price regulation; standards for transparency/ technology adoption) 3. **Trade and investment regulations** (e.g., tariffs, carbon border adjustments, performance requirements (such as technology transfer) for foreign investors) 4. **Financial sector regulation**, such as differentiated interest rates to increase the costs of borrowing for polluting activities/decrease the costs of borrowing for sustainable activities) 5. **Labor regulations**, such as the minimum wage, health and safety protections, protections for workers rights to organize 6. **Corporate governance regulation** to promote more equitable power-sharing (e.g., through workers representation) and accountability 7. **Antitrust regulation** to prevent/discipline concentrated economic power 8. **Nationalization, acquisition of public equity stakes**, and public management of

	critical industries currently being mismanaged by the private sector 9. **Enforcement and litigation** (e.g., to ensure compliance with pollution standards)
ENABLING INSTITUTIONS	1. **Planning bodies:** Institutions that fulfill industrial strategy functions (e.g. prospective research; vision-building; mission-setting; sectoral, geographic, and socioeconomic targeting of investments; and public/stakeholder engagement, evaluation, oversight, and accountability) 2. **Coordination bodies** to ensure coherence among different agencies and levels of government

Source: Adapted from Estevez 2023a

Appendix 3.

Table 6. Menu of criteria for industrial targeting	
Contribution to human and natural flourishing	1. Importance of the industry/production system to human flourishing and to natural flourishing.
Ecosystemic and human health criteria	2. Environmental impact of the industry and indirect effects on people's livelihoods, locally and globally and distribution of those impacts (environmental justice)
	3. Potential reduction of greenhouse gas emissions and other types of pollution
	4. Risk factors created by ecosystemic changes: e.g., how will climate change affect a particular industry?
	5. Windows of opportunity created by the emergence of new technologies related to climate change or other projected ecosystem changes.
Economic, productive, and technological criteria	6. Potential to generate quality work opportunities in the short- and long-run
	7. Contribution to productive diversification and upgrading through industry linkages, knowledge spill-overs, and skills transposition
	8. Technological requirements: how difficult will it be to create the technological capacities required to succeed in the selected industry?
	9. Demand factors: fast growth in global demand, domestic potential demand through substitution of imports
	10. Potential to secure investment/financing
	11. Potential to reduce the cost of core consumer goods including energy, housing, and food.
	12. Challenges and opportunities created by emergent changes in the procurement strategies of global firms and market structure of global production networks
	13. Fallacy of composition risks: how likely is it that too many other entities will pursue the same target sectors, and risk over-crowding the market?
	14. Macroeconomic impacts
Political and social criteria	15. Potential to secure buy-in and collaboration from different societal stakeholders
	16. Potential to increase economic participation by marginalized groups and reduce poverty and inequality
	17. Policy constraints imposed by national rules, regulations, and economic factors
Source: Adapted from Estevez, 2022; based on Estevez, 2017 and Chang, 2016	

Appendix 4.

Table 7. Industrial policy tools restricted in World Trade Organization rules and WTO+ trade and investment agreements[20]

Industrial policy tool	Restrictions in WTO and other trade and investment agreements
Procurement policy, such as preferential treatment of domestic firms or of foreign providers willing to transfer technology or incorporate rising levels of local content	The WTO Agreement on Government Procurement restricts these measures, but most developing countries are not signatories. However, many "WTO plus" bilateral and multilateral trade and investment agreements also restrict these procurement policy measures (e.g., the USMCA and EU-EPAs categorically prohibit them).
Infant industry protections, such as tariffs, quotas, and market set-asides for domestic producers	WTO member countries are all required to implement an upper limit on at least some of their tariffs. In the Doha Round of Non-Agricultural Market Access negotiations, industrialized countries pushed to bind and slash all unbound tariffs. The General Agreement on Tariffs and Trade (GATT), Art. XVIII, allows developing countries with low standards of living to temporarily raise tariffs to promote the establishment of a particular industry, but this requires difficult negotiations, approval of WTO members, and compensation through other tariff reductions. Furthermore, the time frame allowed (8 years) is very short relative to historically effective time frames for infant-industry protections.[21] For example, the automotive sector in Japan and Korea required decades of loss-making public investments before the national automakers succeeded in the global export market.[22]
Subsidies for key industrial sectors to promote high-value-added industries and exports	The WTO's Agreement on Subsidies and Countervailing Measures (SCM) considers subsidies trade-distorting measures and prohibits any sector-specific subsidies as well as subsidies for export promotion and for enforcing the use of local content in manufacturing. It also prohibits *indirect* subsidies through intra-private sector transfers facilitated by government regulation.

[20] Adapted from Estevez, "Multi-Solving, Trade-Offs, and Conditionalities in Industrial Policy"; Andreoni, Chang, and Estevez, "New Global Rules"; and Ha-Joon Chang, Jostein Løhr Hauge, and Muhammad Irfan, "Transformative Industrial Policy for Africa," UN Economic Commission for Africa, April 2016, https://archive.uneca.org/sites/default/files/PublicationFiles/tipa-full_report_en_web.pdf.
[21] Ha-Joon Chang, *Globalisation, Economic Development, and the Role of the State (*Zed Books, 2002).
[22] The Japanese and Korean auto industries required decades of protection, as did Finland's Nokia (Andreoni, Chang, and Estevez, "New Global Rules"). The Japanese auto industry was established in the 1930s and became competitive in the 1970s (Ha-Joon Chang, *Bad Samaritans: The Guilty Secrets of Rich Nations and the Threat to Global Prosperity* (Random House Business, 2007)).

	In practice, however, subsidies can be used until they are challenged or countervailed. Subsidies for R&D, regional balances, and environmentally friendly technologies are 'actionable' but have seldom been disputed, in part because developed countries often use them. Least Developed Countries are permitted to use export subsidies under certain conditions but are not exempted from countervailing measures from trading partners.
Creation of state-owned enterprises (SOEs) to kick-start new industries	The use of SOEs is not directly affected by WTO agreements. However, tariff cuts in the GATT and market-access and national-treatment requirements in the General Agreement on the Trade of Services (GATS) – Mode 3 (commercial presence) can be fatal for SOEs. That undermines the ability of states to use SOEs to bolster local industry (e.g., by buying goods or services from domestic producers) or supplying services to those industries at a subsidized rate)
Capital controls and capital outflow taxes to prevent capital flight and encourage savings to remain in the country, thereby facilitating productive investments (including investments in R&D)	There are restrictions to capital controls under GATS and the Trade-Related Investment Measures Agreement (TRIMS); however, violations of the rules can only be challenged in a dispute if a member country initiates state-state arbitration. WTO+ agreements are much more restrictive. US Bilateral Investment Treaties (BITs), for example, require that US firms be allowed to freely transfer payments in and out of host countries without delay.
Performance requirements, such as requirements that foreign investors incorporate local content/workers or engage in joint ventures and technology transfer	The TRIMS constrains local content requirements but not conditions for joint venture and transfer of technology. The activities covered by the GATS – Mode 3 (services delivered through commercial presence) are subject to fewer restrictions than those covered by the TRIMS. WTO+ agreements increase restrictions on performance requirements (e.g., US BITs strictly prohibit all performance requirements).

Source: Adapted from Estevez, "Multi-Solving, Trade-Offs, and Conditionalities in Industrial Policy" 2023a; Andreoni, Chang, and Estevez, "New Global Rules" 2019; and analysis from Ha-Joon Chang, Jostein Hauge, and Muhammad Irfan, "Transformative industrial policy for Africa," *Addis Ababa, Ethiopia: UN Economic Commission for Africa* (2016).