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The Problem of Knowledge in the Anthropocene. Hayekian Environmental Delusion and the Condition of Ecological Planning

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Working paper



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The problem of knowledge in the Anthropocene

Hayekian environmental delusion and the condition of ecological planning.

1. Introduction

In the XXth century, debates about economic planning were largely shaped by arguments concerning knowledge and information. As the century closed, the dispute almost ended, with an apparent victory of the Austrian side, when a wide spectrum of economists and social scientists accepted that an absolute “problem of knowledge” (Hayek, 1945, p. 529) made central planning impossible. For instance, leading New Keynesian scholar Brad DeLong wrote that “within economics even liberal Keynesian social democrats acknowledge that the Austrians won victory in their intellectual debate with the central planners long ago” (DeLong, 1999, p. 245). Reviewing James Scott’s book *Seeing like a State* (Scott, 1998), he stresses “the spread of what every economist would see as “Austrian ideas” into political science, sociology, and anthropology as well”.

In this contribution, we argue that the Austrian premise concerning the ontological superiority of the mobilization of dispersed knowledge over the use of articulated and centralized one to create a successful social order should be revised, considering the rapid escalation of ecological disruptions. As remarked by William Kapp, the current « transformation of the environment is no longer an expression of an increasing mastery over the world we live in but is instead a sign of a loss of such mastery”(1970, p. 23). Our incapacity to stabilize the social metabolism (Fischer-Kowalski et al., 2014) epitomizes the faulty institutional framework of our socioeconomic activity. More specifically, it reveals that the prevalent forms of knowledge production and uses are inadequate to guarantee the perpetuation of a safe ecological space for our species.

After decades of liberalization and marketization policies (Ostry et al., 2016) in the shadow of Hayek’s market “spontaneous order” (Slobodian, 2018, Chapter 7), the tide is turning. Facing the challenge of achieving rapid decarbonization and, more broadly, of reducing the material footprint of our economies, along with growing geopolitical and developmental concerns, industrial policies are back in fashion (Crisuolo et al., 2022; Juhász et al., 2023; Kapczynski & Michaels, 2024). In the meantime, there is a marked renewal of interest in economic planning with a focus on the ecological issue (Adaman & Devine, 2017; Ban & Hasselbalch, 2024; Durand et al., 2024; Durand & Keucheyan, 2024; Groos & Sorg, 2025; Planning for Entropy, 2022; Sorg & Groos, 2024). However, the underlying epistemic conditions of this potential historical inflection remain largely underexplored.

This contribution aims to take stock of the implications of the ecological issue for the problem of knowledge and the possibilities of planning. It investigates Hayek’s theory weaknesses on environmental matters (section 2). Then, it examines the pervasiveness of a Hayekian framework in contemporaries’ attempts at green finance (section 3) and its contradictions (section 4). It subsequently explores the new epistemic conditions for planning in the digital age (section 5) and the permanence of the necessity to accommodate the fundamental

diversity and limitation of knowledge in any planning project (section 6). Finally, an institutional architecture for ecological planning is sketched in section 7, building on the institutional utopias method (Durand & Keucheyan, 2024).

2. Hayek ecological fallacy

With the hindsight of the intensification of planetary environmental disorders in the Anthropocene (Richardson et al., 2023) and the surge of their economic costs, for instance, due to climate change (Newman & Noy, 2023), the lack of consideration for the ecological issue in the dispute among economists about knowledge and its relation to the respective merits of market and planning is striking.

While this aspect was not heavily debated, Hayek, in his time, understood that the development of the conservationist movement threatened his core argument concerning the preeminence of dispersed knowledge and the adequacy of a market-individualist stance. He thus attempted to show that “there is no more justification in a free society for relieving the individuals of the responsibility for the future than there is for claiming that past generations ought to have made more provision for us than they did” (Hayek, 1960, p. 493).

This strong statement is fragile on several grounds, apparent throughout four crucial and somehow overlapping Hayek’s arguments (Table 1 in appendix).

The first lack of consistency with Hayek’s framing is that individuals cannot be considered properly responsible since they are not genuine subjects. The real subject is the market. The market is the true knowledge processor through which human action takes place. In this world of signals (Slobodian, 2018, Chapter 7), there is, as one may expect, no instance of collective agency. However, which is more surprising for a liberal thinker, there is no proper individual agency either. The truth-making process proceeds via negative feedback, which manifests in individual failures, whose rationale is mostly out of reach of individuals’ consciousness.

This cybernetic take implies that actors without meaningful agency, in Hayek’s framework, are in the meantime considered as responsible for ecological consequences of the activity, which seems inconsistent. Moreover, his emphasis on negative feedback suggests a self-stabilizing dynamic through sanctioning and eliminating inadequate behaviors. However, there is no reason to suppose that the timing of ecological destruction impact and the location of its manifestation would allow to sanction the behavior that caused them. Hayek acknowledged this problem of externalities. He noted that in those instances where “certain harmful effects [...cannot...] be confined to the owner of the property in question [...] we have to resort to the substitution of direct regulation by authority where the conditions for proper functioning of competition cannot be created”(Hayek, 1944, p. 105). There is debate concerning the importance of this concession among specialists. However, this admission reveals that externalities create a serious faultline for Hayek’s epistemic framework since it forces him to make absolute welfarist judgments, contradicting his position about the inaccessibility of economic knowledge (Benson, 2024).

Even more worryingly than this mismatch between market rewards and ecological responsibility, his emphasis on the stabilizing effects of negative feedback loops neglects the perverse dynamic that could arise from positive feedback loops where ecological disorders are self-reinforcing. Kenneth Arrow and his co-authors acknowledged the problem when assessing the economic dimension of the ecological problem, noting that « The biophysical

impacts associated with the loss of natural capital can be highly nonlinear: these impacts may be small over a considerable range, and then become immense once a critical threshold is reached. Crossing the threshold leads to a “bifurcation,” a situation where the characteristics of the natural system change fundamentally.” (Arrow et al., 2004, p. 168). Such positive feedback will eventually force ecosystems to flip or “bifurcate” from long-term stable conditions to unstable or radically new conditions. The literature on tipping points concerning the climate system (Lenton et al., 2019) and ecosystems (Dakos et al., 2019) indicates the likelihood of abrupt and irreversible shifts between alternative ecosystem states, potentially incurring huge societal costs.

In addition to the problem of his cybernetic perspective, a second problem concerns Hayek’s conception of nature and his objection to protecting any resource *per se* or natural resources in general. Resources are, in his view, not intrinsically distinguishable from any form of capital. Accordingly, their preservation is subject to a similar logic of investment. This view is at odds with ecological economists who have long argued that ultimately “natural resources represent the limitative factor”(Georgescu-Roegen, 1971, p. 21). Of course, some natural raw materials have been and will be substituted by capital thanks to increases in efficiency, yet this does not guarantee that this could last indefinitely as human society reaches some material efficiency boundaries. Even more straightforwardly, general natural endowments (clean air, fresh water, fertile lands, biodiversity...) that provide basic life support systems are almost certainly impossible to substitute by capital (Dietz & Neumayer, 2007).

In sum, the Hayekian argument regarding natural resources economic rests on two complementary elements. First, knowledge appears through the confrontation of private decisions on the market, economic punishments of inadequate private projects functioning as negative feedback impulses that guarantee the integrity of the veridiction process. Second, there is no specific *episteme* regarding natural resources, those being subject just as capital to the perpetual discovery process of the most advantageous possible uses that govern investment decisions.

It seems that Hayek was not completely comfortable with this crude theoretical argument. In his chapter dedicated to agriculture and natural resources in the *Constitution of Liberty*, he employs several formulations that undermine his general case. For once, he specifies that his reasoning against resource preservation holds “so long as society anticipates the exhaustion of particular resources” (Hayek, 1960, p. 497), raising the question of the conditions of this anticipation. Even more strikingly, he makes a candid statement about the supposed virtuous relation between the uses of exhaustible resources and economic progress, writing that « In a sense, of course, *most consumption of irreplaceable resources rests on an act of faith*. We are generally confident that, by the time the resource is exhausted, something new will have been discovered which will either satisfy the same need or at least compensate us for what we no longer have, so that we are, on the whole, as well off as before..” (Hayek, 1960, p. 493) (italics are ours).

To justify the epistemic optimism that supports such a gamble, he mobilizes two sub-arguments. The first is that expert knowledge regarding the availability of resources is generally incomplete, which implies that expertise supports a too pessimistic view regarding resource availability. In hindsight, the example he used to illustrate his argument sounds troubling: “Industrial development would have been greatly retarded if sixty or eighty years

ago the warning of the conservationists about the threatening exhaustion of the supply of coal had been heeded” (Hayek, 1960, p. 493). While his point is probably true, one cannot help but think that as a result, we would probably now have a less unsettled climate system. If experts could be too pessimistic, they could be too optimistic too and fail to identify polluting or destabilizing dynamics early on.

The second sub-argument is crucial for the rest of our discussion since it includes major concessions regarding the limits of dispersed knowledge. Hayek indeed explicitly accepts that « there are some facts concerning probable future developments which the government is more likely to know than most of the individual owners of natural resources” (Hayek, 1960, p. 494). He also notes, speaking about the peasantry, that since “most individuals do not even know that there is useful knowledge available and worth paying for, it will often be an advantageous investment for the community to bear some of the costs of spreading such knowledge”. Adding that “We all have an interest in our fellow citizens’ being put in a position to choose wisely” (Hayek, 1960, p. 489). Nonetheless, he insists 1) that the store of knowledge of special circumstances only known to individuals on the spot will always exceed the centralized expert knowledge and 2) that this knowledge can never be concentrated in any single authority while 3) it is always easier to disperse expert knowledge than to centralize dispersed knowledge (Hayek, 1960, p. 494).

The crucial objections have been raised by John O’Neill who writes that “there is good reason to assume that the dispersal of generic knowledge is as intractable as the centralisation of special knowledge” (O’Neill, 2012, p. 1084). In his view the key element is the tacit and practical dimension of knowledge that concerns as much everyday knowledge as expert knowledge. Scientific and technical knowledge rests on a wide set of tacit know-how and a large background body of practical knowledge that could only be gained via long and difficult training. This implies that there is a high likelihood that the distribution of a propositional expression coming from a specific field of expertise will not be helpful as persons outside the field do not have the capacity to understand it. As O’Neill insists, “Science itself relies upon a division of knowledge in which different specialists need to rely on the testimony of others. The attempt to resolve the problems of the division of scientific and expert knowledge in society by distributing it to individual market actors to use in their economic activities is, on Hayek’s own assumptions, open to the same objections as the centralisation of all knowledge to a single planning authority.” (O’Neill, 2012, p. 1084).

He also notes that even if it was possible to articulate the relevant facts in a propositional form, most people could understand, that « solution would in any case place informational burdens on market actors that they could not be rationally expected to bear” (O’Neill, 2012, p. 1084). It suffices to think about the endless revisions that would imply any individual attempt to incorporate consistently safety, social, and ecological criteria in one’s consumption decisions to understand why more traditional forms of public regulation, relying on centralized expert knowledge, plays such a prominent role.

Overall, the Hayekian argument on ecological issues rests on an “act of faith” according to which the risk of natural resources depletion or degradation could be overcome thanks to the substitution of capital or discovery of new resources, which is the reason why a significant positive discount rate should be applied to the investment decisions. A dismissal of the possibility of centrally planned relevant decision-making in those matters completes this optimistic outlook over future ecological prospects, even though his supposition that expert

knowledge could be more easily dispersed than the knowledge of special circumstances could be centralized does not rest on any strong basis.

3. The Hayekian Subconscious of Green Finance

The Hayekian perspective is crucial in framing the response of the financial community of regulators and investors to the intensification of ecological disorders in a way that do not require forms of public interventions such as direct regulation, cap and trade, taxes, credit policy, and planning.

Mark Carney's discourse about the tragedy of the horizon (2015) is a key moment in the articulation of this approach. First, when Carney clarifies that "the point is not that a reassessment of values is inherently unwelcome [...since...] capital should be allocated to reflect fundamentals, including externalities", he states his deep confidence in the process of capital allocation via financial markets. Then, he acknowledges that misperceptions regarding physical risk (the direct impact of climate and weather-related events, such as floods and storms that damage property or disrupt trade), liability risk (if some parties seek compensation from those they hold responsible), and transition risk (changes in policy, technology and physical risks that could prompt a reassessment of the value of a large range of assets) could lead to a sudden wholesale reassessment of prospects that "could potentially destabilise markets, spark a pro-cyclical crystallisation of losses and a persistent tightening of financial conditions".

This peculiar part of his discourse, where he acknowledges the shortsightedness of markets, attracted considerable attention around the headline "an abrupt resolution of the tragedy of horizons is in itself a financial stability risk." However, the sentence that follows immediately entails the paradigmatic proposal: "the more we invest with foresight; the less we will regret in hindsight", is not a praise for more public oversight over capital but for better markets.

This discourse and subsequent research that showed that Central banks' quantitative easing corporate bond purchasing programs were skewed toward high-carbon sectors (Matikainen et al., 2017) led to a tentative greening of some central bank policies, with the European Central Bank (ECB) at the forefront (Deyris, 2023). ECB's boldest move occurred in July 2022 when it announced that it decided "to account for climate change in its corporate bond purchases, collateral framework, disclosure requirements and risk management" (ECB, 2022). By favoring bonds from non-financial firms that have good climate scores, the ECB departed from the 'market neutrality' principle, the bank justifying its action by the "aim to reduce financial risk related to climate change on the Eurosystem balance sheet, encourage transparency, and support the green transition of the economy."

To guide its green decision-making process, the bank internally computes metrics factoring, for each company, past emissions, future emission targets, and the quality and transparency of emission disclosure (ECB, 2023). This internal rating process is based on publicly available data. Indeed, as noted by Eric Monnet, «the central bank has no competent staff for studying and choosing investment » (Monnet, 2024, p. 161). Since there is no green monetary policy without green assets, ECB green policymaking relies on private green expertise, just like other investors, which resulted in the bank contributing by its ignorance to some form of Green extractivism (Dafermos, 2023; Fornaroli, 2023).

In an in-depth study of climate finance, Bryant and Weber explain that « disclosure requirements aim to provide information to markets so that they can price risks and allocate capital accordingly” (Bryant & Webber, 2024, p. 43). In such a perspective, disclosure, with the development of sustainability labels and the improvement of accounting standards, aims at allowing the functioning of a Hayekian economic order based on “the Market as a super information processor [that] knows more than we could ever begin to devine” (Mirowski & Nik-Khah, 2017, p. 72)

4. Better capitalists?

“Save the planet. Be a better capitalist”, this slogan of the Swiss private bank Global Balance (Global Balance Bank, 2024) captures the spirit of investors that propose to leave “behind outdated business models that harm our planet and instead investing capital in the opportunities offered by future-oriented technologies”. As the bank states, “a ‘better capitalist’ thus participates in future topics such as renewable energies, electromobility, innovative materials, pioneering forms of nutrition, artificial intelligence and smart cities.”. The promise is that there is no painful trade-off between doing well and doing good since “These promising technologies not only offer attractive potential returns, but also contribute to ecological balance and improving the quality of life on our planet.”.

The rise of ESG funds at the turn of the 2020s, participated in this promise of a better capitalism, even if the enthusiasm has been somehow dashed since (Agnew et al., 2022; Schmitt & Temple-West, 2024). However, there's many a slip 'twixt cup and lip. In 2019, acknowledging the increasing investor interest in ESG factors, the IMF unambiguously observed the « lack of consistent methodologies and reporting standards » (IMF, 2019, Chapter 6): because corporate reporting is largely voluntary and since “there are concerns about the opaqueness of methodologies and informational materiality” of third-party providers, “measuring ESG effects remains challenging”.

Since then, there have been some progress towards increasing standardization. For instance, the IFRS foundation, the dominant actor defining private accounting standards, promoted its “integrated reporting” framework by stating that “Providers of financial capital are interested in the value an organization creates for itself. They are also interested in the value an organization creates for others” (Integrated Reporting, 2021, p. 16). Accordingly, “when these interactions, activities, and relationships [with other stakeholders and society at large] are material to the organization's ability to create value for itself, they are included in the integrated report”. While this implies an enlargement of accounting practices to sustainability issues, this approach focuses solely on financial materiality, i.e. it neglects to consider the impact of activities if they are not material to investors.

Contrastingly, ongoing changes in corporate sustainability reporting legislation in the European Union aim at providing a more robust disclosure framework (Hummel & Jobst, 2024). The Corporate Sustainability Reporting Directive (CSRD), which will be implemented from 2025 on, adopts the double materiality perspective, calling the firms to assess, on the one hand, the outside-in financial sustainability perspective, accounting for the financial consequences for investors of the social and ecological impact of the firms’ activities and, on the other hand, the inside-out materiality perspective concerning the impact of the company on people and the environment. Yet, it is too early to assess the consistency of the implementation of this framework.

Besides, the EU has deployed the Taxonomy regulation, which adopts an activity perspective rather than an entity perspective like the CSRD. This allows for a tighter technical supervision of what is effectively a sustainable activity. However, Hummel and Jobst remark that “although the clear definition of sustainability for economic activities provides guidance to companies and has the potential to limit greenwashing, this guidance becomes questionable in light of the power that lobbying has played in the regulatory development of the Taxonomy Regulation”(Hummel & Jobst, 2024, p. 334).

Turning to insiders’ testimonies invites to adopt a cautious stance vis-à-vis ESG investment. The affirmations of Tariq Fancy, Chief Investment Officer for Sustainable Investing at BlackRock from January 2018 to September 2019, are enlightening. He considers that Blackrock senior executives «must know that they’re exaggerating the degree of overlap between purpose and profit” and that they are “actively misleading people”. In his view, “Giving people the dumb idea that shifting their savings from one investment fund to another is going to help materially with, say, climate change creates a dangerous distraction from solutions that fit the scale of the problem, all of which involve changing the rules of capitalism through regulation”(Fancy, 2021).

Another interesting example is Desiree Flexler, who was hired by DWS, an Asset Manager at 80 % owned by Deutsche Bank, in June 2020 as Sustainability Officer. She discovered there “a big gap between their public ESG claims and the reality of their ESG efforts. (...) a number of their ESG statements in the Annual Report and other public releases were not only unsubstantiated but were seriously exaggerated, misleading, and just wrong.» (Eccles, 2023) Following her whistleblowing, the offices of the asset manager and the bank were raided by the police for alleged prospectus fraud while, in its 2021 annual report DWS reported 75 percent less ESG integrated assets than a year earlier (Miller & Walker, 2022), revealing the size of the exaggeration.

Though impressive those numbers are not uncommon. The authors of an empirical study on the US Green bond market from 2013 to 2022 (Lam & Wurgler, 2024) observed that «The rapid growth of green bond issuance would seem to be cause for optimism with respect to environmental challenges, but this growth may overstate the bond market’s real, functional response.”. Indeed, their research shows that “the vast majority of green bond proceeds is used for refinancing ordinary debt, continuing ongoing projects, or initiating projects without green aspects that are novel for the issuer. Only 2% of corporate and municipal green bond proceeds initiate projects with clearly novel green features.”. Conversely, 98% of the presumably green bonds do not offer distinct environmental benefits.

At the bottom of the disappointing outcome of the ESG frenzy there is a triple fallacy. The first, as noted by Tariq Fancy, is that there is no such a thing as doing well by doing good. Indeed, the very notion of greenium – access for companies to cheaper capital by proposing green asset - implies a disappointment from the investing side: “a low corporate cost of capital is nothing but a lower expected return. ESG investing *only* makes the world a better place by offering investors lower expected returns.”. And if ESG investing did provide higher returns there is no needs for ESG, since classic “profit-seeking investment managers would be doing all the work for us” (Fancy, 2021).

The second is a fallacy of composition. Empirically, there is such a thing as a greenium. At its peak in European market, in November 2022, it was as significant as almost 8 basis points (Bahra & Zhu, 2024). This means that brown investment generates a higher return than green

assets. At scale, greenium is thus self-defeating since it implies a tendential hegemony of the brown financial capital that is accumulating faster.

The third fallacy is that of the social responsibility of enterprise. Milton Friedman famously declared that “the doctrine of ‘social responsibility’ taken seriously would extend the scope of the political mechanism to every human activity. (...) in a free society ‘there is one and only one social responsibility of business—to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud’.” (Friedman, 1970). The primacy of profit and the necessity of political mechanisms to enforce other values in the social realm is a profound capitalist truth that could be spelled in numerous more apologetic or critical ways. For instance, William Kapp makes the same observation when he notes that “the basic causes of social costs are to be found in the fact that the pursuit of private gain places a premium on the minimization of the private costs of current production. Therefore, the greater the reliance on private incentive, the greater the probability of social costs.” (Kapp, 1950, p. 14). Martin Wolf, from the *Financial Times* retakes the same argument when he affirms that «while it is possible to prevent businesses from doing profitable things, it is impossible to make them do things they consider insufficiently profitable» (Wolf, 2021).

This problem with profit is the crux of underinvestment in green assets. Even when costs are dramatically decreasing, as in the case of renewable energy generation, there is no such thing as a green investment rush. But looking at the profit rather than at the cost side of the problem illuminates the puzzle. Brett Christophers thus asks rhetorically: “why, unless externally forced, would the electricity industry accept, let alone actively embrace, a highly disruptive transition that lowered production costs but saw little, if any, of the resulting efficiency gains accruing to industry actors? » (Christophers, 2024, p. 119) And indeed, they are not embracing this transformation. In a February 2023 earning call that he quotes, Shell CEO is straightforward about why: “I think on low carbon, let me be, I think, categorical in this. We will drive for strong returns in any business we go into. We cannot justify going for a low return. Our shareholders deserve to see us going after strong returns. If we cannot achieve the double-digit returns in a business, we need to question very hard whether we should continue in that business. Absolutely, we want to continue to go for lower and lower and lower carbon, but it has to be profitable” (2024, p. 166).

Beyond the pervasiveness of greenwashing and the difficulties in implementing adequate disclosure requirements, the deeper problem concerns the possibility of relying on private incentives, i.e. the responsibility of the corporation and the drive of the profit motive, to achieve an allocation of capital consistent with social and ecological goals. The fallacies of the attempt at greening finance via ESG investing illustrate the more fundamental limits of Hayekian conception of the market and profit incentives as an adequate processor of information capable of generating and conveying relevant knowledge to engage the actions required to address pressing social and ecological issues. As acknowledged by Milton Friedman, this requires “to extend the scope of the political mechanism”.

5. The conditions of planning in the digital age

The Hayekian approach of the problem of knowledge was not the sole to engage with the epistemological and informational challenges to planning. Charles Bettelheim, who contributed to planning debates in the post-WWII period both as a theoretician and an advisor of several governments of socialist and newly independent countries (Denord & Zunigo, 2005), was perfectly lucid over the difficulties of the task. Drawing on Balibar's insights concerning the distinction between economic property and possession (1965, pp. 436–453), Bettelheim put the necessity to move beyond juridical formalism at the core of his framing of the knowledge problem: planning capabilities depend on the existence of an economic subject, i.e. the effective capacity to deploy economic property relations – i.e. to control and allocate the product and the economic surplus – and possession relations – i.e. to shape and coordinate the labor process (Bettelheim, 1975a).

More specifically, Bettelheim adopts a historical perspective on the knowledge problem where the possibilities of planning are partly conditioned by the socio-technic development of each time: "The size of the economic subjects, their internal organization and their external links appear to be partly subject to the techniques of collecting, codifying, transmitting, assembling and interpreting information (...). This implies that the advances made in the sphere of information techniques may have considerable practical consequences affecting the size of the real economic subjects" (1975b, p. 82).

In other words, whereas the Austrians see the cognitive features of human nature as the main reason for which attempts at economic planning are flawed, Bettelheim locates the limits of planning in its time and space, depending on the ongoing socialization of productive forces. Bettelheim's theory accounts better than Hayek's for the contingency of the limits of planning. It gives room to acknowledge that the dramatic expansion of digital planning devices in the corporate world allows the coordination of a much more dense, geographically extended, and responsive web of labor processes (Bensussan et al., 2023; Durand & Keucheyan, 2019; Mandel, 1986) which entails new central planning possibilities.

Changes in calculation capabilities have led Jack Ma, the co-founder of Alibaba Group, to affirm that "big data will make the market smarter and make it possible to plan and predict market forces so as to allow us to finally achieve a planned economy" (Global Times, 2017). Side-lining with him, defenders of computerized planning considered that «Given the resources available to the Chinese computing industries, the objectives set by Mr Ma are indeed technically feasible"(Cockshott, 2019, p. 314), i.e. it is possible to maximize the fulfillment of a plan target. On the opposite side, Austrian scholars depart from Jack Ma and reassess the Hayekian argument that "The knowledge of the market is not dispersed as bits and pieces throughout the economy that must be collected and computed to guarantee the efficient allocation of resources. Rather, the "intellectual division of labor" and the "division of knowledge" in society is contextual, embedded only within a division of exchangeable private property."(Boettke & Candela, 2023, p. 53). In their view, socialist planning is unfeasible in principle, not just in practice. The development of information forces is not relevant here.

This repetition of the interwar socialist calculation debate *in redux* does not render justice to a possible path forward. Acknowledging, with Bettelheim, the implications of the dramatic historical shifts that occurred in information forces and their implication for the knowledge problem while accepting, with the Austrians, what Otto Neurath alluded as "the 'illusion of complete knowledge'"(O'Neill & Uebel, 2015, p. 61) is not enough to make a convincing case

in favor of macroeconomic planning or to dismiss it altogether. Increasing computational power and data analytical capabilities changes the conditions of planning but, as Silvia Rief argues, it does not suffice to resolve the issue: "Data analytics by itself, if divorced from the reorganisation of economic institutions and from a critical analysis of techno-scientific objectification and commodification, does not automatically equal a socialist or emancipatory project." (Rief, 2023, p. 294). We thus have now to turn to those problems of institutional reorganisation.

6. Diversity and limits of knowledge delineate the frontiers of planning

Rief's Polanyan point rests on a double-layered argument regarding knowledge for planning (Rief, 2023, p. 290). The first is the incommensurable plurality of elements that must be considered: human needs, the hardship of labour, means of production but also technologies, ecological interactions... This plurality is why a multicriteria decision-making process is necessary to allow for a judgment in value about the economic system's direction. This judgment can't be reduced to the formal rationality of a maximizing calculation and requires a kind of substantive rationality that, according to Max Weber, favors ethical action in the world (Kalberg, 1980, p. 1165; Löwy, 2013, p. 19). Regarding more specifically the ecological issues, William Kapp explains that "the formulation of environmental policies, the evaluation of environmental goals and the establishment of priorities require a substantive economic calculus in terms of social use values (politically evaluated) for which the formal calculus in monetary exchange values fails to provide a real measure (Kapp, 2020, p. 38). A multicriteria decision-making process that allows for the expression of substantively rational judgments in value is thus a first condition of planning.

The second layer rests on the distinction made by Polanyi between the external and the internal methods of overviewing those elements. The external overview is achieved thanks to statistics, bureaucratic means, science, and technologies, including the digital information forces that magnify all of them. Those external methods are crucial to understanding the world we live in, and some even argue that they could open "an age of progress" to the extent that, thanks to those social capabilities, a "species consciousness is emerging, in particular one of environmental challenges but also of human rights and human potential." (Therborn, 2016) However, those external methods neither exhaustively express nature nor the personal perspective of a meaningful life.

This issue is crucial in Kohei Saito understanding of the ecological degradation's dynamics: "No matter how much productive forces and technologies develop, (...), it is impossible to continue suppressing the qualitative side of the natural world. Its non-identity explodes in periods of crisis." (Saitō, 2022, p. 96). This non-identity of nature vis-vis human external knowledge means that planning capabilities will always be overwhelmed by the natural world's complexity.

Similarly, for Polanyi, the tools of external overview cannot render the internal overview, i.e. "the knowledge of inner processes, emotional and mental states such as moods and sentiments, experiences of harm inflicted by work, the directions and intensity of needs, the motivations for these and the degree to which they have been satisfied" (Rief, 2023, p. 290).

What is important is that those subjective elements of the economic process cannot be captured by data alone but demand understanding and empathy. However, as Rief recounts,

Polanyi considers that the internal overview is not inaccessible to the planning process; it requires bottom-up self-organization such as labour unions, cooperatives or socialist commune. In Polanyi's words, "the more participatory, the more exact the overview would be" (Rief, 2023, p. 290).

A third layer deals with the power dynamics in planning devices' deployment. Indeed, industrial policy, in general, and ecological planning, *a fortiori*, call for more bureaucratic expertise and authority over production. Such administrative discretion's reinforcement and the potential generation of subsequent sectoral private sector power is a crucial problem. From a Law and Political Economy perspective, scholars advance that "under any adequate conception of democracy, industrial policy must expressly seek to build *administrative* power and build *countervailing* power. Administrative power is the government's technical and legal ability to effectively implement broadly shared public interests. Countervailing power is the organized capacity of structurally disadvantaged groups to exercise collective influence" (Kapczynski & Michaels, 2024, pp. 283–284). In this approach inspired by John Dewey's notion of *public* power, administrative power and countervailing power are "in productive tension with one another" to the realization of "the power of the people, through and beyond government, to meet their collective aims". (2024, p. 284).

The epistemological implications of those arguments concerning the external and the internal overview are crucial for ecological planning in the Anthropocene. They point to a profound contradiction. On the one hand, the reification tendencies of capital are not confined to the realm of commodity fetishism but, as Lukacs enlightened, are also present in the bureaucratic and scientific methods and in technologies (Lukàcs, 1960). They affect both nature and the very possibility of a meaningful life. On the other hand, those knowledge forces are the only path forward for a collective human agency at the macro, if not species level, to attempt to regain control and stabilize the socio-economic metabolism. These informational tools are indispensable for the kind of "substantive economic calculus in terms of social use values" that ecological planning requires.

Polanyi partially resolves the contradiction concerning the integrity of the subject by emphasizing the virtues of participation, which constitutes the first epistemic boundary of the planning process. This line of thinking is consistent with legal scholars' warning that an informed and empowered state must also be democratically responsive.

The second boundary concerns the limits of our knowledge of nature; it calls for a conservative logic of self-limitation of the ecological plan, aiming to stabilize long-observed natural cycles by preservation rather than intervention. The tensions at stake are real, but they do not invalidate the planning project: they call for astute institutional design addressing them.

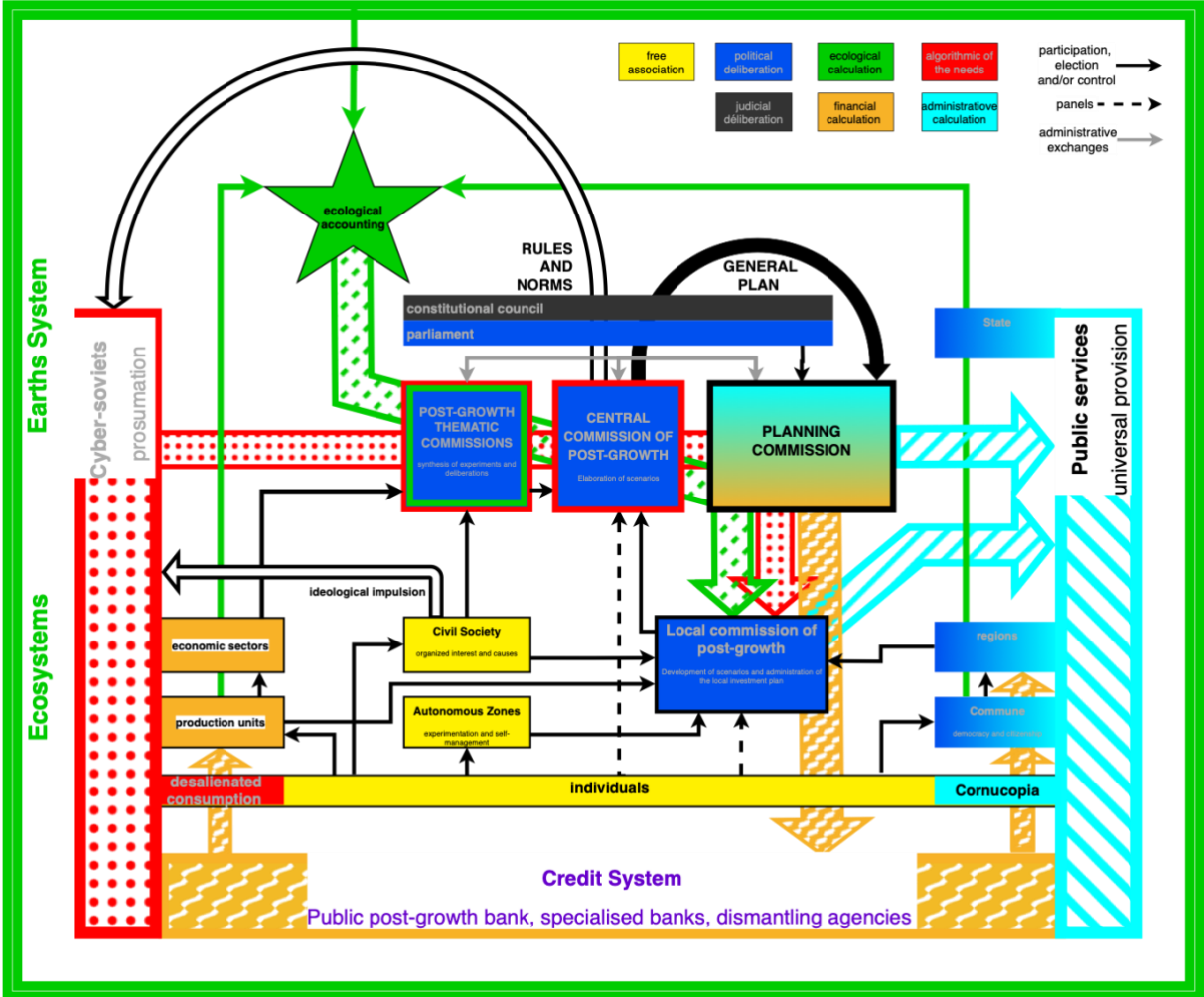
7. The architecture for ecological planning: an outline

The model outlined in this section attempts to articulate the contemporary technological possibilities of planning with the countervailing forces required to accommodate the boundaries related to the non-identity of nature, the protection of individual subjectivities, and the democratic checks and balances both concerning the expression of the needs and the deployment of the plan.

It proposes to project the realist stance toward social change advanced by Erik Olin Wright’s Real Utopias (Wright, 2013) at the macro-social level where ecological planning takes place. The ensuing institutional utopias’ approach to ecological planning’s institutional design is conceived as an innovative redeployment of prevailing or historically existing institutions (Durand & Keucheyan, 2024). The model is thus neither a ready-made programmatic roadmap nor a purely speculative thought experiment but a mid-range creative policy-making exercise to advance the case for ecological planning at the level of applied general principles. It aims to concretize the idea of economic democracy within ecological limits (Durand et al., 2024).

Figure 1 summarizes the architecture of the proposed planning model. The various elements and their links are briefly explained in the following sub-sections, which set out the principle of informed politicization of the investment function, the democratic federalist structure, and the four epistemic logics at stake¹.

Figure 1 : Structuring and articulating the logics of ecological planning



¹ A more detailed description of those institutions and the historical and contemporary experiences backing them are exposed in *Comment bifurquer* (Durand & Keucheyan, 2024).

7.1. An informed politicization of the investment function

The basic principle of economic planning is an informed politicization of the economy. Planning is a process of substantial choice involving judgments that can't be reduced to the formal rationality of optimization. As Michel Husson explains, "The efficiency problem of a planned economy is (...) directly political. (...) the priorities society sets for itself are determined extra-economically, and are imposed as objectives on the laws of economic technique." (Husson, 1991). This echoes Vassily Leontieff remarking that "The very idea of planning implies the possibility of choosing between several possible scenarios" and added that "feasibility is the key concept" (1976, p. 7), referring to the matrix of productive possibilities in a given situation. This tension between the technical side and the political side of the economy is at the core of the process of planning implying, in the words of Otto Neurath, a « continual struggle between the expert . . . and the common man" (O'Neill, 2012, p. 1088).

The politicization of the economy is thus not a disembodied form of voluntarism but, on the contrary, it is grounded on a multicriteria political deliberation process enabling a given community to set priorities and define the main parameters for the long-term evolution of its material civilization. This is a social process relying on human judgment, thus irreducible to computerizable calculation (Weizenbaum, 1976), but informed by diverse kinds of knowledge and logic of action (ecological, algorithmic, administrative, and financial cf below 7.3) above and before the monetary one-dimensionality of the realm of market exchange.

The most salient aspect of this politicization of the economy concerns the socialization of the investment function (Benanav, 2022; Crotty, 2019a, 2019b; Husson, 1991). As Husson stresses, in capitalism "an eminently social function, that of knowing towards which priorities society turns its efforts, is thus exercised by private entities. Planning appears essentially as a means of socializing investment" (Husson, 1991, p. 107). Accordingly, ecological planning's institutional design aims to provide a framework to assume the investment function, including dismantling polluting activities (Bonnet et al., 2021), to satisfy human needs while keeping the socioeconomic metabolism within planetary boundaries (Richardson et al., 2023)².

7.2. A federalist democratic structure

The *Federalist principle* poses that what can be managed at the lowest level is managed at the lowest level. Still, centralization is necessary to gather knowledge to deal with problems manifest only at the macro level and to arbitrate allocation conflicts. The model is organized around a central post-growth apparatus comprising thematic commissions, a central post-growth commission, and a commission responsible for plan implementation. The latter,

² The metaphor of "limits" is a powerful rhetorical tool to break with the idea that natural capacities can be infinitely exploited and substituted. Nonetheless, it should be used cautiously (Althouse 2022, 144–48). There is no such a thing as a clear-cut threshold between sustainability and collapse, but multiple and multidimensional interrelated thresholds (Norgaard 1995, 130). This indicates that the limits cannot be objectively defined: while "thresholds in key Earth System processes exist irrespective of peoples' preferences, values, or compromises based on political and socioeconomic feasibility", "normative judgments influence the definition and position of planetary boundaries" (Rockström et al. 2009, 5).

placed under parliamentary control, is the real headquarters of the plan, the administrative apparatus in charge of providing the elements needed to prepare the plans and to implement the choices resulting from the deliberations of the post-growth commissions.

In a federative spirit, the local post-growth commissions are one of the key forums for drawing up the plan; via their representation in the central post-growth commission, they contribute to the choices made at the central level in preparing the scenarios proposed for the following plan.

7.2.1. The plan's central institutions

The planning process is led by political entities (in blue). Carried out by post-growth commissions (local, thematic, and central), it has its proper administrative apparatus (the Planning Commission), whose autonomy from the rest of the state apparatus is only relative. Parliament and local authorities retain validation power, while constitutional control ensures the institutional robustness of the edifice.

The thematic commissions and the central post-growth commission are made up of representatives from civil society, economic sectors, regions, local commissions and panels of citizens such as the *Assemblée Citoyenne pour le climat* convened by French President in the aftermath of the yellow vests uprising (Pech, 2021) (black arrows). The members of these commissions conduct a deliberative process and formulate judgments concerning the environment and the means of satisfying needs that take the form of scenarios.

Controlled by the parliament, the Planning Commission is the administrative headquarters of ecological planning. It provides the formal elements required for deliberation (information, modeling) (gray arrows from each different logic). It is also responsible for implementing the plan and, in conjunction with the central post-growth commission, continuously adapting it to changing circumstances.

The Postgrowth Central Commission presents the scenarios at the national level to the Parliament. Parliament then decides between the various options and, if necessary, amends them. The chosen plan is then subject to a constitutionality review, to ensure that its environmental impact is consistent with the ecological foundation of the political order.

7.2.2. Local institutions of the plan

Following a federal (and fractal) logic (Durand et al., 2024), the local post-growth commissions reproduce within themselves the central planning structure (thematic and central post-growth commissions, and planning commission - elements not represented so as not to overload the figure) with political control and validation by the regional authorities. Their work draws on experiments carried out in autonomous zones, rests on the participation of local stakeholders (producers and civil society), and mobilizes a wide array of democratic procedures, including panels and referendum for direct decision-making.

While local institutions must accommodate the constraints delineated at the central level, in most dimensions, local plans are highly distinctive because they have to define original, context-specific solutions to contribute to the major objectives set at the central level. Such a feature is already a characteristic of Chinese federalism (Heilmann & Melton, 2013; Xu, 2011). This heterogeneity is a feature that favors institutional and cultural diversity and incentivizes innovation.

7.2.3. The efficacy of the plan

The plan includes sectoral and geographical qualitative objectives in kind (targets) concerning the needs to be met and the preservation of the environment. They are deployed mainly through three channels. Rules and standards define the regulatory space for consumption markets (double arrow), adopted by Parliament on the proposal of the central Planning Commission. The central and local Planning Commissions use two other levers to steer the investment function: the deployment of public services and the credit system.

On top of the plan, Cybersoviets' prosumation (7.3) allows for a direct collective engagement of consumers on the characteristic of production processes to improve and finetuned market outcomes within the plan. Indeed, steering socially the investment function in the course of the elaboration of the plan is not sufficient to democratize the economy. Day-to-day operations should allow for closing the gap that market exchange digs between consumption and production. Indeed: "Men don't just speak on one day, the day of elaboration [of the plan]. Tomorrow must also have its language. But the Market has very few words. It's not so much a question of eliminating it as replacing it with a richer, more faithful mode of expression." (Lorenzi, 1975). Along with existing institutions such as consumers' associations and community-supported agriculture provisioning circuits, certain currently alienating forms of social e-commerce could contribute to a microeconomic democratic complement to the planning process (Xintian & Xiangdong, 2019).

7.3. Four epistemic logics

Four distinctive epistemic logics inform the deliberative decision-making process that animates the socialization of the investment function.

7.3.1. Ecological calculation (natural sciences and ecological accounting)

Ecological accounting and modeling techniques that integrate environmental and socioeconomic data are indispensable to any form of meaningful ecological planning since, without those elements, it is impossible to place the evolution of local and global ecological conditions at the core of planning deliberations. Environmental awareness of the planning process requires thus a specific mediation to account for the socioeconomic metabolism, i.e. to channel the contributions from the natural sciences and a system of ecological accounting (green star) to produce systematic, integrated information on ecosystems and natural cycles. Not only are eco-systems and the earth system scrutinized, but the ecological accounts of economic entities, administrations, and information systems are kept and fed into the plan's bodies (green dashed arrow). Such a permanent (but always incomplete) inventory of nature (Vanoli, 2019) should articulate multiscalar data, from local ecosystems to the earth system. This info should thus be incorporated in modeling to formulate scenarios and manage the plan's implementation. Current research articulating integrated assessment and input/output analysis (Jacques et al., 2023; Lefèvre, 2023) provides a methodological basis to estimate the consequences of decisions regarding investment and consumption standards on the environment.

7.3.2. Algorithmic calculation of needs (cybersoviets)

In addition to this ecological calculation, the planning deliberative process is informed by an algorithmic calculation of needs. The omnipresence of information systems and their growing integration leave digital traces, the processing of which (in red) provides detailed, real-time information on the evolution of consumer behavior. In our capitalist societies, this information is monopolized by the big e-commerce companies and, to a lesser extent, the big industrialists (Durand, 2024; Rikap, 2022). Yet this information is essential for understanding consumption practices and their determinants, particularly concerning their tacit and/or unconscious component, which are not articulable through deliberative processes but contribute to social regularities (Bensussan, 2022, 2023).

By scrutinizing the interactions between producers and consumers (expert consumers, feedback systems, specialized communities, purchasing data...) planning bodies get access to a crucial source of understanding innovation dynamics and societal trends. This information is essential to enable post-growth commissions to deliberate on needs and how to make them evolve in the context of reducing the material footprint (red dotted arrow).

7.3.3. Administrative calculation (utilities)

Public services (in light blue) are one of the pillars of the plan's deployment. They are organized according to a logic of efficacy (goal to be achieved) and not efficiency (economy of means) (Johnson, 1982) and by a principle of universality.

Organized at national or local level (hatched turquoise arrow), they are backed by the State and local authorities. They provide individuals with access to services and goods that may be free or at non-market prices: canteens, health, education, housing, telecommunications, water, transport, etc. The perimeter varies according to time and place, but it is a space where the administratively organized will of a community enables its members to enjoy the freedom offered by a form of abundance, even if this cornucopian sphere is circumscribed.

Insofar as their social *raison d'être* distances them from the logic of the market, public enterprises and social economy organizations are at the frontier of the logic of public services. They can thus relay and extend this planning channel.

7.3.4. Financial calculation (credit for investment and dismantling)

Financial calculation (orange) conveys the allocation of investment and disinvestment effort to achieve the plan's objectives. Credit policy that provides qualitative guidance for modifying the economy's structure is a robust policy tool widely mobilized in post-war rebuilding and developmental contexts (Amsden, 1992; Monnet, 2018).

Credit policy is deployed at the national and local levels (orange zigzag arrow) through a public post-growth bank (capable of covering the costs of dismantling harmful activities) and sector-specific banks.

Preferential rates, credit volume, public guarantees, and popular savings are some of the instruments mobilized, with the constraint of preserving the integrity of the monetary system (moderate inflation) and a low degree of flexibility in the financial system to ensure its robustness (financial repression). The principle of financial viability of productive organizations - the possibility of bankruptcy - is preserved as one of the elements in the regeneration of the productive structure. The same applies to entrepreneurship: productive projects can be submitted to the various financing institutions and obtain credit if they comply with the orientations of the plan (national and local) and are deemed economically viable.

Yet, for the socialization of investment to be effective, private discretion of the economic surplus should be strictly limited, which implies a progressive and at a certain level confiscatory level of corporate taxation.

8. Conclusion

This contribution has argued that widespread acceptance of Hayek's arguments over the impossibility of central planning needs to be revised in the context of the Anthropocene. The weaknesses of this framework in dealing with environmental issues is not a purely theoretical debate since it informs a large array of public and private initiatives under the label of green finance. We have documented their concrete failures and the deeper logical fallacies that undermine them.

In this context, the possibility of planning should be reassessed. Contra Hayek, we have mobilized Charles Bettelheim's historical perspective that conditions the concrete possibilities of planning, depending on the development of information forces. In the meantime, we have rejected that calculability was the sole limiting factor, insisting on the epistemic and political-administrative constraints related to the non-identity of nature, the importance of the Polanyan internal overview, and the need for strong democratic countervailing forces.

Acknowledging this constrained space of possibility, we have proposed an outline of the institutional architecture of ecological planning, mostly based on the premise of the recombination of already existing institutional pieces.

Considering the relative regain of interest for planning issues and the immediate challenges for the destiny of our species that our generation must face, this piece attempted to lay the ground for a solid epistemic basis in favor of radical institutional change. We hope that engaging those fundamental theoretical obstacles can be instrumental to an ambitious socioecological reformist agenda.

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Appendix

Table 1. Limits of Hayek's arguments about ecology and knowledge

ARGUMENT	PRINCIPLE	LIMITS
CYBERNETIC PRODUCTION OF KNOWLEDGE	Cybernetic production of knowledge through collective learning by failure (negative feedback)	No proper human agency and neglect of perverse destabilizing dynamic (positive feedback)
	<p>“the price mechanism operates as a medium of communicating knowledge which brings it about that the facts which become known to some, through the effects of their actions on prices, are made to influence the decision of others.” (1998b, p. 125).</p> <p>“The process of adaptation operates, as do the adjustments of any self-organizing system, by what cybernetics has taught us to call negative feedback”(1998b, p. 125).</p> <p>“in the market it is through the systematic disappointment of some expectations that on the whole expectations are as effectively met as they are” (1998a, p. 104).</p> <p>“The whole system rests on providing inducements for all to use their skill to find out particular circumstances in order to anticipate impending changes as accurately as possible. This incentive would be removed if each decision did not carry the risk of loss, or if an authority had to decide whether a particular error in anticipation was excusable or not.” (1998b, p. 125).</p>	
NATURE AS ANY CAPITAL	Nature is reduced to natural resources who are equated to any capital	Nature is not substitutable but complementary to human made assets
	<p>“any natural resource represents just one item of our total endowment of exhaustible resources, and our problem is not to preserve this stock in any particular form, but always to maintain it in a form that will make the most desirable contribution to total income.”(1960, p. 496).</p> <p>“if one kind of resource becomes scarcer, the products depending on it will also be more scarce in the future. The foreseeable rise in the prices of products consequent upon the growing scarcity of a natural resource will indeed be one of the factors determining the amount of investment that will go to preserving this kind of resource » (1960, p. 496).</p> <p>“all resource conservation constitutes investment and should be judged by precisely the same criteria as all other investment. There is nothing in the preservation of natural resources as such which makes it a more desirable object of investment than man-made equipment or human capacities; and, so long as society anticipates the exhaustion of particular resources and channels its investment in such a manner that its aggregate income is made as great as the funds available for investment can make it, there is no further economic case for preserving any one kind of resource.”(1960, p. 497).</p>	
EPISTEMIC ECOLOGICAL OPTIMISM	Epistemic optimism regarding resources expanding availability or substitutive innovation	Past development does not guarantee that collective cautiousness is not necessary

“most consumption of irreplaceable resources rests on an act of faith. We are generally confident that, by the time the resource is exhausted, something new will have been discovered which will either satisfy the same need or at least compensate us for what we no longer have, so that we are, on the whole, as well off as before. We are constantly using up resources on the basis of the mere probability that our knowledge of available resources will increase indefinitely—and this knowledge does increase in part because we are using up what is available at such a fast rate. Indeed, if we are to make full use of the available resources, we must act on the assumption that it will continue to increase, even if some of our particular expectations are bound to be disappointed. Industrial development would have been greatly retarded if sixty or eighty years ago the warning of the conservationists about the threatening exhaustion of the supply of coal had been heeded; and the internal combustion engine would never have revolutionized transport if its use had been limited to the then known supplies of oil (during the first few decades of the era of the automobile and the airplane the known resources of oil at the current rate of use would have been exhausted in ten years). Though it is important that on all these matters the opinion of the experts about the physical facts should be heard, the result in most instances would have been very detrimental if they had had the power to enforce their views on policy”. (1960, p. 493).

**ASYMMETRY BETWEEN
DISPERSED AND
CENTRALIZED
KNOWLEDGE**

Some knowledge is detained centrally and there are social benefits to its distribution, but there is always more dispersed knowledge and dispersion is more effective than centralization

While complete central knowledge is inaccessible institutional instances of centralization allow for the generation and mobilization of knowledge unavailable to individuals and contribute to alleviate their cognitive burden

« there are some facts concerning probable future developments which the government is more likely to know than most of the individual owners of natural resources” (1960, p. 494).

“There will always exist, however, an even greater store of knowledge of special circumstances (...) which only the individual owners will possess and which can never be concentrated within a single authority.” (1960, p. 494).

“while it is possible to communicate to the owners of particular resources the more general considerations that they ought to take into account, it is not possible for authority to learn all the different facts known to the individuals.” (1960, p. 494).
