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DECARBONIZATION AND INDUSTRIAL POLICY: CHALLENGES FOR BRAZIL

Policy Brief DIP-BR 02/2025

Industrial policy essentials in the face of contemporary development challenges

João Carlos Ferraz

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About the Project DIP-BR

"Decarbonization and Industrial Policy: Challenges for Brazil" (DIP-BR) is a policy-oriented research-action project aimed at influencing public debate on industrial, innovation, and trade policies in Brazil and selected Latin American countries that promote decarbonization and energy transition in the region. The initiative seeks to inform and induce efficacy, efficiency, effectiveness, and innovativeness in policy design and implementation. The methodology encompasses critical benchmarking analyses of past and present policy experiences from an international comparative perspective, regional trade studies, and economic analyses of productive sectors and chains, combining structural analysis of traditional production, employment, and trade statistics and simulation models of sectoral impacts using input-output approach.

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Industrial policy essentials in the face of contemporary development challenges

ABSTRACT

This policy brief compiles and discusses four essential industrial policy themes, quite often under considered by policy practitioners and analysts: the diverse and relatively newness of current development challenges; the need to recognize that place, sector and time matters; the strategic importance of unveiling the constituting elements of State capabilities, and the political economy dimension of industrial policies.

It is argued that current development challenges (not to mention long-standing ones) are unique to our epoch, diverse and increasingly complex. These challenges imply not only economic uncertainties but also policy-related uncertainties as well. In face of that, what development challenges are a country's State institutions aware of and ready to address? This policy brief argues that industrial policies must go beyond common wisdoms or generic policy prescriptions. Essentially industrial policies should be designed aimed at and address moving targets because development challenges are specific to locations, sectors, technologies, and moments in time.

In this context, from an evolutionary and resource-based perspective of the State, the policy brief assesses the urgent need to unveil, understand, and organize the essential constituting elements of public organisations´ capabilities, to increase the chances of effective industrial policies. The political economy of industrial policies is also brought to light in two respects: (i) within a country, as resources are finite, industrial policies often benefit some and leave others relatively "unsheltered;" and (ii) among countries, industrial policies are instruments of national interest in the hope of better placing firms and sectors in the international competitive theatre. Ultimately, politics dictates industrial policies, and this dimension cannot be understated.

KEYWORDS

Industrial policy. Political economy. State capabilities, Development challenges, Decarbonisation.

Fundamentos da política industrial face aos desafios contemporâneos do desenvolvimento

RESUMO

Este documento de política compila e discute quatro temas essenciais de política industrial, muitas vezes subestimados por profissionais e analistas de políticas: a diversidade e relativamente nova dos atuais desafios de desenvolvimento; a necessidade de reconhecer que o lugar, o setor e o tempo são importantes; a importância estratégica de desvelar os elementos constitutivos das capacidades do Estado e a dimensão de economia política das políticas industriais.

Argumenta-se que os desafios atuais de desenvolvimento (para não mencionar os de longa data) são exclusivos de nossa época, diversos e cada vez mais complexos. Esses desafios implicam não apenas incertezas econômicas, mas também incertezas relacionadas a políticas. Diante disso, quais desafios de desenvolvimento as instituições estatais de um país estão cientes e prontas para enfrentar? Este documento de política argumenta que as políticas industriais devem ir além dos entendimentos comuns ou prescrições políticas genéricas. Essencialmente, as políticas industriais devem ser projetadas visando e abordando alvos móveis, porque os desafios de desenvolvimento são específicos para locais, setores, tecnologias e momentos no tempo.

Nesse contexto, a partir de uma perspectiva evolutiva e baseada em recursos do Estado, se avalia a necessidade urgente de desvelar, compreender e organizar os elementos constituintes essenciais das capacidades das organizações públicas, para aumentar as chances de políticas industriais eficazes. A economia política das políticas industriais também é trazida à luz em dois aspectos: (i) dentro de um país, como os recursos são finitos, as políticas industriais muitas vezes beneficiam alguns e deixam outros relativamente "desprotegidos"; e (ii) entre os países, as políticas industriais são instrumentos de interesse nacional na esperança de melhor colocar empresas e setores no teatro competitivo internacional. Em última análise, a política dita as políticas industriais, e essa dimensão não pode ser subestimada.

PALAVRAS-CHAVE

Política Industrial. Capacidades Estatais. Economia Política. Desafios do Desenvolvimento. Descarbonização.

SUMÁRIO

Industrial policy essentials in the face of contemporary development challenges

1. Industrial policies: why now?

Industrial policies are gaining momentum. Everywhere, countries are declaring explicit commitment to industrial policies, regardless of the political orientation of different government administrations. Some policies are based on global challenges such as the Covid-19 pandemic or emerging threats from climate change. Still, most are responsive to increased international competition, conflicts between nations and the adaptation to potentially disruptive technologies. In most policy initiatives, if not all, the defence of national interests comes into high prominence. Currently, while countries with complex industrial settings and capabilities and higher levels of resources are actively mobilising industrial policy instruments of intervention, each with its own particularities, to foster local industries, those nations with lower levels of industrial development and capacity to mobilize resources will be placed in a hopeless back position in the on-going industrial policy race. In this sense, the South Africa T20 recommendations to the 2025 G20 meeting are an open call, with specific industrial policy solutions, for a substantial widening of opportunities for countries to engage in development opportunities (T20, 2025).

Following State activism, the intellectual debate over industrial policies gains substantive traction. From those associated with actions limited to market failures, to those asserting the need of a more interventionist approach, or, from specialists on specific themes, such as energy and environment and, in specific national countries such as China, different schools of economic thought and reasoning are arguing for (more or less proactive) industrial policies.

Given the actuality of the subject and relying on recent work by Peres *et al* (2024) and Ferraz *et al* (2024), this policy brief complies and discusses four essential industrial policy themes, quite often under considered by policy practitioners and analysts: the diverse and relatively newness of current development challenges; the need to recognize that place and time matters; the strategic importance of unveiling the constituting elements of State capabilities, and the political economy dimension of industrial policies.

2. For whom the bell tolls? Or... are bells tuned to development challenges?

The evolving debate about industrial policy in the face of complex development challenges

For quite some time, the industrial policy debate was centred on what these policies were aimed at and, consequently, how they were to be designed and implemented. Interestingly, with notable exceptions such as Block (2008), the focus of attention was on developing economies, while the widely disseminated policy practices of those considered advanced nations were disregarded, as evidenced by Juhász, Lane, and Rodrik (2022). Regarding developing economies, the debate was most frequently reduced to a simplistically stylized comparison of two development modes: import substitution and export-oriented strategies (largely associated with Latin American and East Asia, respectively). In such a context, a primarily ideological bias (in Schumpeter's (1949) sense) has played a significant role in authors' interpretations on the validity of one or another style of State actions (besides the collation of the empirical evidence that best served each one's arguments).

Notwithstanding, long-standing industrial-related societal development challenges have remained firmly in place (diverging productivity levels, structural heterogeneity) while others, new ones have emerged (climate change is the outstanding example). It is very welcome that in recent years, at the policy practice and argumentative levels, efforts have been made to move away from reductionist approaches (export *versus* inward development, vertical *versus* horizontal actions, etc.), while expand and diversify the industrial policy agenda to address long standing and emerging development challenges adequately.

In fact, the recent intellectual debate has evolved to incorporate new approaches to industrial policies. Partially devoid of ideological stands, as argued by Juhász *et al* (2023:2), "a considerable literature has developed in recent years providing rigorous evidence on how industrial policy really works and how it shapes economic activity." In such a context, new approaches were developed to the analysis of industrial policies, with some variance and without neglecting lessons from the past (Aiginger; Rodrik, 2020; Chang; Andreoni, 2016; Gregory; Attenborough; Johnson, 2023; Juhász, Lane, and Rodrik, 2022; Mazzucato; Kattel, 2020; Mazzucato; Rodrik 2023; OECD, 2016; Oqubay *et al.*, 2020, Criscuolo *et al* 2022).

Contemporary developments, such as the geographical reconfiguration of global value chains, the diffusion of generative artificial intelligence, and the search for decarbonisation-enabling technologies, imply significant changes in existing economic and technological trajectories. Without reference models, uncertainty prevails in the sense that investment projects have no track record of costs and returns, demand is uncertain, and institutional frameworks are still designed for "old" practices and norms. If the investment environment is uncertain, so are public policies aiming at new development challenges. These latest development challenges demand the renewal of policy concepts and practices or a need to redesign the scope, contours, and contents of what is to be understood by "industrial policy."

The challenges of contemporary development imply significant changes about how to argue for, design, negotiate, implement, and monitor State action, both conceptually and politically. For that, a substantive framework for policy analysis and policy design can be drawn from evolutionary and resource-based analysis (Nelson and Winter, 1985, Penrose 1995, Teece and Pisano 1994). In fact, increasingly scholars are recognizing that principles from evolutionary economics can be applied to analyse the capabilities and effectiveness of the state. This approach raises critical questions regarding the nature and relative importance of valuable, rare, inimitable, and non-substitutable resources and capabilities in the public sector (Kattel 2022).

One outstanding case: the complexity of fostering decarbonisation

One outstanding example of the complexity posed for industrial policy by current development challenges is related to decarbonisation as one of the facets of climate change. Undeniably, it is a major policy challenge to define priorities and scope of policies, to mobilize resources and instruments, and to define targets and implement actions because of what a trajectory towards low-carbon economies entails: among others, reduction of greenhouse gas emissions, substitution of fossil-based energy with renewable sources; development of biodegradable products and processes.

Regardless of their development stage and degree of novelty, decarbonisation solutions are investment and capabilities-intensive. Most importantly, decarbonisation faces an undetermined but increasingly societal, economic, and political demand for solutions from different sources. That is, the introduction of low-carbon solutions is not merely a matter of decision-making involving suppliers and users of innovative solutions in search for competitive edges in markets. Consumers' demand also plays a crucial role

in fostering, passively accepting, or rejecting specific technological solutions. Direct and indirect social, economic, and environmental implications and externalities are inherent components of decarbonisation. As such, they should be part of national accounts and business ledgers.

Decarbonisation involves different certainty and uncertainty levels. Some solutions will be incremental, in localized economic systems with foreseeable benefits; others may have radical implications, involving substitution and the overhaul of existing installations, each at different stages of capital depreciation. Well-consolidated solutions may be in place in some areas; others are emerging around the corner, and many are still in early development stages (at the so-called technology readiness levels TRL 1 to 4).

Above all, decarbonisation is a multifaceted challenge. It is multidimensional because carbon emissions and their solutions are sector, source, time, and place-specific, all under varying technological, economic, social, and political umbrellas. Thus, the industrial policy implications of climate change impose conceptual challenges. The related literature is paying increasing attention to the subject matter under various headings: a broader perspective (environment), a subject matter (climate), a sector denominated (energy) and a place specific (urban milieu and some specific rural ones, e.g., the Amazon or the coral reefs) while the expression “green industrial policy” shelters the different approaches (Mathews, 2020, Rodrik, 2014). An open question, then, is how to develop adequate frameworks of reference and policy design in view of such a multifaceted phenomenon.

3. Industrial policies for whom? Time and place matter

As countries' development stages and needs differ, so should their industrial policies. The specific development challenges that countries face define the nature of the policy intervention. From this perspective, the design of industrial policies must be able to recognize, mobilize, and put in motion instruments consonant with the nature and the structural characteristics of economic activities, as well as with the development stage of the companies potentially benefiting from such a policy. Thus, it is necessary to take an evolutionary approach to the dynamics of industrial policies, highlighting the effects of path dependence.

Effectiveness in policymaking depends on the mobilization of instruments in line with the policy ambition (its scope and scale), which should address specific challenges and existing demands for State support. Broadly speaking, as a country's development stage defines the contours of potential demand, in many advanced countries, the technological and international competitive frontier can serve as a reference for policy goals. However, even in such contexts, relatively less advanced areas may coexist, such as micro and small enterprises in lower purchasing power pockets, which demands modes of intervention that are conceptually and structurally different from the promotion of technologically advanced activities. In this sense, by analysing the local specificities of energy transition across European countries, Soete and Sierna (2023) argue for a new set of industrial policies to be designed around what they term "a Schumpeterian place-based approach."

In most developing countries, the context is different. Drawing from Abramovitz (1986) three modes of development stages can be stylized: (i) forging-ahead organizations constituted by some islands (maybe archipelagos?) of companies and research institutes close to the international best practices; (ii) catching-up organizations in a larger number that have the challenge of approaching the best international efficiency practices, even if their innovative capacity is not so advanced; and (iii) lagging-behind organizations, probably the majority in number of firms and other institutions with a significant share in total industrial value of production and particularly in employment, and facing serious organizational, financial, productive, and competitive deficiencies. The question, though, is what the consequences of such striking differences would be. Already in 1970, Aníbal Pinto's seminal work on structural heterogeneity proposed three classes of efficiency-related economic agents: the "primitive" group of

firms, characterised by old, backward productivity levels; the intermediate group with country-average efficiency; and a “modern” sector with productivity levels like those of the average world class. He concluded that not only was the magnitude of the differences very significant, but also the “dragging” capacity of the modern sector was very limited (Pinto, 1970).

In such a context, the objectives of an industrial policy, the nature of the public intervention, and the pertinence of instruments to be mobilised must recognize different development stages in the real economy. Aiming at varying targets in motion is a challenge for industrial policies in a development context. The more diverse and heterogeneous a country is, the more complex an industrial policy may have to be. A provocative remark: should industrial policies be focused on specific sectoral goals or should they aim at the whole industrial structure? Besides considering political priorities and national strategies, or the unforeseeable implications of pressing external factors on an internal structure, the decision-making process for such a question would depend on the specific expected performance target, such as structural change, allocative efficiency, employment, climate adaptation, and defence. Each target has a particular scope, requiring specific strategic positioning. For example, being so broad, climate adaptation would require either a detailed specification on what public intervention should focus on, or the design of an equally broad industrial policy with its own expected goals, stakeholders, implementing institutions, resources, and intervention instruments.

Therefore, as industrial policies must deal with (a) country’s level of development of the private sector and the national innovation system, (b) endowment structure (not just in terms of resources but also institutions), and (c) market structure and competition dynamics in different sectors (and resulting opportunities and challenges for developing countries).

4. Without facing up, head-on, the nuts and bolts of State capabilities, no industrial policy

Any public policy requires State capabilities. Defined as "the set of skills and resources necessary to perform public functions" (Wu *et al.*, 2015, p.166), State capabilities are essential to make any public policy serve the common interest and be executed in an efficient, effective, innovative, and accountable manner. State capabilities significantly contribute to the effectiveness of public policies, as they increase the likelihood of achieving positive impacts on policy beneficiaries (Howlett, 2014).

The apparatus of any nation State is very complex, where diverse ministerial structures and public agencies and organizations, each with its own mandates, hierarchies and path-dependencies, overlay with intertwined relations between the different branches of established institutional powers (executive, legislative, judicial, as well as autonomous institutions such as the central banks). Any public policy necessarily involves a quite intangible asset: coordination of multifaceted relationships. Beyond national boundaries, such a challenge is even greater if regional or international coordination is required.

If different public organizations (and their interrelations with the private sector and/or social organizations) can move in common directions, under defined guidelines and priorities in the field of policy, the chances of benefiting from economies of scope and scale increase; therefore, more synergies are obtained in the use of public resources. Industrial policies cannot be dissociated from science, technology, and innovation policies. Depending on their scope, they are also associated with other thematic policies (decarbonisation, energy, transport and communications, education policies, for example). Moreover, industrial policies cannot meet challenges and deliver on mandates if not aligned with macroeconomic policies (Ferraz; de Paula; Kupfer, 2020). In short, the interrelatedness of industrial policies with other public policies matters.

At the specific policy level, State capabilities imply aligning policy initiatives, normative frameworks, development finance, and governance structures of executive agencies, all crucial elements for ensuring effective policy implementation. Legal frameworks define the operational boundaries for executive agencies, including their mandates, governance structures, and regulatory obligations. Proper alignment of such institutional conditions enhances the likelihood of efficiency and effectiveness, particularly for organizations in charge of managing strategic public instruments such as development finance. Moreover, explicit legal and regulatory frameworks define mandates

and objectives, as well as alignment with other national policy priorities. Such frameworks are often supported by specific legislation, and they may explicitly include coordination mechanisms among relevant actors—such as boards or steering committees—that operate based on defined missions and measurable targets.

The knowledge, skills, and tacit resources that public institutions accumulate over time are unique assets to each organisation and, for that, are the essence of State policy capabilities. These relate to how public servants examine the environment, recognize opportunities, search for and identify new solutions, and introduce and implement changes to established practices (Kattel, 2022). However, despite the relevance of policy capabilities for successful policy implementation, most analytical works on this subject focus on general considerations, rather than considering the "nuts and bolts" of industrial policy in action. Moreover, an in-depth understanding of State capabilities is crucial not only for policy implementation but also for the evaluation of results attained, without which no positive feedback or corrective processes can be put into practice.

The specific mode expressed by State capabilities may vary across institutions. However, regardless of the model, a "mission mystique is a fundamental feature of successful innovation bureaucracies" (Kattel *et al*., 2022: 201). Such mystique occurs because public servants in positions of command are imbued with typically Schumpeterian beliefs and attitudes, as Mintrom (2019) argues, and/or because of the (intangible) capabilities of bureaucracy, practicing and accumulating innovative experiences. Such mystique would then represent an internal engine of innovation in public institutions, proving particularly relevant as innovation drivers in public institutions are less noticeable than in business organisations where profit is an underlying fundamental motive for innovating.

Moreover, "the capture" of the State by specific stakeholders' interests has served as the central pillar of criticism by authors arguing against industrial policies (World Bank, 2000). There is no doubt that capturing the State is unacceptable. However, arguing against public policies because of an alleged inevitability of corruption can be questioned on the basis that the State is inherently imbricated in the political, social, and economic fabric of society. Concretely, it would be very unproductive, to say the least, if an industrial policy is not consultation-based and if the interrelations with the private sector and/or social organizations is not explicitly incorporated in its design. Ambitions, configurations, mobilization of resources, implementation capacities, and results to be obtained from any industrial policy depend on the quality of the interactions between public and private institutions directly or indirectly involved in it. In Evans's (1995) terms, the embedded autonomy of the State matters.

5. Politics matter. Politics command industrial policies

Industrial policies necessarily imply choices. It is in the political domain that development challenges are to be prioritised and translated into policy directives. From the moment a political orientation is put forward to the definition of policy directives, until its impacts can be noted, expectations are created, and political compromises are forged. Societal influence and interactions with the public sphere play a crucial role in determining the development avenues to be entered, as public institutions are not insulated from the legitimate pressures exerted by relevant social actors.

The political economy dimension of industrial policies is revealed when priorities are defined. It unveils the nature of potential beneficiaries and conflicts among them; the tensions that may arise from interrelations among the different pertinent executive agencies; societal influences and interactions as public institutions are not insulated from the legitimate pressures exerted by relevant social actors. The political economy of industrial policies is essential and needs to be brought into the limelight.

The political dimension of policymaking—including political change—plays a critical role in initiating and mandating State actions. In this sense, Karo and Kattel (2018:139) argue for the importance of considering that "dominant political and ideological values (e.g., liberal vs. conservative), political decision-making traditions (e.g., authoritarian vs. democratic, majority vs. consensual), and legal systems (public vs. customary)" are useful venues for the analysis of State capacities to be effective and/or innovative. Along these lines, it is fundamental to consider the State's capacity to engage in public policies along their various development stages, from policy design to the negotiation and implementation, with the necessary embedded technical autonomy to decide whether a project should or not be supported based on its technical, externality generation, and economic/financial merits. To be effective, public policies require political priority, clear objectives, quantitative goals, availability of resources, executive capacity of institutions, inter-agency coordination, accountability, networks, and credibility with the business sector and society in general (Hochstetler, 2021).

6. Industrial policy essentials

This policy brief aims to bring to the discussion four essential components of industrial policies, which analysts often underplay.

Firstly, it is necessary to recognize that current development challenges (not to mention long-standing ones) are quite unique to our epoch, diverse, and increasingly complex. New development challenges imply not only economic uncertainties, calling for State action, but also policy-related uncertainties. Where and what State institutions are aware, ready for, and up to which "game"? The challenges of climate change are taken as a case in point as a politically and intellectually acceptable reason for the State to take an active role.

Secondly, given the ease of arguing for generic policy prescriptions, this policy brief emphasises the importance of aligning objectives, scope, and the organization of industrial policies with the development stage and challenges any given country faces.

Thirdly, this policy brief discussed not only the strategic importance of State capabilities, as many authors do, but the urgent need to unveil, understand, and organize their constituting elements which must be pertinent to the challenge addressed, to increase the likelihood effectiveness of industrial policies.

Finally, the political economy of industrial policies has been brought to light in two respects: within a country, as resources are finite, industrial policies benefit some and leave others relatively "unsheltered;" among countries, industrial policies are instruments of national interest in the hope of better placing firms and sectors in the international competitive theatre. Ultimately, politics dictates industrial policies, and this dimension cannot be understated. The 2025 international arena proves so.

This policy brief suggests that contemporary industrial policies should address outstanding development challenges head-on, considering that State intervention is specific to locations, sectors, technologies, and moments in time. Thus, while industrial policies are gaining pre-eminence in the political priority agenda of national States, the emerging agenda is somehow idiosyncratic, varied, and complex that no "one-size-fits-all" solution is to serve. A tailor-made suit of concerted policy actions must be designed and implemented according to each complex, multi-dimensional set of industrial policy priorities in specific national or regional contexts.

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