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Science, technology, and strategic calculation: the contributions of Carlos Matus to Latin American STS

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ABSTRACT

This article aims to address the contributions of the Chilean economist Carlos Matus to the field of Latin American Thought in Science, Technology and Development, considered the pioneering STS field in the region. To this end, it focuses on the affinities between Matus’ early writings (1970–1980) and various exponents of the first generation of STS scholars. Two key dimensions are analyzed: the link between dependency, human creativity, and technology as defined by a certain style of development, and strategic calculation as a method of rationalizing political decisions. While the former is an aspect shared by Matus and other PLACTED members, the latter is his specific contribution. Two aspects are considered: the “strategic procedure” as a non-mathematical formalization to estimate political feasibility, and the “quasi-structured” problems as a theorization that attempts to account for social and political reality. The paper concludes that Matus’ significant contribution to the field is strategic calculation, a means of rationalizing decisions and enabling profound social transformations.

Ciência, Tecnologia e Cálculo Estratégico: As Contribuições de Carlos Matus para o Campo CTS na América Latina

RESUMO

Este artigo tem como objetivo abordar as contribuições do economista chileno Carlos Matus ao pensamento latino-americano em ciência, tecnologia e desenvolvimento, considerado pioneiro no campo CTS na região. Para tal, centra-se nas afinidades entre os primeiros escritos de Matus (1970–1980) e vários expoentes desta primeira geração de cientistas CTS. São analisadas duas dimensões principais: a ligação entre a dependência, a criatividade humana e a tecnologia definida por um determinado estilo de desenvolvimento, e o cálculo

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estratégico como método para racionalizar as decisões políticas. Enquanto o primeiro é um aspecto compartilhado por Matus e outros membros do PLACTED, o segundo é uma contribuição específica do chileno. Dois aspectos são considerados: o “procedimento estratégico” como uma formalização não matemática para estimar a viabilidade política e os problemas “quase estruturados” como uma teorização que tenta explicar a realidade social e política. O artigo conclui que a contribuição significativa de Matus para a área é o cálculo estratégico, um meio de racionalizar decisões e possibilitar profundas transformações sociais.

Ciencia, Tecnología y Cálculo Estratégico: los Aportes de Carlos Matus al Campo CTS en América Latina

RESUMEN

Este artículo se propone abordar los aportes del economista chileno Carlos Matus al Pensamiento Latinoamericano en Ciencia, Tecnología y Desarrollo, considerado pionero en el campo CTS de la región. A tal fin, se centra en las afinidades entre los primeros escritos de Matus (1970–1980) y varios exponentes de esta primera generación de científicos CTS. Se analizan dos dimensiones clave: el vínculo entre dependencia, creatividad humana y tecnología definida por un cierto estilo de desarrollo, y el cálculo estratégico como método para racionalizar las decisiones políticas. Mientras que el primero es un aspecto compartido por Matus y otros miembros del PLACTED, el segundo es un aporte específico del chileno. Se consideran dos aspectos: el “procedimiento estratégico” como formalización no matemática para estimar la viabilidad política, y los problemas “cuasi-estructurados” como teorización que intenta dar cuenta de la realidad social y política. El artículo concluye que la contribución significativa de Matus al campo es el cálculo estratégico, un medio para racionalizar decisiones y permitir profundas transformaciones sociales.

1. Introduction

This article aims to contribute to understanding the emergence of Science, Technology and Society (STS) in Latin America. It seeks to expand on what Kreimer and Vessuri (2018) have identified as the founding moment of the field in the sixties and seventies. This moment was marked by the efforts of a “pioneer generation” that shaped the area of Latin American Thought in Science, Technology and Development (PLACTED in Spanish). Rather than being a professionalized field of study, it addressed a pressing political concern about the role of science in peripheral contexts and technological dependency. Among the most important authors of this generation are Oscar Varsavsky, Jorge Sabato, Amílcar Herrera, Francisco Sagasti, Marcel Roche, and Miguel Wionczek. In this paper, I will focus on a figure whose contributions to the STS field have been relatively neglected. I refer to the Chilean economist Carlos Matus.

Born in Chile on November 19, 1931, Matus graduated as a commercial engineer from the University of Chile in 1955 and later completed postgraduate studies at Harvard

University. Upon his return to Chile in 1965, he assumed the role of Director of the Advisory Services Department at the Latin American Institute for Economic and Social Planning (ILPES in Spanish), an agency of the United Nations Economic Commission for Latin America (ECLA, CEPAL in Spanish). From there, he developed the Annual Operational Plans methodology and contributed to the debates on development and dependency in Latin America with *Dos polémicas sobre el desarrollo en América Latina* (ILPES 1970) and *Estrategia y plan* (1972), the latter with a prologue by Raúl Prebisch. After Salvador Allende's victory in the 1970 elections, Matus was appointed to a series of executive positions: President of the Pacific Steel Company, Minister of Economy and President of the Central Bank of Chile. After the military coup, he was imprisoned by Augusto Pinochet's dictatorship in Dawson Island and Ritoque, along with many top officials of the Popular Unity government. During this time in concentration camps, he wrote the drafts of *Planificación de Situaciones* (1980). In 1975, he went into exile in Venezuela, where he joined the Centre for Development Studies (CENDES in Spanish) at the Central University of Venezuela and served as an advisor to the Ministry of Finance. From then on, he focused on the development of the theoretical and methodological principles of Situational Planning (SP, PES in Spanish), which was first applied in Venezuela's VII National Plan 1984–1988. The Senior Management Foundation (ALTADIR in Spanish), founded and directed by Matus himself, disseminated these principles in different countries. He died in the city of Caracas on 21 December 1998 at the age of 67.

Currently, a significant part of Matus' work can be accessed through the Collaborative and Free Access PACTED Library, an initiative of the Free Chair of Science, Politics and Society (Cátedra Libre Ciencia, Política y Sociedad, in Spanish) of the National University of La Plata in Buenos Aires, Argentina. This cultural heritage has been hosted in the ESOCITE Repository since the First ESOCITE-LALICS Conference, held in virtual mode April 19–23, 2021. However, there is a notable lack of publications in the STS field that have collected Matus' work. He is a widely read author in public policy and administrative studies (Ander-Egg 2007; Azevedo 1992; De Almeida Fortis 2014; Spinelli 2012), and recent attempts to reconnect planning and development in Latin America have appreciated his work (Bernazza 2007; Bilmes, Carbel, and Liaudat 2022). So why should we consider him among the figures belonging to PACTED? One compelling reason is the considerable time he spent in institutions that were central to this intellectual movement, such as ECLA and CENDES (Arellano Hernández, Arvanitis, and Vinck 2012; Dagnino, Thomas, and Davyt 1996). These institutions played a crucial role in shaping Matus' intellectual trajectory. For example, ECLA led him to work with Alfredo Eric Calcagno, a friend and collaborator of Oscar Varsavsky. Also, an encounter with Varsavsky took place during a meeting in Caracas in 1968, jointly organized by ILPES, CENDES, and the Venezuelan Central Office for Coordination and Planning (CORDIPLAN in Spanish). Matus' early writings not only share common elements with those of Varsavsky but also delve into aspects that are only tangentially explored in Varsavsky's work. It is these aspects that this paper will address.

Following the recent emphasis on Latin American scientific and technological creation rather than importation (Medina, da Costa Marques, and Holmes 2014), I seek to highlight the originality of Matus' proposals. My main argument is that, akin to Varsavsky and other scholars of the PACTED generation, Matus' early developments should be recognized as a contribution to the reflection on the role of science in the development and execution

of an ambitious political strategy. In particular, Matus' strategic planning (later renamed Situational Planning) was a creative and innovating approach to rationalizing strategic calculation. I will argue that the importance of considering his proposal lies in addressing one of the criticisms leveled against PLACTED: its general neglect of the interests, habits, and meanings of social actors in the pursuit of transformative, ambitious agendas (Vaccarizza 2011, 50). Considering that over the years Latin American STS has established a dialogue with decision-makers, particularly those involved in scientific and technological development (Kreimer and Vessuri 2018), researchers within this community could be enriched by Matus' strategic calculation. This approach could support authorities at both political and policy levels and provide a valuable framework for analyzing current relations between science and society.

The article is structured into three main sections. First, I will present a brief summary of the most relevant aspects of PLACTED and how Matus resembles and separates from such thinking. Second, I will focus on the way Matus approaches the condition of Latin American dependency. It is important to remember that center-periphery relations would become a constant concern in Latin American STS, despite its changing evolution (Invernizzi et al. 2022; Kreimer 2019; Vessuri 1983). I am interested in showing that Matus considers the relations between knowledge, human creativity, and technology similarly to the perspectives espoused by Varsavsky and other proponents of PLACTED. Third, I will present Matus' conception on strategic calculation, highlighting various experiments conducted to determine the feasibility (especially the political feasibility) of certain projects or programs. This will include an examination of the Utopia experiment developed at CENDES and the "political model" proposed by Alfredo Eric Calcagno, Pedro Sáinz, and Juan de Barbieri. As will be seen, Matus' originality lays both in the emphasis he places on political feasibility and in the way he approaches it: methodologically, from a non-mathematical formalization, and theoretically, from the concept of "quasi-structured problems." I will consider Matus' strategic calculation as a genuine "technological creation," functioning as a rational instrument for societal transformation. Finally, I will summarize the conclusions of the paper and offer some final reflections.

2. PLACTED: a brief summary

The main aspects addressed by PLACTED can be outlined as follows: an examination of the link between Latin America's scientific and technological underdevelopment and the dependent character of its economy; a critical review of the relationship between the epistemic foundations of science and ideology; and, finally, a focus on the challenges of achieving a satisfactory interaction between innovation, science, and technology in peripheral contexts. In the following section, I will briefly present each of these aspects, highlighting both the similarities and differences compared to Matus' thinking. A summary of these comparisons is provided in [Table 1](#).

Firstly, PLACTED understood scientific and technological backwardness within the historical-structural framework of Latin American development. Consequently, any intervention that did not consider these conditions would be insufficient to overcome them. Latin American scientific production was viewed in the context of cultural and technological dependence. For both Matus and PLACTED, this entailed proposing an alternative style of development, one that prioritized qualitative aspects within a comprehensive social

Table 1. Carlos Matus contribution to PLACTED.

		PLACTED main figures	Carlos Matus
Common aspects	Significant problem Proposal	Cultural and technological dependence An alternative style of development weighing qualitative aspects in a comprehensive social project	
Matus' distinctions	Stand out aspect	Scientific and technological autonomy and human creativity	
	Main viability focus	Physical or material feasibility	Political feasibility
	Way of addressing political viability (if so)	Mathematical formalization	Non-mathematical formalization
	Participation role	Desirable aspect	Also key component of viability
	Strong questioning of	Sciences and their role in peripheral contexts	Also politics as an "art" without science

Source: author elaboration.

project rather than focusing solely on the rate of growth. Despite the wide range of positions on social change among the different PLACTED figures,¹ they all agreed on the prominent role of scientific and technological autonomy, understood within the broader framework of human creativity. Matus' contributions on these issues, which he shared with PLACTED, will be explored in Section 3. Concern for the viability of an alternative style of development was also a common aspect. However, most PLACTED figures focused on physical or material feasibility. When they addressed political viability, they did so through mathematical formalization. Matus, in contrast, focused on the problem of calculating political feasibility and proposed to address it through non-mathematical formalizations. In Section 4, I will explore his distinctive contribution, strategic calculation, by examining the formalization known as the "strategic procedure" and the subsequent conceptual development of the empirical reality it sought to address, termed "quasi-structured problems." Additionally, I will highlight that, from Matus' perspective, popular participation was not merely a desirable aspect of an alternative style of development, as it was for other PLACTED members, but a central component of viability.

Secondly, PLACTED entailed a critical examination of the epistemic practices of science, its interactions with ideology and politics, and its societal role, particularly in peripheral countries. Thus, they challenged the notion of science as an ideologically neutral pursuit, one that remains indifferent to the prevailing social order. Oscar Varsavsky's essay, *Ciencia, política y cientificismo* (1969), stands as a milestone in this aspect of the debate, as does the polemic that ensued in the journal *Ciencia Nueva* in 1972, later partially reprinted in Sábato (2011 [1975]). Matus did not actively engage in these discussions. Nonetheless, his insights into the relationship between politics and science offer a unique contribution to the debate. In his vision, it was not only science that needed to be examined, but also politics. According to Matus, a theoretical and epistemic transformation of science was necessary in order to accurately comprehend social and political

¹Kreimer and Vessuri (2018) place Varsavsky at the most radical extreme, Herrera in an intermediate position, and Sábato among the most moderate or "developmentalist" wing. Adriana Feld (2015) notes that the moderate perspective was inspired by dependency theory and systems approach, while the radical perspective was driven more by an unorthodox Marxist framework. The former focused on science policies, while the latter incorporated politics into the analysis. To outline Matus' position within this spectrum is challenging and requires a more extensive bibliographical review. However, there are reasons to preliminarily place him close to Varsavsky. Non-explicit similarities between his horizontal model and Varsavsky's "creative" style (1972) have been highlighted in a recent work (Viedma 2022a). Additionally, Matus (1980) later sought to address the "transition to socialism," pragmatically drawing on the Marxist tradition and attempting to combine it with cybernetics and systems theory in a manner also similar to Varsavsky (Viedma 2022b).

empirical reality. Moreover, he emphasized the need to integrate scientific knowledge of this reality into the “art” of its transformation, that is, politics. I will develop this aspect of his thinking toward the end of Section 4.

Finally, this Latin American thinking called into question the relationship between science, technology and innovation, challenging the “linear model” focused on supply. In this matter, the triangle of Sábato and Botana (2011) stood out. Its vertices were the government, the productive structure, and the scientific and technological infrastructure. The figure sought to illustrate the interrelationship of these three elements which, if properly balanced, would produce satisfactory results. By the mid-1970s, the development of instruments for formulating and planning policies aimed at improving the relationship between knowledge and the productive process was pushed forward by several international organizations (Sagasti 1989). A milestone in this area was the Science and Technology Policy Instruments (STPI) Project, which aimed to examine the process of planning and implementing science and technology policy in developing countries (Sagasti and Araoz 1988). In countries such as Peru, where team members were deeply involved in policy formulation, the project had the greatest impact. Conversely, in countries where leaders were not supportive, such as Mexico and Argentina after significant political changes, the project had the least impact (Oldham 2015). Reflecting on this four-decade experience, several members emphasized the importance of political commitment for effective policy implementation, as well as the need to consider resistance from certain actors (Kuramoto 2015; Sagasti 2015). Although this paper will not focus on the analysis of STI policies, it is relevant to mention these balances because Matus’ strategic calculation could contribute to improving policy implementation in this area in the future. Whereas his proposal has affinities with various perspectives in public policy, it stands out for offering a comprehensive integration of administration and politics, prioritizing the latter. The emphasis on situational logic, irresolvable conflicts between social actors, and the development of a concrete implementation framework make his proposal a genuine effort to “[bring] ‘the political’ into public policy and administration” (De Almeida Fortis 2014, 26). As I mentioned earlier, PLACTED’s voluntaristic approach has been criticized for not adequately considering the reactions of stakeholders to its proposals. Therefore, the inclusion of Matus in this body of thought would significantly contribute to addressing these shortcomings.

3. Styles of development, autonomy and creativity

The book *Dos polémicas sobre el desarrollo en América Latina* (ILPES 1970) begins with a chapter written by Carlos Matus, entitled “The development of Latin America’s interior: fanciful hypothesis or fundamental question?” (1970a, my translation). In this work, the author argues that Latin America developed by turning its back on its interior and locating its main economic activity in coastal areas. He finds the reason for this in the colonial and dependent development induced “from the outside,” which sought to reduce transportation costs for the developed center. To counter this strategy, Matus proposes an alternative: horizontal development, driven by “internal poles” throughout the continent. Based on an “unbalanced leap,” this model would allow a truly Latin American evaluation of the region’s main natural resources, promote economic integration and the supply of hitherto isolated areas, as well as foster cultural and technological autonomy. Matus argued that

one development alternative may be more convenient than another, even if it yields less growth. This “convenience” refers to qualitative transformations, which I will discuss below.

Firstly, this alternative style of development would make it possible to overcome what the author calls the “underutilization of the human capacity for creation” (Matus 1970b, 52, my translation). By strengthening the “pioneering spirit” and the “sense of community,” an authentic Latin American model would turn people from “passive entities” to “creative agents” of a new society. The inclusion of broad sectors of the marginalized population would contribute to this transformation. Secondly, horizontal development would make it possible to overcome cultural and technological dependence, which is developed in Matus’ third contribution to the book. Under the vertical model, centered on the coasts, the supposedly neutral “technological progress” in fact implies a concentration of knowledge in the capitalist centers and an uncritical importation of science and technology by the dynamic sectors of the Latin American economy, which tend to copy or imitate the cultural values of developed societies. On the contrary, the horizontal model would allow “foreign technologies to pass through a critical sieve and to define the selective areas where technological creation is vital” (Matus 1970c, 118, my translation). To this end, it would be necessary to lay the foundations of a new Latin American technological policy based on objectives defined exclusively within the region.

Matus’ proposal has similarities to Oscar Varsavsky’ “creative” style of development, in which “maximum autonomy of thought and culture is sought and thus maximum political, economic, and techno-scientific independence” (Varsavsky 1971, 239, my translation). Creativity is part of this style’s own “view of the world” and is expressed in the way it seeks to satisfy a wide range of human needs: “The just and egalitarian society is then not only an end in itself, but a necessity not to waste the creative capacity that all individuals have potentially and that the present society restricts, inhibits and deforms” (Varsavsky 1971, 230, my translation). In this sense, the Argentine scientist rebelled against “scientificism” and pursued a truly national scientific production, as various publications dedicated to his work have highlighted (Grondona 2016; Hurtado 2011; Marí 2018). This characteristic is shared by all PLACTED figures, although, as has been mentioned, among them radical positions, such as that of Varsavsky, are distinguished from other more moderate ones, among which Amílcar Herrera or Jorge Sábato can be found. Despite the differences, the increase in leisure time devoted to creative activities was an aspect also emphasized by the Latin American World Model (Herrera et al. 1976). In defending this model against some of Varsavsky’s critiques, its director pointed out that it sought “the total use of the creative and working capacity of all human beings” (Herrera 1976, 146, my translation).

Returning to Matus, it is necessary to notice that his weighting of qualitative aspects of development over the measurement of economic growth will translate into a distinction between “speed” and “direction” of the development process, introduced in the book *Estrategia y plan* (1972). The first concerns the Gross Domestic Product (GDP) as a universal measure of the development of countries. The second, on the contrary, defines a comprehensive social project, an image goal that can encompass very diverse human needs, not always translatable in terms of costs. For Matus, working only with economic coefficients or magnitudes makes the ideological direction of a style of development implicit, whereas postulating project-based goals helps to make it visible.

It should be considered that the inadequacy of the growth rate as a measure of development was shared by a large part of the Latin American diagnoses of the 1960s. At that time, a series of reviews along these terms were carried out within ECLA, given the limitations of the industrialization process, the difficulties of external strangulation, and the need to promote regional integration and improve income distribution (Devés Valdés 2003; Nahón, Rodríguez Enríquez, and Schorr 2006). This coincided with a shift in this institution's thinking toward social structures, as well as a process of politicization of its experts linked to the expansion of dependency theory (Beigel 2006, 2010). The peculiarity of Matus, Varsavsky, and other PLACTED exponents' approach lies in their proposal to replace the GDP with a "future image" presented in terms of qualitative, concrete, and ideologically explicit "needs" or "projects," among which the value of scientific and technological autonomy and human creativity stands out (Viedma 2022a).

Far from ignoring the interests at stake, Matus (1970c) had warned early that such a development strategy would not be viable without the support of key social groups. In *Estrategia y plan* (1972), he stated that the task of consensus building had to take into account not only organized forces such as political parties and trade unions, but also the technical and administrative state officials. He proposed that a new discipline called "government method" should focus on the study of bureaucratic, technical, and political actors and their criteria. Later, he would refer to the "government sciences and techniques" and describe the three aforementioned criteria as "government belts" between which it is necessary to find a balance in order to achieve a successful administration (Matus 2007b, 2014). He emphasized the importance of seeking and engaging social groups that were not organized or institutionally represented, and promoting social participation throughout the entire decision-making process. In Section 4 of the article, I will elaborate on these aspects.

4. Strategic calculation as a technological creation

Before continuing with Matus' fundamental contribution, I would like to highlight an aspect of Varsavsky's thinking that is not usually considered as part of his work within PLACTED: his concern for the viability of the ambitious transformation he wanted to build. His proposal to construct "viable utopias" was far from irrationalism (Castro Martínez 2022; Vasen 2016) and intended "to include in the calculation socio-political factors – conflicts of interest– and not only economic-technological ones" (Varsavsky 1971, 10, my translation). For this scientist, full participation in decision-making and collective debate were fundamental aspects of the creative style. He also warned that the inertia of the state bureaucracy could be a serious obstacle to transformation, for which its "re-education" would be necessary.

Despite the previous outlines, it must be acknowledged that Varsavsky primarily focused on deliberating the physical or material feasibility of alternative styles of development, rather than their political feasibility. This choice is related to the controversy, central to PLACTED, with the Massachusetts Institute of Technology (MIT) World III Model, the first one supported by the Club of Rome (Meadows et al. 1972). Published in 1972, the report titled *The Limits to Growth* used computer simulations to call for a halt to economic growth and the implementation of measures to control overpopulation. In response to this, Latin American scholars criticized the political assumptions concealed

behind the “natural limits” to development in the MIT model. They rejected the idea of an impending “catastrophe” stemming from an alleged scarcity of resources. From their perspective, the so-called “limits to growth” were not physical but rather social and political, intricately tied to the prevailing world order (Aguilar et al. 2015; Pryluka 2021; Vieille Blanchard 2010). Thus, the Latin American World Model was developed with the premise that “It is not sufficient simply to describe an ideal society; it is necessary also to demonstrate its material viability” (Herrera et al. 1976, 9). Against catastrophic diagnoses, the demonstration of the physical or material viability of an alternative was then emphasized.²

But Varsavsky’s contributions were not limited to this type of feasibility. One could consider his first mathematical model of numerical experimentation: that of Thomas More’s Utopia, developed at CENDES together with Carlos Domingo. It was published in 1967 and later included in a chapter of the book edited by Alfredo Eric Calcagno and Varsavsky: *América Latina: modelos matemáticos* (1971). The objective of the experiment was to study the stability of Utopia. To that end, the modelers put themselves in the position of those who would try to bring about a social transformation, for which they defined the attitude of each actor toward it (Domingo and Varsavsky 1967). This exercise is considered a pioneer in mathematical modeling and second-order cybernetics in Latin America (Jacovkis and Castro 2015; Maulén de los Reyes 2022). This issue was extended by Alfredo Eric Calcagno, together with Juan de Barbieri and Pedro Sáinz (the latter after the early death of the former). Their “political model” consisted of a mathematical experiment similar to the previous ones.³ Considering a series of governmental acts, it tried to determine their most favorable sequence and the necessary degree of transaction according to the response of support and resistance. The model took into account variables such as the weight of each political force, the value it attributed to each act of the program, the degree of general feasibility of its execution, and its possibilities of remaining stable. Various applications would be presented in the book *Estilos políticos latinoamericanos* (1972).

The similarities between the aforementioned political model and the strategic procedure that Matus began to develop in parallel have recently been pointed out (Viedma 2020). The Chilean shared the interest in trying some kind of formalization that would allow “making the political decision more rational” (Matus 1972, 48, my translation). He was aware of Varsavsky’s experiments and considered them promising to help politicians and decision-makers. However, he increasingly rejected mathematical modeling for this purpose. Thus, his conceptual evolution contributes to and adds complexity to the notions of political viability, which are only tangentially addressed by other PLACTED members such as Varsavsky or considered solely in mathematical terms by Calcagno.

In his work *Estrategia y Plan* (1972), Matus presents an initial formalization of political calculation, which he terms the “strategic procedure.” Conceived as a series of steps, this method was designed to help politicians or decision-makers evaluate the support and resistance their projects may encounter. Figure 1 summarizes these steps, which I will explain below.

²Not only the ideological positioning of the MIT model was discussed, but also its technical aspects, as can be seen in the methodological critique by Hugo Scolnik (1979).

³For a review in English of the various applications of mathematical models under Varsavsky’s initiative, see “Evolution and present situation of styles of development” (Calcagno 1990).

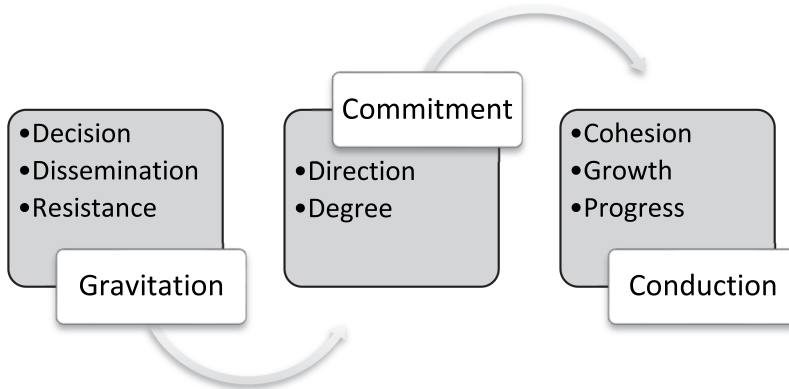


Figure 1. The strategic procedure. Source: author's elaboration based on Matus (1972).

Firstly, Matus considered it essential to determine the chronological order of the projects that would render the overall strategy viable. The successive implementation of each project affected the course of events and thus influenced the possibility of achieving the others. It was therefore necessary to define a dynamic sequence of projects that could be adjusted based on the results of the calculation. Secondly, he proposed to determine the gravitation, influence or weight of each actor. This attribute was divided into three capacities, which depended on each actor's access to three mechanisms: decision, dissemination, and resistance. The first mechanism involved various levels of decision-making that impacted collective life, regardless of their formality or regulation. Most institutions of representation and political management fell within this category. Secondly, dissemination mechanisms referred to the ability to shape public opinion, where the presence of monopolies played a crucial role. Finally, social actors who lacked access to the first two mechanisms often resorted to resistance to veto the decisions of other groups. Once the gravitation of each actor had been determined, it would be the turn of the rigidity or flexibility of their position, referred to as the degree of commitment. This commitment, in addition to its intensity, could be positive or negative, depending on whether the stakeholder supported or opposed each project. This formalization would provide a more reliable idea of the political viability of the entire project than mere intuition, as it allowed for defining the most favorable dynamic sequence of steps for the entire endeavor. Finally, the strategy's conduction throughout each implementation stage must be considered. This would depend on the degree of cohesion and growth of the supporting social groups, as well as the progress in achieving the objective-image. Cohesion referred to the ability to unite the actors who could offer support, while growth involved incorporating new social forces and was contingent on the successes obtained. Progress, in turn, pertained to the pursuit of new goals based on the support garnered, representing an advantage toward achieving the ultimate goals.

The scheme Matus created provides a way to determine the preferred sequence for implementing a major societal transformation. Since it is not possible to fight all the battles at the same time, one must choose where to strike first in order to achieve real progress. For this author, politics is the art of conducting a specific strategy and involves three simultaneous movements. "Unite, add, and advance" (Matus 1972, 125, my

translation): consolidate support, add new social forces, and carry out transformations based on gained power. As can be seen, these three movements correspond to the three variables considered in the final step of the strategic procedure: cohesion, growth, and progress. In this way, the formalization of strategic calculation brings a rational and scientific approach to the art of politics.

According to Matus, social participation is crucial for unifying and mobilizing forces. The challenge is to gain the support of actors who may not initially approve of or be indifferent to the proposed project. Later, he developed the Altadir Method of Popular Planning (MAPP in Spanish, Matus 2007c), designed for discussing issues at the local level, promoting commitment and facilitating upward transfer. As observed by Adriana Clemente (2016), Matus' approach aims to implement engagement strategies while recognizing conflict as a catalyst for social change. For him, participation is not only a desirable aspect of any style of development oriented toward the satisfaction of needs, as it was for Varsavsky, but also a major component of viability (Bernazza 2007). It contributes to achieving two core components of conducting a political strategy: cohesion and growth.

Strategic calculation is far from being a mere compilation of data that would function as a boundary for action. It is not predictive, nor is it passively subservient to the existing state of affairs for the sole purpose of knowing its tendencies. On the contrary, strategic calculation seeks to produce knowledge to intervene in the world. It serves as a *praxis* of social struggle, wherein both the planner and potential opponents are creative agents. According to Matus, planning is a political act where the realization of a plan hinges on social support and resistance to it. Essentially, everyone involved in governance or planning engages in the political calculation of their plan's viability. The author intends to formalize this calculation.

At the beginning of his work, Matus efforts were directed toward integrating political calculation into the public planning process. He then sought to differentiate himself from the planning model he termed "normative," which equated the plan to a norm or "how reality should be" and ignored viability or "how to achieve it based on current conditions" (Matus 1972). As he continues to develop the theoretical and methodological principles of his proposal, he distances himself from other local and foreign forms of calculation (Huertas 1996; Matus 2007c, 2007d). First, he asserts that the various management approaches used in the business world are inadequate for the public sector, the purpose of which is not to compete in the market but to satisfy needs. Second, he distances himself from methodologies promoted by international organizations such as the United Nations Logical Framework or its German version (ZOPP), which addresses partial-, intermediate-, or restricted-level problems. In contrast, strategic calculation stands as a tool for senior political levels to address holistic, highly complex problems encountered in governmental duties. In his latest writings, he further advances the conceptualization of these types of problems.

For Matus, traditional politics based on intuition is ineffective in addressing the vast complexity of government, especially in peripheral contexts. His methodological design would then be deepened with a theoretical approach to social practice, in which the concept of "quasi-structured problems" stands out (Matus 2014). These problems are depicted by the fact that their variables cannot be precisely enumerated, nor the relationships between them. Furthermore, their solutions are debatable and linked to the specific

interests or preferences of the actors involved. Predicting its evolutionary course is impossible because future possibilities cannot be fully enumerated, nor can probabilities be assigned to them. These issues are characterized by both qualitative and quantitative uncertainty, which distinguishes them from structured or semi-structured problems (see [Table 2](#)). It is the very nature of this type of problem that increasingly leads Matus to argue that mathematical formalization is insufficient to account for social and political dynamics.

Given that the reality with which a politician must contend is defined by indeterminacy and uncertainty, the sciences and techniques proposed to aid in his task must be capable of addressing this reality. However, this is not often the case, and the fault lies not only in politics but also in science:

the scientific educational system prepares us to deal with well-structured real or imaginary problems and leads us to believe that we can approach social problems in the same way. How many social scientists are searching for a formula, an equation, or a model that will provide the correct answer? (Matus [2014](#), 128, my translation)

For the author, conventional sciences are considered “vertical”: they are divided into disciplines with boundaries that arbitrarily segment the world. However, reality is a unified entity that transcends these pre-established scientific divisions. Given that sciences are often departmentalized (“vertical”) while practice and social reality is holistic (“horizontal”), there arises a necessity for novel theoretical endeavors aimed at appropriately addressing the complexity of reality within scientific discourse (Matus [2007d](#)). The conceptualization of quasi-structured problems aims to contribute in this regard.

A government must have the capacity to address quasi-structured problems in a “techno-political” way, using rigorous knowledge of the sciences and techniques of governance. For Matus, the theoretical and methodological training of senior leadership was essential to achieving this objective. This would extend the use of methods such as the strategic procedure, later incorporated into his PES planning method, to address the type of problems encountered by politicians and decision-makers in their tasks. As mentioned in the introduction, his methodology was first applied in Venezuela’s VII National Plan 1984–1988 and disseminated in several Latin American countries through the ALTADIR Foundation. Some consultancies have also been carried out at the local level, such as the Governor’s Office of Zulia in Venezuela and the Departments of Risaralda and Huila in Colombia (Huertas [1996](#)). Likewise, it has been used as a reference in various state reform processes in the region, such as participatory budgeting in Brazil (Fedozzi [2012](#); Moura [1997](#)) and results-based management programs in Argentina (García Moreno, Kaufmann, and y Sanginés [2015](#); Ossorio [2009](#)).

Table 2. Types of problems according to Matus.

Type of problem	Number of possibilities	Probability	Type of system	Example
Well-structured I	One	One	Deterministic with certainty	Composition of chemical elements
Well-structured II	Finite and known	Known and objective	Stochastics	Mendel’s laws of inheritance
Semi-structured	Finite and known	Unknown	Quantitative uncertainty	Result of a football match
Quasi-structured	Infinite and unknown	Unknown	Hard uncertainty	Social and political problems

Source: author’s elaboration based on Matus ([2014](#)).

I propose to consider strategic calculation as an innovation or “technological creation” (a term used by Matus and also acknowledged by Medina, da Costa Marques, and Holmes 2014) because it implies leaving behind the old “departmentalization” of science and overcoming the “abyss” between science and political practice (Matus 2007a). According to the author, when politics is reduced to “a pure art,” it becomes improvisation: a certain dose of science and technique is required. Matus seeks to contribute to the development of this science and technique through the methodological development of the strategic procedure and the conceptualization of quasi-structured problems, which are the two contributions highlighted here. Hence, he introduces an innovative perspective on the relationship between Science, Technology, and Society, which holds significance for the field of studies encompassed by these acronyms.

Is it possible to continue to criticize PLACTED for an alleged lack of concern for the reaction of social actors to its proposals? A disregard, perhaps, for the social and political viability of the ambitious projects promoted by its figures? The evidence gathered here, particularly regarding the formulation of Utopia, the political model, and, most importantly, the strategic calculation developed by Matus, suggests a negative response. At the very least, we can state that among the exponents of PLACTED, there were those who addressed the challenges of strategic and political calculation without forsaking the commitment to profound social transformations.

5. Conclusions

This article was intended as a contribution to understanding the emergence of STS in Latin America, a moment marked by the efforts of a pioneer generation commonly referred to by the acronym PLACTED in Spanish. In tandem with some of its proponents, the Chilean economist Carlos Matus reflected on strategic calculation as a way to know and promote the feasibility of profound social transformation toward an alternative style of development. Throughout this work, I have endeavored to elucidate the parallels between his proposals and those of other figures of PLACTED, while also accentuating the distinctive aspects of Matus’ approach.

The analysis began with a review of some aspects present in Matus’s contributions to *Dos polémicas ...* (1970), which would later be continued in *Estrategia y plan* (1972). The style of development that Matus proposed instead of the dominant one was characterized by a drive for regional economic integration, valuation of natural resources, integration of interior isolated areas, and cultural and technological autonomy. I showed that the concern for the enhancement of human creative capacities (especially in terms of technological creation, understood as opposed to imitation) was notoriously similar to that of Varsavsky and Herrera. Likewise, for all these authors, economic growth rate was insufficient as a measure of development and had to be replaced by a set of qualitative needs or projects considered as ultimate goals. This postulation of an alternative style of development, conceived as an integral social project that emphasizes scientific and technological autonomy as well as human creativity is a common thread among Matus and other PLACTED members.

Next, I argued that strategic calculation, as developed by Matus, can be considered an authentic technological creation, given its aim to rationalize decisions in order to advance challenging agendas. This entailed recognizing the necessity of full participation in collective decisions and consensus building among actors such as organized social groups,

technicians, and the state bureaucracy. I demonstrated that exponents of PLACTED were also concerned with these issues, such as the “viable utopias” of Varsavsky and Domingo, and above all the political model formulated by Calcagno, Sáinz, and de Barbieri. However, within Matus’ framework, strategic calculation occupies a central position and is not susceptible to being realized by means of mathematical modeling. While most PLACTED members focused on material or physical feasibility, Matus proposed addressing political viability through the strategic procedure and conceptualizing this reality via quasi-structured problems. For him, popular participation was not only desirable but a central component of viability. Thus, his critique extends not only to sciences but also to politics, specifically due to its tendency to disregard the former. His explorations into political leadership, popular participation and strategic calculation serve to establish his rightful place within the pantheon of PLACTED authors. This place is characterized by his concern for the interests and potential reactions that an ambitious program of social transformation could trigger in social actors, a factor that has been pointed out as absent or scarce in PLACTED. Therefore, the study of Matus’ work could enrich the current generations of Latin American STS both in their objective of conceptualizing and analyzing the relationship between science and society, as well as in the bridge-building and dialogues they seek to establish with decision-makers. It is not minor that one of the most important balances in the implementation of science and technology policies reflects on the importance of political commitment and taking into account the resistance of social actors (Sagasti 2015). Although this article does not focus on policy analysis, but on Matus’ contributions to politics in a general sense, it is important to highlight that his study could contribute to this field of application as well.

Before concluding this paper, I would like to highlight an issue that, although not addressed here, represents a potential avenue for further research. In the history of Latin American STS, reference has been made to a process of professionalization that marks a certain break with the pioneer generation (Kreimer and Vessuri 2018). The abandonment of the general framework of dependency theory (Medina, da Costa Marques, and Holmes 2014), the increase of foreign theoretical frameworks (Vessuri 1987), and the emphasis on case studies over theoretical creation (Dagnino, Thomas, and Davyt 1996) are symptoms of this process. The neoliberal change of the 1980s marked the decline of PLACTED as a movement and the consolidation of the Latin American STS field (Vaccarezza 2011). I would like to suggest that Matus’ career mirrors a similar trajectory. After the mid-1980s, his attention turns to the personal and institutional “capacities of government”: the virtue of generating actions and driving a strategy (Matus 2007b, 2007d). He also undergoes a professional transformation, establishing himself as a trainer and advisor to political leaders and officials. Through the ALTADIR Foundation, he offers his services to organizations with diverse political orientations. While he remains a sharp critic of neoliberalism, there is a discernible technocratization in his proposals. Indeed, this thesis would require a sociological analysis based on institutional sources, which is beyond the scope of this paper. Nevertheless, I wanted to propose it for subsequent studies.

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No potential conflict of interest was reported by the author(s).

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