Articles

Contributions from the critical theory of technology to the analysis of innovation in health services

Aportes da teoria crítica da tecnologia à análise da inovação nos serviços de saúde (abstract: p. 15)

Aportes de la teoría crítica de la tecnología al análisis de la innovación en los servicios de salud (resumen: p. 15)

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This article aims to reflect on the limits of the field of innovation in health services in the light of the Critical Theory of Technology (CTT). Considering the potential of social innovation for understanding how changes could serve less restricted audiences, and, therefore, more consistent with the field of collective health, the study problematizes the validity of the resistance proposed by this theoretical framework in the Brazilian context. Developed from the literature review, the study provides a re-reading of the theoretical limits of the field and innovates by evaluating the validity of resistance channels proposed by CTT in the Brazilian context. The conclusion of the present analysis reaffirms the diagnosis of the influence and values of the CTT, but identifies the necessary adjustments for the application of these solutions in less developed countries.

Keywords: Innovation. Health services. Critical theory. Collective health.

Introduction

In contemporary society, social relations are increasingly mediated by technical solutions. The acceleration of the process of incorporating innovations, since the second half of the 20th century, has intensified with the emergence of new technological platforms such as nanotechnology, biotechnology, fine chemistry, and information and communication technology (ICT), integrated in the various sectors of the economy and promoting substantial changes (industry 4.0) in productive and socialization relations.

In an analysis of the triumph of science and technology (S&T) activities, Dagnino & Dias[1] criticize the notion that scientifically generated and technologically applied knowledge is necessarily associated with something intrinsically good for society. The election of the problems to be solved and the values involved in their solution are determined by a narrow range of interests of the political and corporate elites. As a result, this society built on a so-called technological rationality faces both the exhaustion of natural resources and a series of social injustices and is threatened with collapse[2]; and it is based on these values, to the detriment of values involving human rights and environmental sustainability, for example, that contemporary social mediations are established. The prevalence of the interests of a few has disparate effects on people's ways of life, observed in the unequal distribution of resources and in the living conditions and material well-being on the planet.

The transformation of knowledge into a potential commodity[3] has repercussions on health, especially because the field mobilizes a series of technologies and both influences and is influenced by the dynamics of innovation determined by global knowledge chains[4]. In addition to the existing iniquities and those resulting from social determinants, innovations incorporated in health represent restricted values that concentrate research and development resources (R&D), directed only secondarily to health needs[5]. Significantly, the majority of research investments are destined to the global burden of diseases of a minimal share of society (the "10/90 gap")[6], expanding the circuits of social exclusion[7,8].

The antagonistic interests represented in public agendas and decision-making forums lead to the use of technologies associated with both increased well-being and longevity and undesirable treatment effects[9]. They also result in the reaffirmation of a consumption pattern unavailable to a large portion of the population, implying challenges to the sustainability of universal systems and the need to adjust the healthcare structure. Overcoming these challenges requires a better understanding of the processes involved in innovation in health services (IHS), defined here as the intentional introduction and application of ideas, processes, products, or procedures that are simultaneously relevant to the unit that adopts them and beneficial to individuals, groups, or the society in general[10].

The current study is motivated by the recognition of the lack of impartiality in the knowledge production process and that studies on this theme shed light on essential but insufficient dimensions for interpreting the processes involved in IHS. This is a further effort to overcome the dominant view of the subject, developed primarily based on analyses subordinated to manufacturing or on behavioral studies oriented by the logic of efficiency, overlooking the impact of political variables associated with capitalism's inherent interests in health[7,11-13].

The study, which starts with the recognition of the existence of asymmetrical forces in this political arena and their influence on the choice of technological trajectories in health, seeks to reflect on the limits of the IHS field based on a dialogue with the critical theory of technology (CTT)[2,14,15]. It questions, in the process, the methodological assumption of the CTT that the incorporation of non-hegemonic social actors would contribute to altering the direction of the changes underway, prioritizing, in the case analyzed, the democratization of Brazil's national health system.

This was a literature review conducted in March 2019 in the scientific databases SciELO and MEDLINE, via PubMed, and the CAPES thesis/dissertation database, with the combination of the descriptors "health innovation" and "innovation in health services" with "theory" and "concept" (in Portuguese and English). Articles found in the references of the reviewed studies were also included. The review was updated in September 2019, and the period considered for the sample of articles analyzed was from 2000 to 2019. The sample excluded studies that addressed the knowledge dissemination based on behavioral analyses and included those that focused on the evolution and trends in the field of innovations in health services, theoretical perspectives, expectations or critiques related to these topics.

The analysis advances with the paving knowledge based on a re-reading of the theoretical limits of the field and innovates when evaluating the validity of channels of resistance proposed by CTT in the Brazilian context by identifying obstacles to the implementation of solutions in countries weakened by regional and social inequalities, precarious educational systems and limited capacity to produce and innovate. In addition, it points out the need to formulate new public policies in order to implement the right to health effectively. Such conclusions should not be interpreted as a sign of the irrelevance of social innovation processes. They indicate, however, the relevance of intensifying a research agenda capable of contributing to the overcoming this superficial view of reality, which fails to understand the forces behind perennial domination as well as the spaces for the exercise of resistance (change). The analysis also lists programmatic consequences by indicating inconsistencies in the design of public social policies.

The critical theory of technology

Society has made significant progress in creating solutions associated with increasing longevity and the efficiency of a number of social functions (communication, commuting, commerce, and education, among others). However, something happened in the course of development, reflected in the technological trajectories and other changes integrated into society, which materialized as challenges for social and environmental sustainability, such as exhaustion of natural resources, as a consequence of their misuse, and cost pressures on social welfare systems.

The instrumentalist theory is the most widely accepted view to understanding the repercussions of technological development in society. This line of thinking contends that technology does not bear values (i.e., it is neutral and humanly controlled). There is also another view that denies the neutrality of technology, substantivism, whose prominent authors are Ellul and Heidegger[13]. According to this line of reasoning,

technologies carry ethical and social values and prevent the exercise of human agency, since technological development results only from the search for efficiency[9,14]. Because they are critical of the values embedded in change and their repercussions on ways of life, these authors advocate the abandonment of the use of technological devices.

Some authors[1,15] contend that political democracy is eclipsed by technical systems, given that they present solutions that define the organization of society and its ways of life. The so-called technical rationality sets standards that may or may not include values related to accessibility, collective interest or the importance of exercising the political voice of the population, which is essential in democratic regimes. These issues generally appear in debates in antagonistic positions: on the one side, there are values associated with human rights, social cohesion, and environmental sustainability, and on the other, the need to position itself strategically in the global economy.

In contemporary capitalism, competitiveness is directly and increasingly related to a number of technological and non-technological innovations. These are capable of generating disruptions in the existing technological trajectories (defining the leadership of new technologies and companies) and incremental changes (aimed at improving the product or service and the compensation for labor and capital, among others). The choices of technological trajectories generally reflect the interests of the industrial and financial elite, whose objective is to obtain hegemony of a given technical standard capable of promoting ever greater profits and accumulation of capital.

The technical code would therefore represent the consummation of an interest or ideology in a technically coherent solution to a given problem[2], while simultaneously creating rules that ensure the primacy of incorporated interests. Once the code is established, the disputes between different meanings and worldviews would cease[16], crystalizing the dominant hegemony, which Foucault identified as the most potent modern form of oppression[17]. Technology is the main source of power in modern society, exercised through designs that limit the range of interests and concerns represented by its solutions[2]. The resulting hegemonic values represent a form of domination so rooted in social life that it seems natural even for the dominated:

> Once introduced, technology offers a material validation of the social order to which it has been preformed. I call this the 'bias' of technology: apparently neutral, functional rationality is enlisted in support of a hegemony[15]. (p. 18)

Precisely because both the choice of incorporated technological trajectories and their impacts are intrinsically social, technology does not represent just an efficient way of dealing with nature[2,18]. The strictly rational approach to technology means that only its function is addressed, but not its meaning, thereby socially decontextualizing its understanding. Feenberg's critique of modernity includes the observation that, as long as there is no shortage of resources, the population has the freedom to use a given technology, but, in doing so, unconsciously adopts another lifestyle stemming from the reification of technology, a process that threatens the sustainability of life[15]. The winning technological trajectories materialize a particular social archetype, which has a concentrating effect in modern society.

The growing incorporation of technology has transformed health systems. There are many changes, and they are increasingly faster, enhanced by the integration of ICTs in the field, and with them we observe the hegemony of a fragmented and biology-centered model that prioritizes symptomatic treatments over etiological ones[9], with growing costs that threaten universal health systems worldwide.

The challenges these systems face today reveal the need for change that involve the development and adoption of new technical paths. However, both the changes (technological and non-technological) and the understanding of how to promote the emancipation of the various actors involved in health, disease, and healthcare processes, as advocated by the field of collective health, face important gaps. The Critical Theory of Technology allows a denaturalization of these gaps by assuming that they do not result from the limits of knowledge per se, but from a very restricted set of vested interests and the influence of this group's values in the choice of problems to be prioritized and of possible solutions.

Knowledge gaps in the IHS field and the CTT

Understanding the knowledge gaps in the dynamic of innovation in health services and the mechanisms for establishing and maintaining the hegemony of the concentrating technical code presupposes understanding the social role of technical objects and the vested interests within the productive systems involved in healthcare, promotion, and prevention. These systems have been undergoing profound transformations defined in the global market, highlighting the search for new innovation fronts due to the exhaustion of existing trajectories, the organization of global production chains, and the R&D base, confrontation and arbitration given the political and systemic conditions of national and local competitiveness[19]. The productive base of health and research funding is concentrated and monopolized by the interests of large multinational conglomerates and financial capital[20]. The production of knowledge is oriented by the dictates of capital accumulation and is linked to the constant introduction of new healthcare technologies and procedures which are only secondarily related to health needs[21]. This incorporation, associated with the demographic transition and changes in the epidemiological profile, has posed challenges to the sustainability of universal health systems in general and Brazil's Unified Health System (SUS) specifically.

The winning values not only guide the choice between the various technology alternatives to solve a given challenge, but also constitute the metrics against which the efficiency of the technology is measured[22]. These are the evaluation parameters available to inform the formulation of public policies, so that the technology emerges from policies that represent the values of an elite and, with the same bias, defines policies after their emergence[15,16].

The innovation in services began to be studied more systematically in the 1980s and 1990s, based on an interface between studies on services and those on innovation, a prolific field marked by the influence of Schumpeter and his followers, a theoretical framework established in order to analyze a society in which the means of production

were dominated by manufacturing. As the importance of service attributes in the innovation dynamics grows, its limits become evident. These limits were originally observed by studies[23,24] that mapped the existence of a research system invisible to the theoretical framework that studies it. As open models of innovation gain importance, this hidden system gains more evidence[25-27].

Although studies on the subject have increased, they are still mostly formulated from traditional perspectives (of assimilation), not consistent with the post-industrial economy[28,29] or with the health sector[30]. Most of these studies do not incorporate service attributes – such as interactivity (ad hoc and tailormade innovations), intangibility, inseparability, perishability, and simultaneity – and are not able to capture the peculiarity of the organization of innovation processes in services, which in health finds important spin-offs, such as the emergence of the day hospital, outpatient surgeries, and others that have been reconfiguring the system as a whole.

A study in the United Kingdom[31] observed that the development of new genetic tests benefited more from informal interactions than from formal R&D structures, indicating that the limits of the theoretical basis make the attributes involved in the dynamic of technological innovations invisible. The study also emphasized the programmatic implications of these observations, since the informal system is capable of innovating without the need for venture capital, patent enforcement, and spin-off firms, which, despite being important structures, should not benefit from virtually the entire promotion of innovation, as occurs under the prevailing policy. Their findings pointed to the existence of a gap between practice, theory, and units of measurement that allows one to question the validity and effectiveness of policies to promote innovation in the United Kingdom[31]. The findings also point to a significant bias in this metric which, in addition to favoring investments in technological innovation, fails to capture the activities of creative effort that are characteristic of services, with an increasingly leading role in the innovation dynamics of the contemporary functional economy, substantially attenuating the boundaries between what is traditionally defined as "service" and what is traditionally defined as "product". In fact, studies[27-34] have signaled the existence of attributes of innovations that have not been sufficiently studied because they are invisible to the available assessment tools, pointing to the emergence of paradoxes in innovation that stem from a systematic weakness in the theoretical analysis and the indicators on which it is built[3,31].

This metric, identified in the specific literature as one of the theoretical limits of the field, reflects the winning interests of large conglomerates and is not capable of capturing neither the social changes nor the results related to sustainability, with an impact on human development, social cohesion, equality, equity, and environmental protection, all of which are essential values for collective health. This metric also informs the formulations of policies to foster innovation, whose legitimacy should be addressed if what is sought is the democratization of our society's technical code and, specifically, of the technologies incorporated in universal health systems.

Researchers in innovation in services acknowledge the importance of advances in the field, highlighting the attempts to incorporate the attributes of services materialized in the various analytical perspectives (technicist, differentiation, inversion, and synthesis)[35-37]; and the academic and institutional advances, which may be observed in the increase of

scientific journals on the theme, conferences, and services innovation networks (such as Redlas and Reser)[28]. Various theoretical schools have contributed to the understanding of the field, highlighting the types of institutional arrangements and stakeholders[38] and the incorporation of the lack of consensus[11-13]. Specifically in health, it is worth highlighting the discursive bundles of technological innovations (modernist, humanist, political economy of the technological industrial complex, and management change)[39]; evidence-based medicine; the science of dissemination, diffusion, or implementation[40]; the emerging study of precision medicine; genomic medicine[41], and the impact of new technologies in the provision of care, organization of health professions and institutions, such as additive manufacturing, internet of things, blockchain, etc[42-44].

In spite of their contributions, there is a minority but growing group of researchers who believe that the field of innovation in services (in health and otherwise) has been successful in analyzing the technological innovations implemented in formal channels and top-down changes[28,45-47]. They defend, however, an approach to the social sciences, more specifically to the field of social innovations, aiming to expand the channels that inform the dynamics of innovation and favoring the incorporation of services' attributes.

The field of social innovation is based on the understanding that redesigning social networks allows less powerful actors (with a greater understanding of social problems and the ability to analyze changes that happen in place and in practice) to design new solutions in a participatory manner[47]. However, originally developed as a field of practice, social innovation still faces significant challenges for its theoretical improvement: it has made more progress in designing than in implementing solutions; it faces barriers to its scaling-up; it usually experiences limitations in resources and thus in results; it involves adverse working conditions for workers in the social sectors, and it suffers from the lack of incorporation of veto points and channels of support from political agents and policymakers[48-50]. The literature points to criticisms related to the ambiguity and fragility of its definition, to the conservatism of its results, and to the excessive influence exerted by the market and government model (it draws strength by filling gaps left by austerity policy)[51,52].

Despite the limitations addressed above, the field of social innovation has been joined by researchers worldwide. Researchers on the left side of the political spectrum have found affinity with the field for its resolution of evident contemporary social problems, based on materializations that have the social interest as the means and the end and that aim at (and affect) values such as equity, justice, and empowerment. Meanwhile, researchers on the right side of the political spectrum support this format for seeking solutions as a counterpoint to the downsizing of the social welfare state, a hegemonic trend even in the more developed countries[49]. With this convergence of interests, the field of social innovation has been studied in a more systematic way since the 1990s. In addition, with the increasing protagonism of the user as the open models of innovation ascend, a multiplicity of actors that have traditionally been relegated to secondary roles have begun to be featured in the studies. Although in an incipient way, the exclusive focus on the market has begun to shift to include the contexts of clinical practice and civil society, and even with their limitations underlined, studies that relate frugal innovations with technological innovations and bottom-up initiatives have progressed[26,27,32,34,53,54]. In this process, besides the social sciences, the fields of medical sociology and history of medicine have called the attention of researchers in the field.

Spaces of resistance involving CTT in Brazil

According to the CTT, the democratization of technical codes involves the search for potential benefits of technology that are suppressed by capitalism, a solution that would involve the maturation of democracy[14]. Feenberg[55] contends that democratic interventions are motivated by two factors: they address problems of public interest or achieve potentials that are currently limited by the existing technical codes. His theory thus defends the involvement of a wider range of stakeholders and interests, pointing out the social process of innovation as a potential space for exercising resistance[2].

CTT is opposed to the technocratic argument, which assumes that the expert detains all the relevant and rational knowledge in his or her field, overlooking that the restriction of the contemplated interests limits the scope of the solutions. CTT also emphasizes the benefit of incorporating the complementary perspective of the layperson when prioritizing problems to be confronted and choosing solutions, since it contributes a knowledge of praxis with greater understanding of the side effects of the changes underway[2,56]. What CTT proposes is consistent with the growing perception that the complex challenges to the sustainability of life require collective interventions, such as a series of initiatives and achievements also observed in Brazil, like the multiplication of public hearings, in addition to advances in the institutionalization of human rights, such as the recent classification of homophobia as a crime of racism and the enactment of the Brazilian Inclusion Law.

In fact, the negotiations between social and technical systems have multiplied, as have the publics involved, whether they consist of consumers, human rights advocates, environmentalists, or other representatives claiming protagonism in the issues that affect them. Examples in health are the resistance of women to innovations in childbirth[57]; the struggle of patient groups to influence the agendas of scientists and institutions, and the citizen participation in the debate on the constitutionality of stem cell research involving issues of bioethics and biosafety, in public hearings, among other examples. This is shaping a movement, albeit an embryonic one, in which the logic of efficiency is challenged and redefined based on values derived from diverse social groups[56]. In this movement, there is an emergence of principles that provide the basis for a bottom-up democracy[56].

However, democratization via the expansion of channels for participation and consultation encounters various limits and should also be studied through a contextualized analysis which addresses the forces that will oppose the changes. In the case of health, there is a powerful movement that attempts, and often succeeds, in reducing health to the access to it, overlooking the structuring equality and comprehensiveness of a democracy. Even with the progress in access to information resulting from the expansion of the internet, the empowerment of the patient before the authority of the physician is still questionable in terms of redistribution of the immanent power of knowledge[58]. There is also evidence of channels through which the pharmaceutical industry exerts power and influence on patient associations and in the production and circulation of health information, as well as evidence that health sector industries occupy spaces in which there are healthcare voids, influencing the perceptions of the population regarding needs and preferences. Thus, they strengthen the hegemony of a given technological trajectory that is not necessarily available to everyone, as a universal system presupposes[5,59,60].

There are efforts[61] to map conditioning factors for effective participation in the processes involved in the production of science and technology. However, promoting change in the status quo is notoriously difficult, especially in less developed countries, due to socioeconomic and regional differences, the fragility of democratic institutions, the stage of the struggle for human rights, and the precarious quality of the educational and productive systems. A country like Brazil with profound socioeconomic inequalities, ineffective redistributive policies, fragile institutions, and a precarious educational system has not been capable of forming the necessary competencies to guarantee the sovereignty of health policy.

Although there are some spaces of resistance in Brazil – increasingly threatened by budget cuts in social areas and the reduction of spaces for citizen participation –, the lack of autonomy in production and innovation does not give Brazil the conditions to reverse this uncritically adopted alliance with a neoliberal agenda, hindering the search for alternative paths. In health, the lack of competencies and, therefore, of sovereignty to design technical codes prevents Brazil from influencing the decisions on priority problems and solutions consistent with the country's sociosanitary and economic characteristics. The country is relegated to a subordinate position in the global productive arena.

Effective citizen participation presupposes conditions of equality between people and a quality educational system that develops analytical skills, creativity, imagination, and problem-solving tools and allows individuals to understand the factors at stake in decision making[31]. Even more developed countries have experienced limits both to develop and to incorporate innovations, due to gaps in the distribution of specialized knowledge, conditioning a better use of knowledge of praxis and its adaptation to the local context. Thus, although the increase in the importance of services might benefit the search for solutions that address the needs of the population (since they do not presuppose large-scale investments such as those required in technology bases), the lack of critical mass of the population hinders the realization of this opportunity.

Final remarks

Understanding the limits of the literature on the innovation in health services in the light of the CTT recognizes the existence of a bias in the production of knowledge and in the formulation of indicators and policies that greatly affect knowledge-intensive services such as health. This allowed us to address the validity of the methodological assumption that the incorporation of non-hegemonic social actors would contribute to altering the orientation of the changes underway aimed at the democratization of technical systems also in less developed countries. This understanding also reflected on the singularities of the potential of social innovation to foster changes capable of serving less restricted publics, consistent with the field of collective health.

The study concludes that in Brazil the validation of this space of resistance is not only conditioned by the limits recorded in the literature. It also runs up against the need for changes in redistributive social policies and practices, including those related to the promotion of innovation and the educational system, aiming to enhance non-specialized knowledge and the social orientation of innovations in health.

The paths for strengthening the innovation base of the national health system need to derive from contextualized analysis that consider the institutional arrangements and the relations of domination arising from the hegemonic technological trajectories. A programmatic suggestion is to intensify redistributive policies and the pertinence of designing an innovation policy for health systems that promotes the distribution of capacities and acknowledges the importance of innovations that occur outside the commercial environments, that values plural participation (including that of users). This also emphasizes the importance of expanding efforts to promote the autonomy of the productive base of health, considering that in developing countries, characteristic dependence of a subordinate approach to service in relation to industry has a double bias: health sector subordination and subordination to multinational industry, since the productive sector in developing countries lacks the competencies required to produce cutting-edge technology.

It is necessary to develop a research agenda for the field that goes beyond traditional approaches. This would include mapping the state-of-the-art of innovation in services (qualifying the solidity and improving the typologies and the critique of institutional advancements and their trends), as well as the conditions for establishing mechanisms of coordination between health policy and innovation in health policy.

The suggestion is for a more in-depth understanding of the extent to which bottom-up social innovation initiatives give rise to possibilities for breaking with the prevailing technical-scientific model, that is, to better understand the degree to which these initiatives are capable of promoting change in policies, in the economy, and in society; and identifying what would be the appropriate institutional, macropolitical and micropolitical conditions to enhance the results of this method of intervention. In this process, it is recommended to systematize the interfaces between innovations in health services and research and initiatives in the third sector; NGOs; social cooperatives; social intervention; and community and cooperative work (a diverse set of domestic production related to the field of social innovation).

In addition, it is crucial to map practices and knowledge that have led to changes in technical health codes (systematizing of changes in the field of practice) and the conditions under which pressure groups are successful in promoting change. In other words, it is important to pursue and conduct empirical studies capable of unveiling how the influence of certain invested groups is established in the processes of choosing and designing innovation in health systems and how their implementation establishes new values in terms of what is necessary for the well-being of the population.

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Este artigo tem como objetivo refletir sobre os limites do campo da inovação nos serviços de saúde à luz da teoria crítica da tecnologia (TCT). Ao considerar o potencial da inovação social para o entendimento de como as mudanças poderiam atender públicos menos restritos – e, portanto, mais condizentes com o campo da Saúde Coletiva –, o estudo problematiza a validade da resistência proposta por este instrumental teórico no contexto brasileiro. Desenvolvido a partir da revisão de literatura, o trabalho aporta uma releitura dos limites teóricos do campo e inova ao avaliar a validade dos canais de resistência propostos pela TCT no contexto brasileiro. A conclusão da presente análise reafirma o diagnóstico das relações de influência e valores da TCT, mas identifica adequações necessárias à aplicação dessas soluções nos países menos desenvolvidos.

Palavras-chave: Inovação. Serviços de saúde. Teoria crítica. Saúde coletiva.

El objetivo de este artículo es reflexionar sobre los límites del campo de la innovación en los servicios de salud a la luz de la teoría crítica de la tecnología (TCT). Al considerar el potencial de la innovación social para el entendimiento de cómo los cambios podrían atender públicos menos reducidos – y, por lo tanto, más de acuerdo con el campo de la salud colectiva – el estudio problematiza la validez de la resistencia propuesta por este instrumental teórico en el contexto brasileño. Desarrollado a partir de la revisión de la literatura, el trabajo aporta una relectura de los límites teóricos del campo e innova al evaluar la validez de los canales de resistencia propuestos por la TCT en el contexto brasileño. La conclusión del presenta análisis reafirma el diagnóstico de las relaciones de influencia y valores de la TCT, pero identifica adecuaciones necesarias para la aplicación de esas soluciones en los países menos desarrollados.

Palabras clave: Innovación. Servicios de salud. Teoría crítica. Salud colectiva