Engaging Science, Technology, and Society

Innovation Doesn't Work: The Explanatory Power of a Socio-Technical Approach

LUCAS BECERRA
CENTRO DE ESTUDIOS SOCIALES SOBRE CIENCIA, TECNOLOGÍA Y DESARROLLO (CITEDE), INSTITUTO DE ESTUDIOS SOBRE CIENCIA Y TECNOLOGÍA DE LA UNIVERSIDAD NACIONAL DE QUILMES (IESCT-UNQ-CIC-BA) CONICET
ARGENTINA

HERNÁN THOMAS
CENTRO DE ESTUDIOS SOCIALES SOBRE CIENCIA, TECNOLOGÍA Y DESARROLLO (CITEDE), INSTITUTO DE ESTUDIOS SOBRE CIENCIA Y TECNOLOGÍA DE LA UNIVERSIDAD NACIONAL DE QUILMES (IESCT-UNQ-CIC-BA) CONICET
ARGENTINA

Abstract

This comment engages with two questions introduced by Alan Irwin's introductory essay to this thematic collection on STS and Innovation (2023), and invites the reader to reflect on them as parts of a problem-solution relationship: *When it comes to engaging with and acting upon socio-technical change, is 'innovation' part of the solution or of the problem? What new conceptual and empirical resources can STS bring to the study of innovation?* The 'problematic side' (the first question) of our argument is focused on the theoretical constraints of 'innovation' as an analytical concept. Then, to address the 'solution side' (the second question), we introduce an approach to socio-technical change: the interactive socio-cognitive model. This model is presented as an analytical framework that makes explicit the explanatory (and programmatic) advantages that the notion of socio-technical change has compared to innovation.

Keywords

innovation; socio-technical change; knowledge; technology; constructivism

Introduction

When we affirm that innovation 'doesn't work' we are not denying the development of new products and processes aimed at increasing the profit rate. We will seek to briefly explain here that the concept of innovation is problematic. It has theoretical and practical implications that not only constrain the understanding of processes of technological change and stabilization but also entail negative derivations in terms of the specific practices of knowledge production and technological development.

To cite this article: Becerra, Lucas, and Hernán Thomas. 2023. "Innovation Doesn't Work: The Explanatory Power of a Socio-Technical Approach." *Engaging Science, Technology, and Society* 9(2): 66–74. https://doi.org/10.17351/ests2023.1395.

To email contact Lucas Becerra: lucas.becerra@unq.edu.ar.

We regard this issue in terms of a problem-solution relationship,[1] linking two questions presented by Irwin's opening essay to this thematic collection: Whether 'innovation' is part of the solution or of the problem when we try to understand the dynamics of change and stabilisation as a result of co-construction processes between technology and society; and which new conceptual and empirical resources can STS bring to the study of technological change and innovation.

In this sense, the 'problematic side' (the first question) of our argument is focused on the theoretical constraints of 'innovation' as an analytical concept. Then, to address the 'solution side' (the second question) of the problem-solution relationship, we introduce an approach to socio-technical change we developed after almost twenty years of theoretical and empirical analysis: The interactive socio-cognitive model is presented as an analytical framework, resulted from the 'hybridisation' of IS and STS, that makes explicit the explanatory (and programmatic) advantages that the notion of socio-technical change has compared to innovation.

Innovation: Its Performative and Problematic Character or Why it is Part of the Problem

A critical approach to the notion of innovation cannot fall into an empirical testing exercise. Why? Because the notion of innovation has a performative character on materiality, i.e., it builds up its own empirical basis (MacKenzie 2009). Furthermore, the almost infinite multiplication of the possible uses of innovation has generated a pervasive process that has turned particular phenomena into universal laws (Callon 1998). Hence, in terms of an epistemological approach, we have chosen to critically analyse the notion of innovation focusing on its constitutive elements and its socio-cognitive pathway.

Although conceptualizations regarding the role of technologies in production processes can be traced back to Adam Smith, there is consensus that Joseph Schumpeter has been the one who managed to build a school of thought around this concept, giving consistency to innovation studies (IS). The logical sequence of causal relations constructed by Schumpeter can be stylized as follows:

1. Firms coexist in a competitive world, and this has implications for their 'foundations and their very lives' (Schumpeter 1950, 82).

[1] The notion of problem-solution relationship is aimed at understanding how the definition of a problem implies a constrained set of solutions. In practice, 'problems' and 'problem-solution' correspondence relationships can be approached as socio-technical constructions (Thomas 2008).

This approach differs from deterministic analysis, which take problems for granted, as if they were not part of the socio-technical processes, as if they were part of the 'nature' of the artefact, the social groups or the systems.

2. Innovation, defined as the creation of 'new commodity, new technology, new source of supply, new type of organization' (ibid., 82), provides the means of survival through the generation of extraordinary profit rates (building up relative monopolies).
3. Innovation is carried out by entrepreneurial firms, which generate a continuous restructuring of the production system. Innovation 'incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism' (ibid., 83)
4. Thus, entrepreneurship is the engine of economic growth and development and the source of innovation and creativity.

The theoretical problem is not whether Schumpeter's explanation is true or false. The problem, analysed from an STS perspective, lies in the ontological characteristics that this causal explanation has given to the concept of innovation (and of course, to the concept of 'change'), which have been spread and diversified by IS.

First, this perspective on innovation implies that what is new, what happens in the future, is necessarily better than what exists in the present. And this presupposes a linear (evolutionary) and virtuous socio-economic development as a universal mechanism. Innovation, as an idealized process, renders invisible the concrete power dynamics behind the definition of who wins and who loses, who makes technological decisions and who adopts technological solutions which technological pathways unfold, and which are left unexplored.

Second, over the last two decades, different expressions were coined in order to gain more flexibility and legitimacy: 'responsible innovation', 'social innovation', 'sustainable innovation', among others. However, these notions reproduce the original rationale: what is new is better than what exists, and it is desirable. These notions imply linear, evolutionary, teleological relationships. Again, the actual dynamics which explain who wins (or loses), what alternatives are activated (or blocked) are not part of the analytical questions.

Third, the notion of innovation introduces an analytical asymmetry since it aims to explain what changes. But it doesn't explain why the existing technology works, why technological artefacts and systems are stabilized, and why certain 'ways of doing things' (practices) crystallise.

Finally, the notion of innovation is exclusively artefactual, even in its broad meanings about changes in organisational technologies. At this level, the systemic interactions that give rise to the processes of change (and stabilisation) are displaced from the analysis.

Innovation, as a concept, can be clearly recognized as a reductionist approach. Addressing social, environmental, and democratic problems requires a different framework that may be able to overcome these limitations. Two questions arise: Is it convenient then to change the meanings associated with 'innovation'

or is it preferable to foster the development of other theoretical notions? Or, in terms of this *ESTS* thematic collection, is 'innovation' a conceptual leverage or constraint?

The first option involves altering not only the narrative dimension of the concept but also the materiality that resulted from the process of socio-technical co-construction, including academic works, technological systems, regulatory frameworks, human resources, higher education systems, etc. In other words, in the presence of increasing polysemy and pervasive adoption of the notion of innovation, a strategy of resignification would imply an unequal fight against common sense.[2]

Science and technology studies have developed over decades an arsenal of concepts aimed at enhancing the ontology of IS's. In the following section, we propose the notion of 'socio-technical change' that could overcome the limitations of the concept of innovation.[3]

In the same ontological order, several works produced by scholars in the sociology of technology focus on interactive dynamics rather than on the accumulation of all kinds of stocks—data, information, human resources, buildings, equipment (Callon 1992; Thomas 2008). In particular, this perspective approaches phenomena as a co-construction of societies and technologies Bijker 1995; Thomas 2008). Artefacts are co-constructed by producers and users: the very socio-technical process by which technologies are designed, produced and used creates social relations of production, work, communication, and coexistence. Following this approach, 'problems' and 'problem-solution relationships' are socio-technical constructions. As part of the co-construction processes, they condition the set of socio-institutional practices, the learning dynamics, the generation of organizational instruments, the formulation of policies and techno-productive strategies.

The 'interactive socio-cognitive model' was developed in our research group as a 'hybridisation' of IS and STS (see figure 1 in Becerra and Thomas 2017). The model introduces the notion of socio-technical change (from a constructivist socio-technical approach) as a co-construction process generated by heterogeneous actors (the spheres in the figure 1). The relationship between actors and four main constitutive elements of technologies (problem-solution relations, knowledge, learnings and capabilities) is also a central aspect of our model. As a result of those interactions, actors also create their identities, give shape to ideologies, foster

[2] We use the term 'common sense' in the Gramscian way: 'the traditional popular conception of the world – what is unimaginatively called "instinct", although it too is in fact a primitive and elementary historical acquisition' (Gramsci 1971, 199). According to this definition, 'common sense' is not 'good sense', instead, it refers to the collective beliefs and opinions about what exist.

[3] There are multiple ways of defining socio-technical change, depending on the heterogeneous research groups that exist in STS. Here we will work on the notion of socio-technical change built as part of the research lines of the IESCT-UNQ, which is based on the interactive socio-cognitive model.

or hinder technological change based on the activation of particular processes and the production, reproduction, and circulation of concrete practices, artefacts and technological systems. This systemic dynamic is what we mean by 'socio-technical change'.

This notion explains the changes and stabilisation of sets of interactions between knowledge, capabilities and particular problem-solution relationships. Since the co-construction process is continuous and dynamic, the system is always in a state of motion. Therefore, stabilized relationships should not be misunderstood as rigid or fixed relationships. The stabilisation of a relationship within the system (for example, the way in which R&D institutes and private companies interact in the creation of knowledge) is continually qualified and reinforced by the operation of the system.

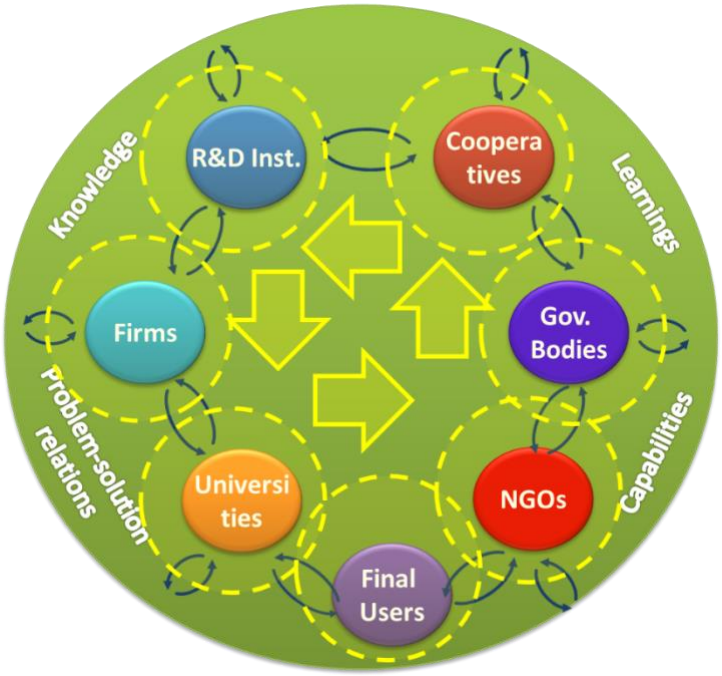

Figure 1: Interactive Socio-Cognitive Model: General Case. (Source: Becerra and Thomas 2017).

In the general model depicted in figure 1, socio-technical change is explained by free movement of knowledge and fluid interactions between the different actors in the system, which boost the generation of learning and capabilities based on broad and open participation in the construction of problems and the democratisation of solutions. In its ideal version, the maximisation of interactions ensures the creation of new learning and, by extension, technological change processes that are sustainable over time, and aimed at meeting the techno-cognitive needs and requirements of societies.

Since the system is in perpetual motion, the four circulating elements (problem-solutions relationships, capabilities, knowledge, and learnings) are always inputs and outputs, resources and products, problems and solutions. In this sense, the kick-off conditions (for example, the capacity to activate physical or

monetary resources or the initial stock of knowledge) are (at the same time) restrictions and drivers of the system. So, in analytical terms, techno-cognitive needs and requirements are neither universal nor linear; they rather depend on the actual spatial and temporal configuration of the model.

The system is self-organised, in the sense that there are relationships that are the product of continuous co-construction between the elements that constitute it. In other words, for example, the system produces learning at the interface between users, pre-existing knowledge, R&D capabilities, and new problems to be solved. These learnings are not necessarily the product of an exercise in organization and control, but rather they occur in the actual practice (often as tacit knowledge). Of course, within the self-organising system, there are units that plan and build mechanisms that aim to govern the system.

In empirical terms, systems can have key nodes or elements that define a 'socio-technical style' (Thomas 2008). In this sense, a system can be centred around a particular set of institutions, such as profit-maximising firms (see figure 2). What does this mean? It means that the configuration of problem-solution relations, the generation of knowledge, the increase in capabilities, and the direction of learning, is oriented to boost the role of the firm as an 'innovative agent'.

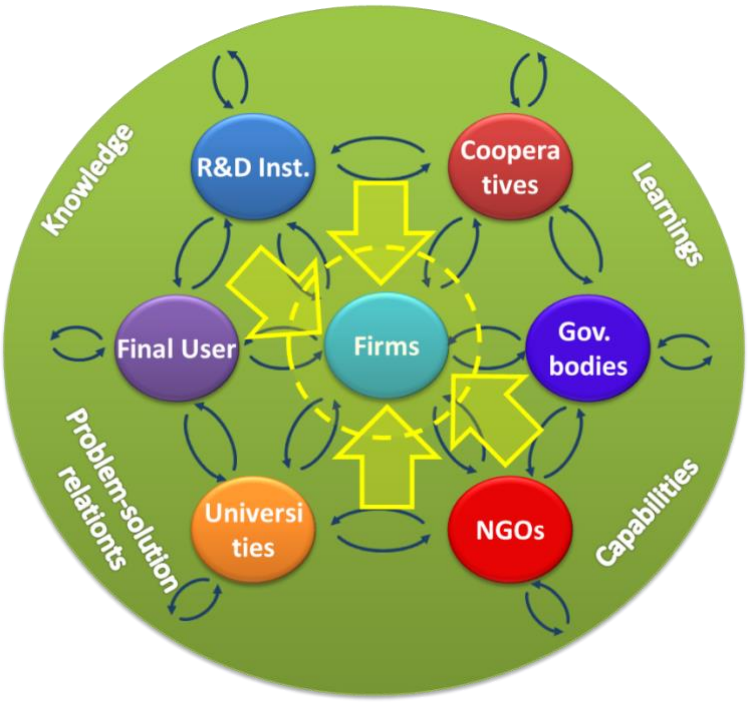

Figure 2: Interactive Socio-Cognitive Model: Innovation Style. (Source: Becerra and Thomas 2017).

Innovation, in Schumpeterian terms, is then only a particular form of socio-technical change, where the innovative agent has the ability to coordinate and align the system and privately appropriate the dynamics of knowledge production, learning, mobilisation of the agenda of problems (and solutions), capacity

building. This private appropriation is a necessary condition for achieving the ultimate objective of innovation: the generation of extraordinary profit rates.

This style of socio-technical change imposes structural restrictions on the system and limits its soundness in terms of the generation of learning, new knowledge, and the development of capacities. Why? Because the privatization process carried out by the innovative agent requires the construction of silos within the system (for example, via intellectual property or industrial secret). These silos isolate part of the knowledge, learning subjects, and techno-productive capacities. They withdraw them from the general functioning of the system, restricting the dynamics of learning by interacting. In short, when socio-technical change is governed by the 'innovation style', the development of technological solutions to social, environmental, and productive problems is limited.

Enhancing the Scope, Deepening the Explanations

Two questions raised by Irwin in the introduction to the current *ESTS* collection (2023) have ordered the argumentative structure of our document and our critical appraisal and theoretical proposal.

> When it comes to engaging with and acting upon socio-technical change, is 'innovation' part of the solution or of the problem?

We tried to show that the analytical reduction performed by the concept of 'innovation' generates a critical misunderstanding where a particular phenomenon (innovation) is presented as *the* general theory of change.

Once we can put aside this meta-theoretical mistake (enhancing the scope), it is possible to perform a better analysis of this issue (deepening the explanations). New ways of understanding emerge from a wider theoretical view propelled by the hybridisation of STS and IS, which may constitute our answer to the second question, namely:

> What new conceptual and empirical resources can STS bring to the study of innovation?

The notion of socio-technical change (provided by the interactive socio-cognitive model) allows researchers to move away from the notion of innovation as an organizing concept and re-set the analytical scope. This will enable us to grasp broader dynamics of interaction between technology and society.

What does this theoretical change imply?

- Shifting the focus of analysis from the units (particular actors and institutions or singular artefacts and processes) towards the interactions between them implies expanding its explanatory capacity (and, by derivation, improving the policy making processes).

- Innovation is not the only form that socio-technical change takes, nor is it its natural or desirable form. Innovation is the (contingent) result of the exercise of control (power dynamics) that the firms exert on the system, giving it a particular style of socio-technical change.
- Understanding processes of stabilisation is as important as understanding the dynamics of change. Both dimensions are inextricably linked.
- The resolution of social, environmental, and productive problems that humanity faces now and will face in the future requires expanding the agenda of problems, enhancing learning dynamics, generating heterogeneous knowledge, and building new techno-cognitive and productive capabilities. For this, it is necessary to build more a more fluid and interconnected dynamics of socio-technical change. This model is viable as long as no productive unit appropriates the knowledge generated by the system and excludes the rest.

Finally, rethinking the analytical notions with which socio-cognitive dynamics are approached is not a mere theoretical-conceptual exercise. It is a key issue for socio-economic dynamics at global scale, and specially for developing economies. The design of STI polices, R&D strategies, and the resolution of social, environmental and productive problems, that is, the possibility of building more inclusive and sustainable societies, depend on the explanatory capacity of the theoretical frameworks we choose to develop and promote.

Acknowledgements

We would like to thank Universidad Nacional de Quilmes (UNQ) and the Consejo Nacional de Investigaciones Científicas y Técnicas (Conicet) for the instutional and financial support. Many thanks also to Alan Irwin, the anonymous reviewers and the editors of *ESTS* for their insightful suggestions.

Author Biography

Lucas BECERRA is regular professor in the UNQ (Argentina) and researcher of Conicet (Argentina). Lucas conducts his research on Inclusive and Sustainable Development in the Centro de Estudios Sociales sobre Ciencia, Tecnología y Desarrollo (CITEDE), Instituto de Estudios sobre Ciencia y Tecnología, Universidad Nacional de Quilmes (IESCT-UNQ-CIC-BA).

Hernán THOMAS is full professor in the UNQ (Argentina) and researcher of Conicet (Argentina). Hernán is the Director of the Centro de Estudios Sociales sobre Ciencia, Tecnología y Desarrollo (CITEDE), Instituto de Estudios sobre Ciencia y Tecnología, Universidad Nacional de Quilmes (IESCT-UNQ-CIC-BA).

References

Becerra, Lucas, and Hernán Thomas. 2017. "Six: Innovation, Cooperatives and Inclusive Development: Rethinking Technological Change and Social Inclusion." In *Towards Just and Sustainable Economies: the Social and Solidarity Economy North and South*, edited by Peter North, and Molly Scott Cato, 99-116. Bristol, UK: Policy Press.

Bijker, Wiebe. 1995. *Of Bicycles, Bakelites, and Bulbs. Toward a Theory of Sociotechnical Change*. Cambridge, MA: The MIT Press.

Callon, Michel. 1992. "The Dynamics of Techno-economic Networks." In *Technological Changes and Company Strategies: Economical and Sociological Perspectives*, edited by Rod Coombs, Paolo Saviotti, and Vivien Walsh, 72–102. London: Harcourt Brace Jovanovich Publishers.

Callon, Michel. 1998. *The Laws of the Markets*. London: Blackwell.

Gramsci, Antonio. 1971. *Selections from the Prison Notebooks*. London: Lawrence and Wishart.

Irwin, Alan. 2023. "STS and Innovation: Borderlands, Regenerations and Critical Engagements." *Engaging Science, Technology, and Society* 9(2): 41–56. https://doi.org/10.17351/ests2023.1363.

MacKenzie, Donald. 2009. *Material Markets: How Economics Agents are Constructed*. New York, NY: Oxford University Press.

Schumpeter, Joseph Alois. 1950. *Capitalism, Socialism and Democracy*. Third edition. London, UK: Allen and Unwin.

Thomas, Hernán. 2008. "Estructuras cerradas vs. procesos dinámicos: trayectorias y estilos de innovación y cambio tecnológico." In *Actos, actores y artefactos. Sociología de la Tecnología* [Acts, Actors and Artefacts. Sociology of Technology], edited by Hernán Thomas, and Alfonso Buch, 217-262. Bernal: Editorial UNQ.