

# Introduction: Work and Organizing in Scientific and Technological Phenomena

Attila Bruni 

University of Trento

## Corresponding author

Attila Bruni

Department of Sociology and Social Research, University of Trento  
Via Verdi 26, 38122 Trento, Italy

[✉ attila.bruni@unitn.it](mailto:attila.bruni@unitn.it)

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## Abstract

Work and organizing have always been central to Science and Technology Studies (STS). Focusing on work and organizing practices has allowed STS to highlight the routine activities of scientists and the often-invisible work embedded in scientific and technological phenomena. STS have been one of the major sources of inspiration for developing a non-deterministic view of technology in Organization Studies (OS), but contemporary STS seem to have forgotten part of their interest towards work and organization, as from the scarcity of these themes in major STS conference tracks and special journal issues over the past fifteen years. This special issue aims to reinvigorate the focus on work and organization within STS, suggesting that insights from OS can enrich STS frameworks. The introduction proposes five propositions about work and organizing in science and technology, setting the stage for the issue's contributions.

## Keywords

science and technology studies; organization studies; work; digitalization; actor-network theory.

Work and organizing have always been at the core of STS. Focusing on work and organizing practices has been crucial for STS in order to grasp and highlight science and technology as the results of the ordinary and routinary activity of scientists (Latour and Woolgar 1979; Knorr-Cetina 1981; Lynch 1985), but also to attract attention on the invisible and articulation work that technologies and innovations often imply and require to their users (Star and Strauss 1999).

The work conducted by STS has thus become relevant to Organization Studies (OS) and to develop a non-deterministic approach to technologies in relation to work and organization. This is mirrored in a variety of papers, special issues and edited books published at the beginning of the new millenium. Barbara Czarniawska and Tor Hernes's edited book *Actor-network Theory and Organizing* (2005), the special issue of the journal "Organization" provocatively titled *Does STS Mean Business?* (Woolgar et al. 2009), and/or the translation in organizational terms of the concept of sociomateriality (Barad 2003) by Wanda Orlikowski (2007) are telling examples of the relevance STS concepts have acquired for organizational scholars and of their appropriation within OS and management theories.

Given the relevance and the appropriation of an STS approach in OS, one could symmetricaly ask: in which ways an organizational perspective could contribute to STS and to a relational approach to science and technology? Which concepts, theories, and approaches coming from the field of OS could STS borrow? More broadly, what is the attention devoted by contemporary STS to work and organizational issues in technological, scientific, and innovation processes?

Unfortunately, in my view the answers to these three questions point out how “work” and “organization” have progressively dropped out (at least in explicit terms) from the STS debate. For example, “work” and “organization” very rarely appear in the titles of the more than hundred thematic tracks present in EASST and 4S conferences over the past fifteen years. Just as an example, at the 2022 EASST conference in Madrid, out of 97 thematic panels only three included words such as “work” and/or “organization” in their titles (*Practices and politics of digitalization: Work and organization in STS*; *Emotions at work: The affective drivers of technoscientific workplaces and futures*; *Algorithms we live by and resist: How Artificial Intelligence reshapes daily organizational practices and control*) – and one out of these three was proposed by Brit Winthereik and myself. At the approaching EASST&4S conference of this year, out of 490 thematic open sessions, closed panels and workshops, only 10 clearly thematize issues of work and organization (see CP428; P029; P057; P139; P156; P206; P279; P326; P335; P340; P349).

Special issues of the principal STS journals (“Science, Technology, and Human Values – STHV”; “Social Studies of Science – SSS”; “Science & Technology Studies – S&TS”) have indeed rarely focused on work and organization in recent times: the last special issue dedicated to such themes by STHV dates back to 2016 (*Governing Algorithms*, Volume 41, Issue 1); if one looks at SSS, the most recent special issue framing organizational issues was edited in 2015 (*Ethics, Organizations, and Science*).

In the same vein, while that of the relationships between digital platforms, algorithms, AI and organizing processes represents a blockbuster theme in present organization and media studies, it is mostly absent from the STS debate. This is also mirrored by the fact that STS scholars are mostly absent from the current debate going on in OS about the digitalization of organizing and work practices, while media studies play a central role (Beyes et al. 2019; Beyes et al. 2022).

The aim of this special issue is thus to call for a renewed attention for issues of work and organization when studying scientific and technological phenomena, and to look for concepts elaborated in the field of work and organization studies in order to enrich the STS conceptual framework. In the rest of the Introduction, I will sketch a few themes in this direction.

In a recent Special Issue of the journal “Organization” on *Technology and Organization*, the Editors formulate ten theses on “the nature of technology and organization studies”. Advancing these ten theses, Authors’ intention is: “to put technology first, and to think through its consequences *before* subordinating it to frameworks of organizational thought” (Beyes et al. 2022, 1003, *emphasis in original*). While I basically disagree on the idea that technology has consequences before its framework (or context) of application and find dismissive to adopt the word “technology” and reify it as it was a monolithic concept (at least, we should talk about “technologies”, so to constantly remind that they are plural, diverse and not equal to each other), I share authors’ attempt of listing a number of characteristics of the relationship between technology, work and organization. Thus, in a similar but more modest vein, I will suggest five propositions on the nature of work and organizing processes in scientific

and technological phenomena. They are contrasting and contradictory propositions, so to highlight the ambiguous *albeit* essential relationship (in that I prefer a relational approach to ontology) between work, organizing, science, and technology:

1. Work and organizing are constitutive of scientific and technological phenomena;
2. Work and organizing translate scientific and technological phenomena;
3. Work and organizing are invisible in scientific and technological phenomena;
4. Work and organizing overcome scientific and technological phenomena;
5. Work and organizing institutionalize scientific and technological phenomena.

While presenting these five propositions, I will also introduce the papers composing this special issue. Instead of trying to summarize authors' arguments, I will propose my own interpretation of their research, so to acknowledge how the reading of these papers vividly contributed to the elaboration of these propositions.

## 1. Work and organizing are constitutive of scientific and technological phenomena

This first proposition recalls one of the most important and crucial insights of STS. Scientific and technological phenomena are the outcome of various processes, relationships and actants, and the way these processes, relationships and actants organize and are organized is essential for an action-net to stabilize and give birth to a stable set of practices and heterogeneous associations. This is quite evident if we look at past and present laboratory studies (Latour and Woolgar 1979; Knorr-Cetina 1981; Lynch 1985; Cambrosio et al. 2006; Neresini and Viteritti 2014; Beltrame 2014; Crabu 2017; 2021), but also if we look at what can be considered the basics of scientific knowledge: mathematical demonstrations. As noted by Livingston (1986), whenever a mathematician undertakes a demonstration, he or she has to prove the existence of an independent "mathematical object", external to the activities that allow this object to be visible. But if the demonstration does not proceed in a sequentially orderly manner, if the writing does not keep pace with what is being said aloud, if the material is not properly organized, arranged in proper temporal concatenation, the demonstration turns out to be incorrect, inconsistent, and the promised mathematical object does not come to light.

This is a telling example of how a scientific phenomenon (a mathematical demonstration) coincides with an organized set and sequence of activities. Indeed, it could be argued that for an activity to be recognized as "scientific", it must be organized into a clear, reproducible structure, so that the ideas of "organized" and "organizing" are somehow embedded in that of science itself.

The constitutive role work and organizing play in scientific and technological phenomena is also evident in Michel Callon's St. Brieuc scallops (Callon 1986b) and in many actor-network oriented researches: vessels, navigation and the Portuguese route to India were stabilized thanks to a process of heterogeneous engineering (Law 1986; 1987), that is in itself a process of organizing; medical protocols, standards, and "evidences" are the product of the management of the trajectory of the patient (Berg 1997); the making and use of software and digital

infrastructures are embedded in the organizational and work practices of their designers and users and their usefulness and reliability often depends on the invisible that align them with a broader work environment (Star and Bowker 1994; Star 1999; Star and Strauss 1999).

To move to more recent times and phenomena, work and organizing are constitutive of the entire social media, digital platforms, and artificial intelligence (AI) panorama. This emerges evidently not just from the literature (Alaimo and Kallinikos 2024; Pais and Stark 2020; Crawford and Joler 2018; Delfanti and Frey 2020; Tubaro and Casilli 2018), but also from all the papers and the various sections that compose this special issue. Work and organizing practices are integral to platforms for food delivery (Bonifacio, *this issue*); to the making of an app for the digitalization of the Italian public administration (Esposito, *this issue*); to the enactment of fluid technologies within a school setting (Kiær, *this issue*); to the way emerging and future technologies are envisioned (Saaoud et al., *this issue*).

Moreover, work and organizing processes are the focal point of the reflections presented in the Crossing Boundaries and the Scenario included in this special issue. In this regard, it is important to specify how all the authors contributing to these sections were contacted on the basis of the request of writing a piece on AI, and they all ended up writing about the role work and organizing have for AIs and algorithmic processes.

In short, precisely as “technology needs to be viewed as endogenous to and constitutively entwined with organizational actions and structures” (Faraj and Pachidi 2021, 2), work and organizing should be framed as endogenously co-constitutive of scientific and technological phenomena.

## 2. Work and organizing translate scientific and technological phenomena

In its very early stages, actor-network theory (ANT) was also termed “sociology of translation”. The concept of “translation” was introduced by Callon’s essay on scientific problematization, which he explored in the context of a French research program on electric vehicles (Callon 1980). Callon later defined “problematization” as the initial stage of a series of actions through which an actor becomes indispensable to others (Callon 1986a; 1986b). This involves using strategies and devices of *interessement* to mobilize and enroll heterogeneous elements and integrate them into a program of action. In short, translation aims to simplify and combine entities, reducing multiple actors to a few spokespersons, making them similar enough that one can substitute for another, or simplifying them by “black-boxing” while still retaining their differences (Callon 1986a).

The ideas of “actor-network” and “translation” were thus both developed to highlight the heterogeneous nature of the social world, the distribution of agency across both human and nonhuman actors, and the processes by which collectives evolve. Unfortunately, over time the prominence of “translation” diminished (Law and Hassard 1999), even though as aptly noted by Shiga (2007), without the concept of translation ANT risks being reduced to just another type of social, technical, or communication network, merely restating the agency-structure debate. Translation involves displacement, drift, invention, mediation, and the creation of new links that modify the involved elements or agents (Latour 1988). Elements

within a network deviate from their previous states, and through translation these elements are defined, assigned roles, mobilized and circulated. This process of translation inherently means that while some possibilities are realized, others are not. Therefore, translation is not merely a transfer but also a transformation, altering the original nature and solidity of entities, as from the famous expression: “to translate is to betray”.

As it is common in ANTI, translation is thus at the same time both a practice of creating equivalences and an outcome that includes the realized effects and the displacement of alternative possibilities. Consequently, translation emerges as a key characteristic of organizing (Gherardi and Lippi 2000). Organizations mimic each other through a process of translation, in that organizational actors adopt and adapt ideas to fit their own needs and means. This involves active handling, choices, and significant persuasion, leading to the transformation of the translated idea or object (Czarniawska 2009). The translation may start by converting the idea into a tangible form, like a model or a PowerPoint presentation, which can then be adopted and adapted by others (Czarniawska and Sevón 1996; 2005).

In this vein, Saaoud, Rampa and Agogué (*this issue*) nicely show how technological innovation is managed in a large electricity utility (EnerCo) through practices of anticipation and dissemination (that is, translation). Authors’ inquiry starts when EnerRD (the R&D division of EnerCo) is mandated by EnerTransport (the transportation division of EnerCo) to formulate a long-term technological strategy for the electricity transportation system. The initiative is termed by EnerRD “Vision Network 2035” and this label generates significant interest within and beyond EnerTransport, prompting EnerRD to expand the strategic process to other business units. This expansion aims to create the Organizational Technological Vision for 2035 (OTV 2035), addressing future issues across the organization. Subsequently, the need to operationalize the technological vision and translate it into concrete projects leads to the launch by EnerRD of the Organizational Technological RoadMapping (OTRM). In this way, the Vision Network 2035 is translated into the elaboration of the OTV 2035, which translates itself in the establishment of the OTRM, which finally gives the direction for the elaboration of innovation projects. Linking the STS literature on technological expectations with the zooming in/out framework (Nicolini 2009), the paper by Saaoud and colleagues highlights how emerging technologies are entangled in a mesh of organizational processes and practices that act as necessary translators of their enactment and materialization.

### 3. Work and organizing are invisible in scientific and technological phenomena

A basic assumption of STS is that technologies and infrastructures are invisible until they break down (Star 1999). In the same vein, the concept of invisible work (Star and Strauss 1999) reminds us that the work performed in “hidden” organizational times and spaces, and/or by “transparent” actors, and/or assumed to be routinary, low skilled, and sometimes not even part of any job description, often remains in the shadow. Until it is performed. When it is not, suddenly things and spaces get dirty, communication does not flow, and actors become nervous because nothing seems to be “ready” or properly organized.

Bridging the invisibility of infrastructures with that of work, so called maintenance and repair studies (Denis and Pontille 2010; 2015; 2019; Denis et al. 2015) have nicely shown the continuous as well as fragile nature of innovation phenomena. They have done so mainly by focusing on how maintenance and repair take place and, more recently, on what people do to properly maintain systems and things, and on the kinds of knowledge emerging in these particular moments (Denis et al. 2024).

Thus, maintenance and repair studies already elicited how work and organizing are crucial for the stability, the usefulness and the safeness over time and space of technologies and infrastructures. Moreover, it could be easily argued that since the study of large technological systems (Bijker et al. 1987), the organizational dimension that surrounds technologies has always constituted a focus of attention for STS scholars.

My point here is that not only technologies, infrastructures, architectures, work and organizational processes become visible when they crash, and/or that not all technical objects and types of work have the same degrees of visibility, but that even when work and organizing evidently sustain the introduction and the performance of a new technology, they tend to be relegated to the background. This is the case, for example, of the ongoing debate on artificial intelligence: even though many AIs are truly “artificial” in that they imply the work of a crowd of “clickworkers” (Casilli 2019; Tubaro et al. 2020) in order to be efficient, a relevant number of studies and discourses continue to foresee the decadence of human work instead of a more bounded idea of automation (Fleming 2019).

Various papers presented in this special issue could give telling examples of this process, but my favorite is the one by Francesco Bonifacio. Based on an ethnographic study conducted in Milan in 2020, this article brings to light the different stances, attitudes, practices and strategies with which subjects approach one of the most largely debated sector of the platform economy: food-delivery. The discussion surrounding digital labour platforms basically concentrates on “algorithms”, “algorithmic management”, “algorithmic power”, and “algorithmic despotism” (Griesbach et al. 2019) on one side, and “algorithmic resistance”, “algoactivism” (Kellogg et al. 2020), and “algorithmic imaginary” (Bucher 2016) on the other. In other words, as it often happens when technology is debated (Plesner and Husted 2019; Bruni et al. 2021), the first side stresses the control exerted by technology over actors, while the second underscores the agency actors still have and the way they circumvent control. What is missing, are the concrete work and organizing practices deployed by food-delivery couriers. Maybe paradoxically, by essentializing “algorithms”, regardless of how their technical specificities can vary and turning them into the driving force of organizational control and/or workers’ resistance, once more work practices remain in the shadow. “Once more” because this was also the case for the introduction of ICTs in organizational contexts, which at the end of the Nineties motivated the birth of workplace studies and their call for a renewed attention towards the reciprocal ways in which technologies and humans support each other in their activities (Luff et al. 2000).

By considering the specific configuration of workers in the platform architectures, Bonifacio identifies two distinct groups of workers, whose different cultural and socioeconomic backgrounds are mirrored in the ways they “imbricate” (Leonardi 2013) with the platforms, leading to various working styles and approaches (namely, “reactive” and “strategic”). In this way, beyond the tension between algorithmic control and resistance, work practices re-acquire visibility and return to center stage.

## 4. Work and organizing overcome scientific and technological phenomena

Recalling the attention on how “existing social stratification of workers is reproduced through the processes of ‘imbrication to platform’”, the paper by Francesco Bonifacio also points to how work and organizing share and are embedded in broader dynamics and processes, which overcome scientific and technological phenomena. Work is fundamentally a social activity and the ways people interact and collaborate are central to organizational life (Hughes 1956; 1958; Corbin and Strauss 1993). Interactions are influenced by technological tools but are not determined by them, as organizational culture shape how work is performed and how technology is used (Olson 1982; Suchman et al. 1999). At a wider level, the dynamics of labor markets and the broader economic system affect organizational strategies and practices (Smelser and Swedberg 2005). Finally, organizations operate within an institutional environment which provide frameworks and guidelines that influence work practices, organizational structures, and technology adoption (DiMaggio and Powell 1983; Powell and DiMaggio 1991).

An interesting research example of how work and organizing transcend science and technological phenomena is given by Karina Kiær’s paper (*this issue*). The paper takes into account literacy coaching work in Denmark. Literacy coaches are educators who have received additional training in the areas of reading and writing, with a particular focus on supporting students’ development of written language and enhancing the instructional techniques and strategies of their fellow teachers in literacy education. Apart from possessing a specialized expertise in reading and writing, literacy coaches play a crucial role in coordinating, analyzing, and translating texts and other learning-related data into concrete instructional strategies to improve teaching and learning quality. They are seen as central to the school organization, and are responsible for implementing management visions regarding increased data use.

Denmark, Sweden, and Norway have integrated literacy coaching into their educational systems, but literacy coaching is an interesting phenomenon in that it mirrors a global trend: it is well-established in the US, with many schools employing literacy coaches to improve reading and writing instruction; in the UK, literacy coaching is part of broader efforts to improve educational standards; Australia and Canada have also embraced literacy coaching to support literacy instruction and address diverse learning needs. In 2014 a European Literacy Policy Network (ELINET) was founded, involving 78 partner organizations in 28 European countries.

Literacy coaching thus appears as a major attempt that at the institutional level various Countries are undertaking in order to foster organizational change in the educational field and practice. In this regard, Karina Kiær shows how in order for new routines to emerge, new objects have to be shaped and adjusted to local circumstances, encompassing teachers’ instructional practices. These objects allow teachers to reflect on new grammar teaching practices, yet they also restrict certain approaches. Additionally, literacy coaches do not have the chance to observe how teachers implement these new teaching and learning strategies in classrooms. The literacy coach thus acts as an “emulsifier” (Kiær, *this issue*), by introducing various models, establishing boundaries, enabling the integration of new methods into other components, thus guiding the processes of a novel, emerging routine.



While the interpretation of the author focuses on a fluid approach to technologies and organizational artifacts for renovating routine dynamics, mine wants to underline how in this case work and organizing encompass much more than applying flexible technologies, as organizational routines involve more.

## 5. Work and organizing institutionalize scientific and technological phenomena

Given their constitutive nature, work and organizing processes play a crucial role in the institutionalization of science and technological phenomena. In this regard, one of the earliest, most well-known, and extensively quoted research is probably the one conducted by Susan Leigh Star and James Griesemer in 1989 at the Museum of Vertebrate Zoology at the University of California. Here authors highlight how:

Successful pursuit of the research problems through which the Museum of Vertebrate Zoology's scientists hoped to gain recognition depended on *an evolving set of practices instituted to manage the particular sort of work* occasioned by the intersection of the professional, amateur, lay and academic worlds. (Star and Griesemer 1989, 391-392, *emphasis added*)

The standardization of methods and the development of “boundary objects” were the two main practices instituted to manage the encounter of different professionals and knowledges. Standards and classifications are crucial elements in scientific and technological phenomena: protocols, guidelines, indexes, physical and digital infrastructures, software, databases, internet, apps are all about standardization and standardizing. As famously argued by Bowker and Star (1999, 320): “The act of classification is of its nature infrastructural, which means to say that it is both organizational and informational, always embedded in practice”.

Choosing the right device or protocol and enacting proper organizations and organizational processes is a crucial way for institutionalizing new tools and practices (Lanzara 2016). The paper by Fabio Maria Esposito present in this issue is a telling case in this regard, also because it accounts for what is happening in a relevant field, namely the Italian public administration (PA). Digitalization in PA is often viewed optimistically, presenting it as an inevitable process tied to organizational benefits like efficiency, transparency, and effectiveness, although its outcomes at the moment are quite varied and unpredictable (Plesner and Husted 2019). What is clear is that the digitalization of the PA, while affecting procedures and practices related to public interest and the state apparatus (Plesner and Justesen 2022), depends from an intricate actor-network which, in the case of Italy, materializes around the Department for Digital Transformation (DTD).

The DTD aims to uniformly digitalize Italian PA bodies (municipalities, schools, ministries) using economic, legislative, and technological resources, including a digital platform (PA2026). The goal is to standardize digitalization processes across Italian PA, but the attempt is also to institutionalize specific digitalization methods, processes, and practices.



As the author writes:

by incentivizing digitalization through massive economic resources, and by establishing *PA2026* as an obligatory passage point to get these resources, the DTD aims to impose its “digital institutions” upon all Italian PAs by coercion. By establishing an action net [...], *PA2026* participates in DTD’s institutional entrepreneurship insofar as it supports “[...] the mobilization of resources, the construction of rationales for institutional change, and the forging of new inter-actor relations to bring about collective action” (Hardy and Maguire 2017, 270). (Esposito, *this issue*)

Mingling ANT and neo-institutional theory, Esposito addresses “technical isomorphism” as an organizational strategy willingly pursued to induce institutional change, showing how technologies may participate in the purposeful crafting of normative, coercive, and mimetic pressures on organizations.

## Concluding remarks

The aim of this special issue is to recall attention to issues connected to work and organizing when approaching scientific and technological phenomena. In this Introduction, I have sketched five propositions regarding the relationship between work, organizing and scientific and technological phenomena. The papers presented in the special issue will do the rest.

## Post-scriptum

During the writing of this Introduction, Barbara Czarniawska passed away. Had I not had the privilege of knowing her personally and spending some of the early stages of my career with her, this Introduction – and I myself – would surely have been different. Thanks, Barbara.

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