

Exploring tensions in knowledge networks: convergences and divergences from social capital, actor-network theory and sociologies of the south

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Abstract

Knowledge networks have been discussed as mechanisms that facilitate access to resources and information. They are noted as organisations that promote the generation of new contacts and interactions between actors in order to produce knowledge that increases the speed and reliability of communication. They are also understood as platforms that encourage learning and knowledge coordination in order to advance technoscientific innovation processes. Despite these benefits, knowledge networks can engender areas of tension. The article will examine the tensions in knowledge networks by analysing the theoretical convergences and divergences between social capital insights, actor-network theory and several contributions from the sociologies of the south. The following four categories will be discussed: 1) hierarchy production; 2) blockages to the access to resources; 3) the spatialisation of networks; and 4) the different ways of understanding power. The latter offer opportunities to make the tensions in knowledge networks visible. The article proposes initiating a discussion focused on the dynamic movement of asymmetries to analyse knowledge networks between the global North and the global South as entities that are in a process of constant negotiation.

Key words

Knowledge networks, actor-network theory, social capital, sociologies of the south, knowledge asymmetries and tensions.

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Introduction: approaches to exploring tensions in networks of knowledge

The network concept is a classic sociological topos. The abundant literature on networks comprises such a broad variety of perspectives, methodologies and empirical cases that the attempt to grasp it in its entirety turns into an arduous, almost impossible task. For this reason, I pay particular attention to some of the contributions of knowledge networks from science studies that focus on analysing the benefits of networks (Albornoz, 2006; Luna and Velasco, 2006; Podolny, 2001; Powell, 2004; Sydow, 2010; Windeler, 2005). Moreover, I discuss them in reference to different sociological approaches, particularly those concerned with social capital (Bourdieu, 1986, 1994; Portes, 2010), actor-network theory (Callon and Latour, 1981; Callon, 1995; Latour, 2005), as well as various contributions from the sociologies of the south (Beigel, 2014a; Connell, 2013; Costa, 2014; Gurminder, 2015; Vessuri, 2014).

In the literature of science studies, a consensus has been reached about the important role that networks play in the production, transformation and circulation of knowledge. To analyse networks, they have been categorised into different types: collaboration networks, knowledge networks, innovation networks and production networks. From this point of departure, a research agenda was created that highlighted the benefits of networks as mechanisms which facilitate access to resources and information; as organisations that promote the generation of new contacts and greater interaction amongst actors; as spaces that increase the speed and reliability of communication; and, finally, as platforms that promote learning and knowledge coordination in order to encourage innovation processes.

The analysis of knowledge networks in science studies was essential to documenting network processes of knowledge production and circulation. However, it is important to underline the shortcomings of this scholarship and to propose how knowledge networks can be understood in new ways. The concept of a knowledge network has so far highlighted the benefits it provides as a neutral, despatialized and egalitarian organisation with a narrow view of power. This article aims to explore tensions in the notion of knowledge networks by reviewing how they have been approached from the social capital perspective, the actor-network theory and the various contributions from sociology that have been grouped as 'sociologies of the south'.

The exploration of tensions in knowledge networks makes it possible to identify convergences and divergences in the different bodies of literature. This offers a counterweight to the strict focus on the benefits of networks in terms of four different categories: 1) hierarchy production; 2) blockages to the access to resources; 3) the spatialisation of networks; and 4) the different ways of understanding power in networks. Bourdieu's work provides tools to analyse social structures, hierarchies and power struggles for scientific authority. Meanwhile, actor-network theory calls for the exploration of agency and translation processes through a principle of symmetry between both human and nonhuman actors, as well as for 'reassembling the social' in technoscience studies. On the

other hand, the contributions from the sociologies of the south analyse in-depth knowledge asymmetries in the world scientific system, the global structures that produce them and the mechanisms that reinforce them. By drawing on these three approaches, I will explore the points of convergence and divergence in networks and thereby promote a renewed discussion for a future research agenda that focuses on the dynamic movement of the asymmetries between the global North and the global South as entities that are constantly being contested and negotiated.

The article is divided in seven parts. In the second section, I present a brief review of the main theoretical contributions to knowledge networks in science studies. The review is not exhaustive and is limited to the work that have been inclined to highlight the benefits of networks. The third section highlights the theoretical starting points and the main contributions of social capital approach, actor-network theory and the sociologies of the south to exploring tensions in networks from a variety of perspectives. The fourth section discusses networks beyond the benefits they provide in terms of four categories. The fifth section highlights the convergences and divergences in the analysed bodies of literature. Finally, the sixth part proposes a way to analyse transnational knowledge networks that is based on asymmetries and discusses the challenges that the future research agenda faces.

Knowledge networks in science studies

During the 1970s and 1980s, the network concept in science studies was anchored in structural sociology (Granovetter, 1973; Cook, 1983; Burt, 1992), both theoretically and methodologically. Structural sociology aimed to analyse social relations as a network. Granovetter (1973) highlighted the importance of networks in social relations for the dissemination and flow of information, as well as the potential that weak ties have as connectors. Burt (1992), on the other hand, argued that networks promote access to resources and information and, as consequence, save time in the generation of contacts.

At a methodological level, social network analysis developed mathematical and statistical techniques and econometrics for analysing and exploring links between actors (Hanneman and Riddle, 2005; Wasserman and Faust, 1994). An actor's importance in the network could potentially be measured by using categories such as centrality, closeness, or betweenness. Thus, an actor's power was determined by his number of connections and position in the network (Cook, 1983; Knoke, 1994).

At the beginning of the 1990s, the trend was to draw attention to the benefits of networks as social organisations with flat hierarchies, where authority is broadly dispersed and borders are porous (Hage and Hollingsworth, 2000; Powell, 1990; Williamson, 2005). According to Powell, the common characteristics of networks related to the speed and reliability of communication, the reciprocal allocation of resources and actions and the promotion of learning and economic benefits by facilitating resource management and adaptability through coordination and communication (Powell, 2004; Powell and Smith, 1994; Powell and Stine, 2005). In the same vein, Podolny and Page (1998) suggest that the benefits networks provide are legitimisation and status, in addition to providing shelter from uncertainty. More recently, Sydow (2010) has argued that reciprocity, reputation, trust and co-specialization are characteristics of networks as well.

Table 1. Network types and characteristics in science studies

Type of network	Characteristics	Main references
Collaboration networks	Co-authorship. Interaction exists between different authors in publishing articles.	Mullins (1972) and Ynalvez et al. (2011)
Innovation networks	Coordination mechanisms to integrate knowledge and bring about innovation processes.	DeBresson (1991), Freeman (1991), Rammert (2000), Pyka (2002), Rampersad et al. (2010)
Knowledge networks	Stable and profound ties to produce long-term knowledge.	Podolny (1996), Casas (2001), Powell et al. (2004), Giuliani (2005), Bonaccorsi (2010)
Production networks	Ties between corporations and other institutions that take part in the industrial production process.	Saxenian (1991), Ernst (2000) Allarakhia et al. (2012)

Source: Own preparation

Through the 1990s, interest in interactive models of knowledge production grew, giving rise to increased literature production on networks in different social sciences disciplines, above all sociology and economy. For example, the works from DeBresson and Amesse (1991); Freeman (1991), Emirbayer (1994), Podolny (1998), Davern (1997) and Powell (2005). Networks were understood as an institutional mechanism that synchronised fragmented knowledge through interactions and relations, establishing ways of cooperation and platforms for communication. Thus, the role of networks was not merely to transfer information between different actors but the interaction itself also constituted an opportunity for innovation (Etzkowitz, 2006; Powell and Stine, 2005; Rammert, 2001).

The concept of innovation networks gained great interest in the global North, where successful network study cases in knowledge intensive fields such as biotechnology and nanotechnology were documented (Cowan and Jonard, 2006; Rampersad, 2010; Taeube and Whyte, 2007; Wiek et al., 2007). In contrast, the notion of knowledge networks was increasingly popular in Latin America as a way to analyse and conceptualise processes of generating, distributing and appropriating knowledge through learning processes and by establishing systems of trust and exchange between different actors. From this perspective, it has been possible to document knowledge networks in different areas such as aquaculture and wine (Albornoz, 2006; Casas, 2001; Giuliani, 2005; Luna and Velasco, 2006).

Despite the benefits that networks provide, their limitations must be acknowledged. By reviewing the specialized literature, I have attempted to identify them and, furthermore, determine how it may be possible to further develop the research agenda. I have divided the limitations into the following four categories. Firstly, the tendency to conceptualize networks as egalitarian organisations has completely obscured the tensions they generate. Secondly, the descriptions about the way networks work and the benefits they provide are almost entirely related to the access of resources. Thirdly, as most attention has been paid to the interactions in the network, the analysis about how they are determined by their context has been neglected (that is, they are analysed as de-spatialized entities). Finally, a narrow understanding of power persists in knowledge networks. In order to motivate a more balanced view of networks, I will review, from different perspectives, the main approaches to explore tensions in knowledge networks. These perspectives are social capital, actor-network theory and the sociologies of the south.

Networks beyond the benefits they provide: theoretical starting points

Bourdieu: social capital, structures and hierarchies

Bourdieu's concept of social capital has greatly influenced research on networks. According to Bourdieu, social capital is an integral element of networks that can be manifested through sharing a name or being part of a community/institution. Bourdieu (2001) argues that the amount of social capital an agent possesses depends on the size of the number of network connections one can mobilise and the amount of capital (economic, cultural and symbolic) that can be gained through the connection to other actors. Portes (1998) discusses the benefits that networks provide, especially as ways in which actors access economic resources, increase their cultural capital through contact with experts or even acquire membership privileges to certain institutions. The author also identifies areas of tensions related to the exclusion of external parties, excessive demands from other members of the group, restrictions to individual freedom and downward levelling norms. For Portes, the very ties that provide benefits to a group's members are mechanisms of control that deny others access to the same social capital (Portes, 2010).

Beyond Bourdieu's social capital concept, its various applications and the proposal that it entails a shift away from the positive consequences of networks, other concepts proposed by the author such as field, diverse forms of capital and habitus provide specific tools to explore tensions in networks. Bourdieu dedicated a great part of his work to analysing the structures of the scientific field and the power struggles in the quest for scientific authority (Bourdieu, 1988, 1994, 2001; Bourdieu and Wacquant, 2005). He argues that there is a competitive struggle to achieve a monopoly on scientific authority, which intrinsically entails capability and social power (Idem). The accumulation of scientific capital ensures power over the mechanisms of the field that can be reconverted into other forms of capital (Bourdieu, 1994).

Bourdieu broadly develops the idea that the scientific field has hierarchies that depend on the cultural capital of the agents and the domination strategies of their counterparts (Bourdieu, 1988). Based on Bourdieu's ideas, several studies have appeared that analyse ethnical enclaves and the transnational communities of Cuban migration in the USA (Portes, 2010); the hierarchies of the world scientific system and the segmentation of knowledge circulation circuits in Argentina (Beigel, 2014b); the exercise of symbolic power in organisational networks within a French company in Singapore that simultaneously structures social inequalities (Lee, 2013); and, finally, hierarchy production and power struggles for scientific authority in a Chinese laboratory, based on what lo Wei Hong (2008) calls theoretical and technological capital.

Exploring agencies: actor-network theory

Callon, Latour (1981, 1995, 2005) and Law (1986) propose using the actor-network theory to analyse the role that science and technology (technoscience) play in power relations. They identify an asymmetry in the analysis of power relations in the social sciences and also the natural sciences. According to Callon (1995), nature is devoid of power relations, as power

can only be analysed in terms of social relations. For this reason, actor-network theory does not distinguish the associations between networks in nature and networks in society.

A key concept in actor-network theory is translation, which means to express in one's own language what others want to say and to explain their actions and associations – that is, to assume the role of a 'spokesperson' (Callon, 1995: 277). Actor-network theory renders the agency of the involved actors visible by means of four moments of translation. These are: 1) problematisation, or how to be indispensable; 2) interessement, or how to keep allies in their place; 3) enrolment, or how to define and coordinate roles, and 4) the mobilisation of allies, or determining whether the spokesmen are representative. When we translate in terms of these four moments we exert power.

In the same vein, Latour's argument revolves around 'reassembling the social'. This is also the title of the book in which he develops the main ideas of his actor-network theory. In his approach, 'nonhumans – microbes, scallops, rocks and ships – presented themselves to social theory in a new way' (2005:10). In actor-network theory, 'the social' is not a domain of reality, but the name of a movement – a displacement, a transformation, a translation and an enrolment. It is an association between entities which, except for the brief moment in which they are reshuffled together, (ibid.: 65) under no circumstances are recognisable as social in the usual sense. According to Latour, the traditional role to which objects are limited renders power relations and social inequalities meaningless for it elides the means through which inertia, durability, asymmetry, extension and domination are produced (Latour 1994, 2005).

Actor-network theory has inspired several empirical studies on networks such as the role of objects in public interventions (Marres, 2012), the mediation of technology in the new tensions, resistances and inequality in access to water in Egypt (Barnes, 2012), the registry of introgression of transgenes in Mexican maize (Bonneuil et al. 2014) and the intersection of Western knowledge and other forms of knowledge between hybridisations of Chinese medicine and biomedicine (Lin and Law, 2014), among many others.

The sociologies of the south

Sociology has provided both theoretical and empirical contributions regarding the production, circulation and emergence of knowledge networks in social sciences. Here, I refer to 'sociologies of the south' as the different approaches that encompass various understandings of the unequal structure of the world scientific system, the mechanisms that perpetuate knowledge asymmetries between the global North and South and their claim for a global, more inclusive, sociology.

According to various authors, the world scientific system has a centre-periphery structure (Heilbron, 2013; Keim, 2011; Mosbah-Natanson and Gingras, 2013; Vessuri et al., 1984). However, it comprises various experiences and grades of dependency, which has motivated the appearance of concepts, such as centres in the peripheries, multi semi-peripheries or a wide range of peripheries (Heilbron, 2013). A study on the production of knowledge in scientific collaboration networks and citation patterns in the social sciences in different world regions show that article production is dominated by North America and Europe. Their position has been hegemonic for over thirty years, notwithstanding the dynamic development of social sciences in Asia and Latin America (Mosbah-Natanson and Gingras, 2013).

The centre-periphery structure has also been analysed from the perspective of the positions that researchers hold in global knowledge production structures. It has been argued that there is an international division of scientific labour, in which the academics from the South either hold subordinate and marginal positions in knowledge production structures or are relegated to the position of providers of evidence and data (Alatas, 2003; Kreimer, 2006).

Given the existence of structures that generate knowledge asymmetries in the world scientific system, discussions have emerged that draw on postcolonial debates. They aim to promote a global sociology that incorporates perspectives from the South by deconstructing the Eurocentrism in theories, methodologies, regulations and, research practices amongst journals and syllabi concerning knowledge production and circulation in networks (Gutierrez et al., 2010; Lander, 2000; Patel, 2014; Vessuri, 2014). Proposals have been made to render visible the new identities and agencies of academics from the South that contest and transcend the sole function of providing evidence for the theories of the North. The concrete proposal is to escape the identity of victims of the powerful agencies of the North (Rosa 2015: 6). The ultimate goal is to make visible the multiple agencies, convergences, identities and social processes which have also provided explanations, understandings and theories about global phenomena (Comaroff and Comaroff, 2012).

In light of this approach, studies have analysed and criticised the diffusionist model of knowledge circulation (Keim, 2011), denounced the marginalisation of the Arabic language in the world scientific system (Hanafi and Arvanitis, 2014), proposed the rise of South-South networks (Bayle, 2015), explored local and global ties in collaborative social science networks in Chile (Ramos, 2014) and reviewed the competence regimes that shape the direction of research in Latin America (Vessuri et al. 2013).

Exploring tensions in knowledge networks

Applying the aforementioned approaches, science studies have analysed networks in intensive knowledge fields such as biotechnology and nanotechnology. In recent years, numerous efforts have been made to illuminate the benefits they provide. Meanwhile, the structures, agencies and circulation mechanisms that allow for asymmetries have been analysed by social capital, actor-network theory and the sociologies of the south approaches. Particularly, the contributions from the South suggest a striving for a global sociology and localised knowledge circulation as a means to offset knowledge asymmetries.

Despite the contributions of social capital theory, actor-network theory and the sociologies of the south, knowledge network analysis in science studies developed in parallel with few points of contact. The analysis of relevant literature makes it possible to present categories that are helpful for exploring tensions in knowledge networks. These categories are related to the issues that remain to be explored in-depth in the literature on knowledge networks. Here, I present elements to discuss networks as egalitarian or hierarchical and in terms of access to resources or blockages in networks, the proposals to spatialize networks and, finally, the visions of power they entail.

Egalitarian or hierarchical networks?

The contrast of networks as social forms of organizations with market and hierarchical governance structures was widespread in the literature on knowledge networks (Powell, 1990; Powell and Smith, 1994; Williamson, 2005). From this perspective, networks are generally understood as a kind of organisation where actors experience flat hierarchies and porous borders. Thus it assumes an equality between actors who enjoy reciprocal relations. This leads to the notion that authority in networks is diffuse (Powell and Smith, 1994; Luna and Velasco, 2006) or that networks lack authority to moderate or solve disputes (Podolny and Page, 1998: 59), which greatly differentiates them from hierarchical social organisations such as the market.

Bourdieu's work on field and scientific capital explores the mechanisms that produce hierarchies and authorities in networks. He assumes the existence of an imbalance of unequal forces and a constant struggle for the monopoly of scientific authority in the scientific field. There are therefore those who dominate and those who are dominated. The former occupy the highest positions in the capital distribution structure and the latter are the newcomers in the field (Bourdieu, 1994: 137). Hierarchies are also visible in the objectivity of social mechanisms such as the sanctions of the academic market (Bourdieu and Wacquant, 2005: 134).

For Latour (1993), the production of authorities and hierarchies lies in what he calls 'the great divide' between the natural and the social world, or between the human and nonhuman. As humans exert their authority over nature more divisions arise such as: human/natural, science/technology/society, machines/social factors, modern/non-modern, among others. This 'great divide' carries with it the problem domination and exclusion (Latour, 1994: 53). According to Latour most of the features that seem to define social order such as scale, asymmetry, domination, power, hierarchy and role distribution cannot be comprehended without enrolling nonhuman actors (ibid).

For their part, the sociologies of the south analyse the mechanisms that generate knowledge asymmetries in networks. One mechanism that is widely discussed is the international publication system and its consumption, which is dominated by European and North American producers, publishing houses and journals. This has given rise to the prevalence of Eurocentric views of social phenomena (AlMaghlouth, Arvanitis, Cointet, and Hanafi, 2015; Beigel, 2014b; Ramos, 2014). A second mechanism is related to the inequitable evaluation and rewards systems based on prestige, visibility and scientific authority (Vessuri et al., 2013). These mechanisms in knowledge production and circulation condition the asymmetrical accumulation of research capabilities and the inequitable distribution of prestige (Beigel, 2014a; Keim, 2014).

A study by AlMaghlouth et al. (2015) of collaboration networks based on the analysis of a database containing 519 articles shows a clear hierarchy between three different knowledge production levels that conceptualise and debate the Arab uprisings: the so-called 'experts, informants and locals'. This work shows a hierarchy in which the third circle (locals) is comprised of authors that publish in Arabic and are relegated in the debate and in the framing of the event. Furthermore, while the local authors quote the authors located in the first circle (experts, mainly from the USA), there is no reciprocity. The informants provided the experts with information; the experts dominated the conceptualisations of and approaches to the Arab uprisings without, however, possessing knowledge or even speaking

the local language. The study also makes visible the Western strands of political and ideological normativity that prevail in the debate around the Arab uprisings.

The convergence of the approaches I have discussed (social capital theory, actor-network theory and sociologies of the south) consists precisely in the strategies they provide to make visible the existence of hierarchies and authorities through the strategies, struggles and unequal forces, agencies, actors and types of knowledge that have been excluded. Thus, authority and hierarchy production systems are implicitly at the centre of the social relations and positions that the actors sustain. This authority system works as a self-regulating mechanism that validates the knowledge that is disseminated and who is part of the network. For example, the actors, who embody a first authority system that have been entrusted with the power to validate what sort of knowledge is to be published and under which rationalities, for instance, the editorial boards in peer-reviewed publications; the agents that validate and register patents that are to be approved under certain requisites as well as the reviewers that supports project financing.

Following Bourdieu's reasoning, there are likewise authority systems based on accumulated recognition and scientific prestige. These structures, according to the sociologies of the south, are asymmetrical. The list of authorities produced by networks seems endless, since the scientific and technological field is full of authorities and, therefore, hierarchies. One could say that the network itself is a space of authority based on the validation systems it enforces who is part of the network and about what type of knowledge flows in it (Stone and Maxwell, 2005). In this regard, networks also entail processes of exclusion related to the actors that are not in the network and other types of knowledge and rationalities, which they undermine and render invisible. As authority systems are closely related to the production of hierarchies, it is difficult to imagine hierarchies being made invisible in the constitution of networks.

Access to resources or blockages in networks?

The literature on knowledge networks in science studies typically recognizes networks as coordination mechanisms where knowledge is easily transmitted. Networks facilitate access to resources (infrastructure, trust systems, economical resources, technical or theoretical information, skills and procedures, among others), while information dissemination facilitates inter-institutional learning (Powell and Stine, 2005; Sydow, 2010). Therefore, the flow of knowledge amongst actors in various areas becomes an opportunity for network innovation in the network (Etzkowitz and Leydesdorf, 2000; Leydesdorff, 2000; Pyka, 2002; Rammert, 2000).

Despite the aforementioned benefits related to the access to the resources, networks also present block access to these resources. Social capital theory offers strategies for overcoming such hindrances. In this perspective, studies on networks that go beyond focusing on the benefits of social capital have addressed this issue, such as the one related to Brazilian immigration in Amsterdam (Roggeveen and Meeteren van, 2013). The study presents evidence concerning the potentially negative role that legal status, class and educational level immigrants play in determining their access to the community's social capital.

The sociologies of the south, on the other hand, discuss the structures that impair the flow of knowledge from South to North (AlMaghlouth et al., 2015; Beigel, 2014b; Connell, 2013; Ramos, 2014). Beigel (2014b), for example, analyses the performance of Latin American publishing vis-à-vis the four circuits of the world academic system: the international publication circuit, dominated by the big publishing houses; the transnational networks and regional repositories of open access circuit; the regional circuits of the South; and the national circuits based on local publications. Through his evaluation of academics competing for research positions in Argentina, the author shows that knowledge circuits are segmented due to the hierarchies of the world scientific system and the local structures and professionalization histories. She identifies a triple hierarchy based on institutions, disciplines and the language of publications that block the circulation of knowledge in the networks.

On the other hand, the actor-network theory explores the agency distributed between the human and nonhuman actors to render visible who is included in the networks, who locates and who is located (Latour, 2005). From this perspective, studies have documented how in one transnational knowledge network between Mexico and the USA, the processes for accessing the infrastructure, knowledge and information resources from the network have to be negotiated by each individual research project (Suarez and Dutrénit, 2015). Even though the actors are part of a network, for each research project they have to negotiate and clearly lay out the way the information will flow, the sort of equipment that will be used, who will exploit the benefits of copyright and property rights and any possible industrial applications. As a consequence, the access or blockage to resources in networks is constantly changing. Thus, along with taking into account the role that nonhuman actors (such as scientific laboratories) play in technoscientific circulation process, the material analysis of social links also renders blockages in networks visible

Spatializing networks

A more balanced knowledge network analysis further requires spatializing networks by locating them in their specific context and the logics at work across them. The focus on network dynamics explains why networks are analysed in science studies as an autonomous field of relations (Luna and Velasco, 2006) and why more attention is paid to links in the network while the way in which social space produces networks or how networks determine the production of space is insufficiently discussed. This literature has paid little attention to the context in which networks emerge compared to the trajectory of the relations that sustain them, which means that networks are analysed as delocalised entities. Studies range from taking a reductive approach toward social relations to considering what is happening in the network, without explaining in detail the context in which networks are framed and the logics that shape them (Kreimer and Jean-Baptiste, 2008). In most cases, when networks are analysed authors do not discuss how they came to be or how they are conditioned by local space. Nor do they address how local space itself is produced or how it is conditioned by global connections and translations. The view that networks are social organisations that are external, unsituated, unlinked and independent from the social space in which they emerge is prevalent. Thus, an intersection of the contributions of social capital theory, actor-network theory and the sociologies of the south provides a means for spatializing and situate networks.

Bourdieu's conceptual proposal revolves around the notion of a social field and the capital distribution structure of agents. Latour's proposal, however, is of a more operative nature with regard to situating relations: 'localising the global, redistributing the local and connecting sites'. This expands the spectrum of social relations from the geographic containers (locality, sector, or region) to which they have been restricted by problematising their global connections and determinants. In this manner, networks and their agencies can emerge and overlap in a spectrum of spatial connections (translocal, transregional and transnational), as shown in the studies on transnational knowledge networks in India (Philip, 2008) or in the ethnic enclaves and transnational Cuban migration communities in the USA (Portes, 2010).

Besides localising local and global ties in networks, the proposal of the sociologies of the south analyses their field of action, the unequal distribution of capital and contextualises networks through a detailed analysis of the structures and mechanisms that produce asymmetries in them. It calls for a global sociology by locating power relations at play in South to North knowledge circulation. Connell (2014, 2015), for example, points out that despite the steps taken towards a global gender sociology expressed in the emergence of collaboration networks, as well as greater knowledge flows, it is metropolitan thinking that still provides the theoretical frameworks for approaching gender. Gender sociology from the South is relegated, as reflected in the main international journals, where most of the articles come from North American and European institutions. Connell attributes this bias to recognition and knowledge circulation issues, not to a knowledge production deficit in the South. She urges us to conceive a new vision of gender theory that is really global and inclusive and goes beyond perceiving the experiences of the South with paradigms from from the North. Furthermore, Connell argues that theoretical contributions from the South can explain North dynamics.

A narrow vision of power in knowledge networks

The limitations regarding the discussion of power in knowledge networks have to do with the fact that power is analysed as something external to the actors and dependent on the number of connections they have (Cook, 1983; Davern, 1997; Knoke, 1994). There is thus a narrow vision of power in knowledge networks, for it is regarded as dependent on the resources and connections of each actor. This leads to the false idea that actors who are not well-connected are powerless or are passive in the network.

Actor-network theory explores new sources of power and legitimisation by associating human and nonhuman actors. Power relations according to Callon (1995: 278) are rendered visible in the description process of how actors are defined, associated and simultaneously obliged to remain faithful to their alliances and, above all, how a few actors have the right to express and represent the numerous silent actors of the natural and social worlds that have been mobilised in a network. Along the same lines, for Latour (1986), power lies in the action of displacing, transforming, translating and reconverting. In his view, power is a movement that must be explained and not a concept that can be used to designate something (Latour, 2005). Thus, for any actor to exercise power, what matters is not the resources s/he has or her/his position in the network, but her/his agency in mobilising, translating and, indeed, in acting.

For Bourdieu, on the other hand, the sources of power are associated to the different types of capital. For instance, capital accumulation and recombination turn into new forms of power. As a result, struggles arise to keep or preserve the balance in the capital distribution structure. However, the strategies of an agent not only depend of the amount and structure of his capital at any given moment. They are also a product of his social trajectory and the dispositions (*habitus*) constituted in the relation with a determined distribution of probabilities (Bourdieu and Wacquant, 2005: 153).

The sociologies of the south not only analyse power structures, the unequal distribution of capitals and agencies and the mechanisms by which knowledge asymmetries are perpetuated. They also analyse the geopolitics of knowledge by problematizing the positions from which power in knowledge is exerted and legitimised. Moreover, the sociologies of the south propose rendering visible not only the agencies of the South, beyond the provision of data for the theories of the North (Comaroff and Comaroff, 2012; Connell, 2013), but also the complicity strategies in the reproduction of knowledge asymmetries (Rodriguez, 2014). They conceive of the South as a site of knowledge production that also defies hegemonic power by means of turning the North-to-South knowledge flows in the networks in the opposite direction. Keim (2011), for example, drawing on a case study of South African Labour studies, proposes a counter-hegemonic sociology. Here, she analyses the historical development of the discipline, while addressing its public and political impact and its recent professionalisation and internationalisation. The idea of a counter-hegemonic science is related to the rise and integration of scientific communities as well as the new generation of academics in close interaction with society.

Discussion: exploring tensions in networks

The four categories proposed in this article (hierarchies and authorities, discussion of blockages and the need to spatialize networks and discuss them from a broad view of power) make it possible to identify convergences and divergences in the approaches of social capital theory, actor-network theory and the sociologies of the south and thus to explore tensions in knowledge networks in social science studies.

The first convergence is related to the existence of hierarchical networks. Both actor-network theory and social capital theory, as well as the sociologies of the south, provide tools to explore tensions in the idea of egalitarian networks. While for actor-network theory the 'great divide' between humans/nonhumans explains differences and asymmetries, social capital emphasizes the unequal capital structure and the struggle for scientific authority. The sociologies of the south, on the other hand, stress the knowledge hierarchies that leave out the different types of knowledge.

The second convergence is related to knowledge flow blockages in networks. Social capital theory focuses on the types of affiliation and the access to sources to accumulate social capital or to block it. On the other hand, actor-network theory focuses on the role that objects play in alleviating blockages in knowledge flows. The sociologies of the south underline the existence of segmented knowledge circuits that materialise as blockages in knowledge flows. These approaches go beyond merely highlighting the benefits of networks as platforms where knowledge is produced and transmitted. They also provide space for

discussing the existence of access points and blockages in networks and of structures that block the flow of knowledge coming from the South.

The divergences between the three perspectives lie in the subject of network spatialization and the discussion of power in networks. Social capital theory proposes the analysis of the social field and the capital distribution structure to spatialize and analyse power relations. Actor-network theory centres on associations of human and nonhuman and on situating local and global connections. The contributions from the sociologies of the south give priority to discussing both structures and agencies. They render visible unequal structures and, at the same time, reflect on the dominance of the agencies from the North in the conceptualisation and approach to global social phenomena. They also analyse the agencies from the South itself that bring global power relations into being. Furthermore, the sociologies of the south have conceptualised and analysed counter-hegemonic power flows through empirical case studies.

Without a doubt, the greatest divergence between the three approaches is related to the category of power, specifically the tension between structure and agency. For social capital theory, structures both explain and shape power relations. By contrast, actor-network theory focuses on transcending structure and agency dichotomies through the association of heterogeneous actors. According to Latour, scientific objects can explain the social, but not the other way around. Latour's argument to enrol this sort of actor lies in the critique that he himself makes to the sociology of science, namely that it limits itself to analysing career patterns, institutions, ethics, public comprehension, rewards, legal dispute systems and some of its relations and scientific facts. In his opinion, 'objective scientific' explanations – meaning the natural sciences, their laboratories and artefacts – have always presented themselves as too hard, too technical, too real, too eternal and too remote from human and social interest (Latour, 2005: 95).

While, for Bourdieu (2001), Latour's (1986) laboratory ethnography did not really explain power structures, Latour contends that there is not a structuralist explanation to approach a phenomenon. He proposes following the actors in order trace sturdy relations and to discover more revealing patterns by finding a way to register the links between unstable and changing frames of reference in terms on how the social is generated (2005: 24). Similarly, whereas actor-network theory tries to go beyond the classic structure/agency dichotomy, social structures are a fundamental form of scientific capital in explaining power struggles and relations. Nevertheless, Bourdieu's concept of habitus –as an open system of dispositions constantly subjected to experiences, constantly affected by them to reinforce or modify the structures themselves (Bourdieu and Wacquant, 2005: 195) – reduces the distance in the divergence between both approaches. Latour himself regards 'habitus' as an excellent concept and equates it with the concept of agency (1994: 51).

The sociologies of the south similarly articulate the limits of Bourdieu's work. The first critique relates to the limitations of assuming the fields of production and reception are national, whereby international is explained as an extension of the national (Keim, 2014: 4). The second is related to the assumption that national contexts are not altered by knowledge circulation (ibidem). The third criticism is related to the need to integrate other regional reference frameworks, supranational financing, institutionalisation mechanisms and transnational networks that transcend institutions and government agents (Wagner, 2008).

There is also a criticism related to the absence of a discussion about the role that materiality plays in social interactions (Rodríguez, 2014: 16). In view of all of these limitations, the sociologies of the south highlight the need to analyse networks from peripheral and non-privileged positions from which hierarchies and power relations that cross processes can be made visible (Keim, 2014; Rodríguez, 2014).

In spite of these divergences, some scholars have attempted to build bridges of dialogue between Bourdieu's contributions and actor-network theory. Rodríguez, for example, reconciles both theories by altering the notions of capital and field in light of the ideas from actor-network theory. The result of this dialogue is a revised proposal of the concept of field that differentiates between institutionalised fields and scientific network fields (2014: 16). The scientific network field makes it possible to render visible the agencies and informal mechanisms that organise science in the global South. This proposal also aligns with Wagner's (2008) suggestion that networks can be thought of as an invisible school with unwritten laws. Rodríguez further makes visible the agency of academics from the South by describing the strategies by which they appropriate knowledge from the centre fields to structure their careers. Following the proposal of actor-network theory, these strategies are understood as a translation. Academics also incorporate new elements such as books, articles and conferences into the networks to strengthen their position in the local realms of the scientific field. Both Wagner (2008) and Rodríguez (2014) emphasize that academics in the South are far from being passive actors in the networks and thus point out that exchanges do not always imply academic dependency.

Other authors have built bridges of dialogue between actor-network theory and the sociologies of the south (Go, 2013; Rosa, 2015; Yehia, 2007). Rosa, for example, argues that incorporating some aspects of actor-network theory could help the sociologies of the south to produce ontologies and agencies that are not yet part of the traditional focus of sociology (2015: 2). The social then must not be seen as a stable arrangement, but as a movement of associations and multiple perspectives.

Dynamically asymmetric knowledge networks: towards a future research agenda

Now that we have identified the convergences and divergences between network-author theory, social capital theory and the sociologies of the south in order to explore the tensions in knowledge networks and countered the emphasis that has been placed on their benefits, another step becomes necessary. Specifically, we must identify the main challenges for a future knowledge networks research agenda. Despite the convergences, we can observe a fragmentation in the literature about knowledge networks with few points of contact. The fragmentation shows a gap between the contributions related to knowledge networks in the natural sciences and knowledge networks in the social sciences. While science and technology studies have focused on power relations by giving a central position to the role of objects and technologies according to an actor-network theoretical approach to technoscientific networks, the contributions from Bourdieu and the sociologies of the south have been discussed and extended to analyse knowledge circulation in different fields of the social sciences.

The various remarks on knowledge networks literature discussed so far clearly point to the need for a new framework that addresses the challenges for a future research agenda. I

propose, therefore, a notion of knowledge networks with a dynamic movement of asymmetries where it is not enough to identify the global power structures that turn into blockages for the flow of knowledge. It is also not enough to visibilize the agencies of the actors from the South who, through their local and global complicities, bring into existence power relations that follow the interests of their own agenda, as it is argued by the sociologies of the south. Rather, it is necessary to transcend the global North/South and centre/periphery dichotomies, as well as the categories of dependency and counter-hegemony. We can do this by highlighting the dynamic, multiple and constantly moving agencies of the actors that bring networks to life. Recognizing multiplicity in networks would thus make it possible to show the simultaneous existence of collaborations, conflicts, interactions and distances in a network (I. Wagner, 2006).

This means that knowledge networks that emerge and converge from the global South have actors sustaining multiple agencies. A global South actor that in a specific project exerts more power (in Latour's terms of translating, assembling and mobilising), in another project changes his position dynamically in the network. For example, a researcher's performance in a technoscientific project in which he produces counter-hegemonic knowledge changes the direction of knowledge flows from North-South to South-North. However, in another project, the same actor might reinforce the scientific dependency by translating discourses from the global North to benefit and restructure his career at a local level. As a consequence, knowledge flows or blockages in a network do not reflect a continuum but constitute access points or blockage points that are under constant negotiation, depending on the actors' strategies and interests. For this reason, the category of asymmetry discussed here can articulate the constant movement and multiplicity in the interactions in global North and South scientific relations.

This shift paves the way to thinking about networks as being under constant negotiation and contestation. Thus, the nodes with the most power in a network are dynamic and changing according to certain sub-fields of knowledge or specific on-going research projects. Asymmetries are produced due to the hierarchies, authority systems and determinants of the global logic in which they are inscribed and due to the reproduction of asymmetries at a local level where they are based. As a result, networks simultaneously produce and reproduce asymmetries, but they also feed off them.

It needs to be clarified that the category of asymmetry does not have a negative connotation or indicate a fixed tendency of the movement. The category is apposite, since it allows us to visualise the complexity as scales in a balance that are constantly changing their inclination. These asymmetries are also made visible in the agentive role played by laboratories and scientific infrastructure, which moreover serve as objects that incorporate power and give status and, therefore, help to configure more powerful nodes implicit in authority systems, hierarchies and even scientific identities.

Under this new perspective – one that dialogues with and brings closer the fragmented theoretical positions of knowledge networks – a network contains different power nodes and, at the same time, it always reproduces asymmetries because of the hierarchical relations and the authority systems it has to serve. Analysing only what happens in the network would mean to despatialize the network, to abstract it from its particular context and to fall in the trap of focusing solely on the benefits it provides. The category of asymmetry explains the

evidence in a more plausible manner, for it allows us to understand the scientific relations between the global North and South, which are in constant movement. This dynamic allows us to understand the multiple contradictions, hybridisations and tensions that take place in the same network. Therefore, in order to devise the future research agenda, it is necessary to discuss the ways in which theoretical and methodological frameworks, in the light of the various contributions that exist already, are going to be able to account for these processes of constant struggle and negotiation.

In the future, we not only need to analyse more in-depth the contributions of the sociologies of the south to provide elements to think about counter-hegemonic knowledge and render visible the agencies and complicities that bring about power asymmetries. We also have to allow for approaches related to the dynamic power movements of the actors both in the North and South networks and their multiple positionings. Specifically, in order to transcend the South/North dichotomy, it is necessary to explore the asymmetries that are produced in South/South or North/North networks or to look for new categories to analyse the intermediate positions between technoscientific dependency and counter-hegemony in order to render visible the multiple and contradictory positions of the South in the North or of the North in the South.

Finally, another challenge that the future research agenda on knowledge networks faces is related to methodology. Knowledge networks in science studies were based on statistical analysis, econometrics and case studies. At the same time, the social capital and actor-network theory approaches have relied on extensive ethnographic accounts. On the other hand, the sociologies of the south have privileged hybrid methods (publication analysis, ethnographies and case studies). Future research on knowledge networks will surely be confronted with a challenge in the convergence of methodologies. The biggest difficulty in the future will be to allow for greater dialog between different methodological perspectives to analyse the materiality of networks, not only in texts, books and journals, but also in technological artefacts and digital media. Indeed, interest will only increase in media studies, big data and algorithms, as well as in networks to analyse digital culture.

As the elements we have identified in this article show, knowledge networks will necessarily continue to be analysed as processes of constant negotiation and contestation that are subject to the adjustments and maladjustments of social processes in their wider contexts. In summary, the main challenge is to analyse knowledge networks as complex global organisations, which, in spite of the benefits they provide, also produce highly dynamic tensions as a result of an ever greater connection between growing and diverse network contributions.

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Footnotes:

1. Also called the sociology of science. See Latour (2005)
2. In this regard, Grossetti (2007), points out that the social structure of the object of study cannot be reduced to a network or diverse social relations reduced to a single tie, leaving out other forms of social organisation.
3. The idea of South that I will follow in this article is in line with Santos' metaphor (Santos and Gandarilla, 2009: 10) the geographical global South, the South that also exists in the geographical global North, the Imperial South that contains not only the systematic suffering caused by global colonialism and capitalism but also the local practices complicit with them and, finally, the anti imperial South.
4. Some literature dialogues with Latour's ideas about the importance of artefacts in the decodification of power and its consequences, for example: machines as the measure of men (Adas, 1990), machines as codifiers of certain forms of power and authority (Langdon, 1992), machines as the index of civilisation (Escobar, 1994) and artefacts as a discursive, material and agency practice (Barad, 2007).
5. See, for example, Bourdieu, P., 2001. El oficio del científico. *Ciencia de la ciencia y reflexividad*, Barcelona: Anagrama, from page 51.

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