

STS in a (Post)Socialist Context

Science and Technology Studies in Croatia

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Abstract This paper presents an outline of science and technology studies (STS) in Croatia in both the socialist period and the transitional (or post-socialist) period. Introductory remarks delineate the social and intellectual context of Croatian STS in both observed periods. A brief sketch of early STS follows - primarily philosophical, historical and economic studies. The central section of the article is a presentation of Croatian sociological studies of science and technology from the early eighties until the present. The interdisciplinary issue of Croatian STS is discussed in the conclusions.

Keywords: Science and technology studies; Croatia; socialist period; transitional/post-socialist period; interdisciplinarity.

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I. Introduction: Social and Intellectual Frames

The presentation of science and technology studies (STS) in a particular country/society, rests on the presumption that this scientific field is precisely defined, which may be questionable. Two different publications, an older qualitative book chapter and a recent quantitative journal paper, claim that two distinct research streams have been simultaneously growing apart in this field - qualitative and quantitative science and technology studies (Edge 1995; Martin *et al.* 2012). The authors, contrary to more exclusive views, classify both streams in the same field: science and technology studies. Moreover, Edge (1995) pronounced and observed the beginnings of their creative reconciliation. Such a view, acknowledging the heterogeneity of the observed field, also underpins this paper on Croatian science and technology studies. The theoretical and methodological implications of that standpoint are reflected in the coverage, range and selection of the S&T studies analysed. Due to the author's own professional profile and interest, sociological studies of science and technology are the main subject of this analysis.

In line with the importance of the social framework of any meta-analysis of science and with the STS theoretical and methodological credo, the social and intellectual context of Croatian science and technology studies has to be delineated, even for a well-informed reader. A more relevant reason for this background is that in STS literature the specificities of post-socialist, transitional countries are often neglected and overlooked, in both a theoretical and an empirical sense. Theoretical models, such as post-academic science (Ziman 1996), the new mode of knowledge production (Gibbons *et al.* 1997), triple helix (Etzkowitz and Leydesdorf 1998), academic capitalism (Slaughter and Leslie 1997), and science in the agora (Nowotny *et al.* 2003) have been identified in the social and techno-scientific context of the most powerful economies, of comparatively huge investments in R&D and of competitive research systems. Therefore, these models are not theoretically appropriate for S&T studies in socio-culturally, politically, economically and techno-scientifically different, post-socialist societies (Prpić 2007), nor they are necessarily very inspiring for empirical verification in those societies.

The social context of Croatian STS should be described according to its three most relevant features. The first is basic and refers to the dominant characteristics of Croatian society in the socialist and post-socialist periods. The second concerns the intellectual, scientific and ideological influences on science, especially on social sciences and the humanities, and consequently on the development of STS in Croatia. The third operates at the mezzo societal level and is connected with the characteristics of the Croatian research system in both periods.

The broadest social and intellectual context of Croatian studies of science and technology in the second half of the twentieth century was to the highest degree formed by the socialist political and economic system in ex-Yugoslavia, which was not under Soviet control and consequently less oppressive and more liberal (Steindorff 2006; Goldstein 2011). In comparison with other socialist countries, the Yugoslav political and economic system was generally much more open to the developed Western countries and their cultural and intellectual influences, which was particularly important for the development of science and technology and STS.

At the same time, the specificities of the economic and socio-cultural development of Croatia also had an important impact on its scientific and techno-economic development. Croatia was the second economically most developed federal state. Due to the influx of foreign tourists into the country and the massive manpower emigration from it, Croatia had the most intensive communication with Western countries. There were also traditional intellectual and scientific ties with Austria, Germany and Italy, where the Croatian intellectual elite was educated for centuries before, but also after the establishment of Zagreb University in the seventeenth century.

At the beginning of the nineteen-nineties, the dominant social frame-

work was radically changed as a result of the political independence of Croatia and its social, economic and political transition towards a capitalist and democratic system. The transformation of Croatian society began in worse social, economic and political conditions than in most other post-socialist countries. It was characterised by the destruction of war, the collapse of economic activities, socially irresponsible and problematic privatization, and the formal democratization of the political system (Županov 1995). The social, economic and political consequences of these processes, in spite of the improvements in all spheres of life, are still felt in Croatian society.

The broadest socio-cultural context, especially the value orientations of the Croatian population, also changed over that long period of time, but it remained essentially dualistic. In spite of the differences between the value orientations of the population as a whole and its social elite, they show combinations of traditional and modern values (Hodžić 2002; Labus 2005; Sekulić 2011).

The intellectual background of Croatian social sciences (especially sociology) and S&T studies has also been changing during the (post)socialist period. One could agree with the claim that in 'the entire socialist period, sociology was marked by a Marxist perspective of social philosophy and critical social theory' (Tomić-Koludrović 2009, 154). However, there was a significant difference between the dogmatic Marxism that was characteristic for other socialist countries and the so-called creative Marxism which included some social criticism.

(Non)Marxist social science theories and approaches were also taught at Croatian universities, and there was tolerance towards many empirical studies that were inspired by such, especially narrow or middle-ranged theories.¹ Therefore one could not decisively claim that all social science research and output was ideologically impregnated or that sociology was just a "legitimising science", and that empirical research was dominated by a "positivist approach" (Tomić-Koludrović 2009, 162, 158). Naturally, the theoretical and methodological pluralism in social sciences have been fully promoted in the intellectually much more stimulating post-socialist years.

The Croatian/Yugoslav research system most certainly shared some essential features with other socialist countries – it was not competitive, it was dependent on public/state funding, and its industrial R&D was rather underdeveloped (Šporer 2004; Radošević 2004). It also showed some comparatively significant differences from those systems. It was not based on the Soviet tripartite model of science organisation, it was considerably less funded (and consequently not as hypertrophied), less centralized and more open to international scientific communication (Prpić 2007).

¹ An analysis of sociologists' Ph.D. theses, for example, found that Croatian women sociologists more frequently carried out this kind of (non-ideological) research for their doctoral theses than their male colleagues (Lažnjak 1990).

Generally, the changes of the research systems of transitional countries have been difficult because of the lack of the appropriate institutions and instruments: primarily developed market economies and independent scientific communities (Šporer 2004). Most of them introduced competitive and decentralised systems of research funding and evaluation (Frankel and Cave 1997). The Croatian research system was also subjected to deep structural changes in the post-socialist period, but some of them had undesirable outcomes. One of them was the devastation of industrial R&D, manifested in a drastic reduction in research personnel in industrial institutes and units (Prpić 2002).

Contrary to most post-socialist countries, whose research systems underwent decentralisation of decision making, the Croatian system has been centralised (Prpić 2007). As a consequence of this process, the autonomy of scientific organizations, particularly public institutes, has been decreasing. The influence of Croatian scientific community (even suggestions and policy proposals) does not seem to be important in scientific policy-making and implementation, which indicates that the real interest of the political elite in science and technology studies, as a policy basis, might also be weak.

To conclude, these specificities of the Croatian social and intellectual context compared to the other socialist countries, but also to other Yugoslav states, create the framework for meta-analysis and an understanding of the character, development and scope of Croatian science and technology studies.

2. Early STS: The Predominance of Philosophical, Historical and Economic Studies

Though philosophical and historical studies of science have a longer history in Croatia, the interest in science studies intensified in the nineteen-sixties and particularly in the nineteen-seventies. It was related to a global interest in science following the II World War, especially interest in the science of science, which was developing at the time in both the Western and the Eastern world (de Solla Price 1963; Dobrov 1969).

The early development of STS in Croatia was at the same time similar and distinctive in comparison with global patterns. Thanks to the intensive communication between Croatian natural scientists and the international scientific community, they were the first to focus on the philosophical, historical, quantitative and policy issues of scientific development in Croatia (Yugoslavia). The echoes of Kuhn's famous book on scientific revolutions were also of great interest to social scientists and humanists. Interest in studying science was not just a reflex of the international intellectual stream. It was also reinforced by the Croatian/Yugoslav social context, especially the economic and political liberalization in the sixties, which needed theoretical and pragmatic answers, and by the dominant

(Marxist) ideology and its concept of science and technology as a driving force of economic and social development.

Philosophy and history of science as traditional disciplines were given a new stimulus with the establishment of two specialized journals that had Yugoslav character but were published in Croatia: *Encyclopaedia moderna* (1966-1976) and *Scientia (Yugoslavica)* (1975-91). These journals were also open to the quantitative and bibliometric aspects of science, to science policy issues as well as popular topics of scientific and technological progress. Apart from these thematically specialized journals, papers on science and technology issues were also published in philosophical and historical journals, natural science and biomedical journals, general social science journals, as well as disciplinary (sociological, economic, political and information science) journals. Books, of course, have always been an esteemed form of publications in the S&T field. According to a complete bibliography of publications about science and technology from the fifties to 1985, almost 6000 books and papers were published in the former Yugoslavia (Milinković 1989). Although the bibliography includes translations of foreign authors' books and some selected newspaper articles by scientists, it still indicates the considerable interest of scientists in science and technology topics and shows their publication productivity on those topics during the socialist period.

The sixties and seventies were a period when philosophers, historians, political scientists, and economists were predominant among Croatian S&T researchers. There were also some natural scientists and scientists from other hard disciplines interested in quantitative analyses of science, primarily in S&T indicators and the use of citation analysis as an evaluative tool. Croatian sociologists began to join those specialized or occasional researchers in this field more intensively in the seventies.

Therefore, from the beginning there was parallelism between the two basic STS orientations based on qualitative and quantitative research. The former was preferred mostly by philosophers and historians of science (Supek 1964, 1974; Lelas 1969, 1979; Dadić 1962, 1975). The second was used by natural and information scientists (Maričić 1977; Ružić 1978; Težak 1976) and economists mostly, but not exclusively, interested in technoscientific progress and technology transfer (Mesarić 1969; Dubravčić 1970; Lang and Kanceljak 1975). Both orientations have continued until the present, particularly in philosophical and historical studies of science (Lelas 1990; Paušek-Baždar 1994; Dadić 2000; Kutleša 2007) and scientometric analyses (Šlaus 1980; Lacković *et al.* 1991; Trinajstić 1993; Klaić 1995). However, the foci of quantitative information and economic studies of science have shifted towards new social challenges. Information science has turned to comprehensive and long-term bibliometric comparisons of productivity in numerous (all) fields and whole scientific areas (Jokić *et al.* 2010; Macan *et al.* 2012). On the other hand, economic studies of S&T have focused on innovations (Aralica *et al.* 2008; Radas and Božić 2009; Radas and Anić, 2013).

The development of these disciplinary studies partially corroborates S&T analysts' claim that a tradition of scientometric, philosophical and historical studies of science was present in ex-socialist countries, which was not the case with the sociology of science or scientific knowledge (Balázs *et al.* 1995). The exception was Poland, with a long tradition of sociological studies of science. Ex-Yugoslavia and Croatia became another exception².

3. The Sociological Turning Point in STS: the (Post)Socialist Decades.

Two kinds of Croatian sociological studies of science (and technology) appeared in the seventies – theoretical studies of scientific knowledge and of science (Marušić 1970, 1971; Šušnjić 1973/1982) and descriptive (social) studies relating to Croatian research personnel based on empirical investigations by the Institute for Social Research in Zagreb (Korićančić 1972; Previšić 1975; Benc *et al.* 1979)³.

The Institute was the first scientific organization in Croatia to initiate, start and organize systematic (empirical) research in the sociology of science and technology at the end of the seventies and the beginning of the eighties. At first, the Institute's engagement in the field was policy oriented, that is, it focused on the empirical analyses of the financial, institutional and personnel potential of science in Croatia/Yugoslavia as the bases of public/state plans for R&D development. Social, economic and techno-scientific development planning was obligatory in the socialist period, with the (ideological) aim of avoiding the chaotic effects of economic and social processes in the capitalist world.

The Institute even became a Yugoslav focal-point for this type of applicative research in the S&T field, but by the mid-eighties it became clear that neither exclusive policy orientation nor purely theoretical or empiricist orientation alone could offer a deeper understanding of the social roots, aspects and impacts of science and technology. Therefore the Institute's team of sociologists began to take interest in theory driven empirical investigations, covering three broader STS themes: a) the social role of science and science policy; b) the science system and scientific potential and profession; c) technological development and innovations.

This research agenda had its intellectual foundations in crucial con-

² The most well known and productive sociologist of science in the former Yugoslavia was Vojin Milić, who also wrote a well-known overview of sociology of science in co-authorship with Mulkay (Mulkay and Milić 1980).

³ Đuro Šušnjić was already an eminent researcher in STS when he came to the Institute for Social Research in Zagreb, where he was employed for more than a decade. His contribution to the development of sociology of science in Croatia was significant, especially in science system studies (Šušnjić 1988).

temporary techno-scientific issues, but it was also related to the problems of Croatian (Yugoslav) society in the late socialist period. In the late seventies and early eighties, the political elite (particularly the scientific establishment) tried to solve the long-term problems of the inefficient socialist economy and social development through intensification of S&T development, especially in Croatia, whose investments in R&D were even lower than the Yugoslav average (Petak 1991). Therefore the power elites were prone to finance S&T studies regularly (but not generously) in order to get some answers from them. At the same time, they were not willing to apply the STS findings since they implied radical economic and social changes.

Regarding theoretical orientation, Croatian sociological studies of science were not inspired by Merton's approach. The theoretical frameworks of empirical studies were, depending on their subject, derived from the relevant sociological theories, such as the theories of technological change, of social capital, of organizations, of professions, of brain drain, of gender and others.

A seminal sociological theory of science, the organizational theory of sciences or scientific fields (Whitley 1984) or the theory of scientific organizations (Fuchs 1992) was seen as the most promising theoretical framework. Its heuristic value for sociological studies of science was recognized in the postulated plurality and variety of the mutual dependency of the social and intellectual organization of different sciences. The impact of national science systems was presumed even before Whitley pointed it out in the introduction to the second edition of the book (2000) and in his recent work (Whitley 2007, 2010). The compatibility and complementarity of this theory with other relevant theories of science, the theory of disciplinary cultures (Becher and Trowler 2001) and the theory of scientific field (Bourdieu 1991, 2004) was also its great advantage as a source of hypotheses in the subsequent empirical research.

In the eighties, S&T research by the Institute's team was focused on the topics and issues of contemporary scientific and social relevance, both local and broader. Since the sociological studies of S&T were a new research field, there were no previous empirical insights into the local R&D characteristics and output. In addition to science policy issues, the main research problems arose from the late socialist social and techno-scientific context, which was showing systemic problems in its techno-economic and research performance and productivity.

International comparisons of Yugoslav/Croatian science indicators, especially of R&D funding and personnel, were crucial for establishing the place of national research system in global trends, while analytical overviews of science potential in Yugoslavia and its federal units had policy significance (Petak 1980, 1981). Empirical research into innovation activities by Croatian industrial organizations was carried out in order to understand the determinants of (unsatisfactory) technological development based on the import of foreign technologies (Čengić *et al.* 1990,

1991). The most relevant characteristics of science organization and potential in Croatia were analysed in the studies of the professional differentiation in science, of the recruiting and renewal of research personnel, of researchers' professional and other activities (time budget), and in the studies of scientists' migration abroad - the brain drain (Prpić 1989, 1990; Golub 1985, 1988).

With the political and social transformation of post-Yugoslav federal units which started at the beginning of the nineties, the relevant research issues shifted towards the problems of a transitional social and techno-scientific system. Deep political, economic and social changes transferred the stress to the transforming of pseudo-egalitarian, non-selective and inefficient science and techno-economic systems towards competitive, productive and efficient (sub)systems. Unfortunately, a limiting factor for STS in this challenging "social experiment situation" was the extremely low level of funding, resulting in very restricted possibilities for empirical investigations.

S&T policy studies turned to a comparative analysis of the main models of financing scientific research and experimental development, in order to establish a new Croatian funding system (Petak 1991). Research into technological development was primarily oriented to the process of privatization as an essential precondition of techno-economic development in a post-socialist society, and to the technological modernization of Croatian enterprises (Čengić 1996, 2000). The third line of research was focused on the real and potential actors of Croatian scientific and technological development. Therefore scientists' performance, including their productivity predictors, was studied, as well as their professional ethics, at both a value and a conduct level (Prpić 1994, 1996, 1998). Empirical investigations also dealt with the real and potential drain of scientists abroad and the social reproduction of the scientific elite (Golub 1996, 1998), and with the characteristics and values of the managerial elite (Krištofić 1999; Čengić 2000).

Relatively recent sociological studies of S&T show continuity in the new millennium, but they have also included new STS topics. The research continuity of STS is a stable orientation of these studies, at least at the Institute. Its scientific and social roots are related to the nature of social phenomena and the cognitive advantages of accumulating a comparative dataset from various investigations in order to study S&T changes and their trends. On the other hand, new topics and issues in Croatian S&T research have been inspired by the most interesting STS mainstream themes and by new or unsolved problems of national R&D development, especially those connected with evaluation system and the relationship between science and society.

As a result of this orientation to the continuity and novelty of research topics, in the last decade sociological studies of S&T have continued to investigate the deeper and wider aspects of scientists' ethics, the brain drain and waste, women scientists and young researchers, and the science

system and research personnel development (Golub 2005, 2010; Prpić 2002a, 2002b, 2005; Golub and Šuljok 2005; Brajdić Vuković 2012). At the same time, new research themes have dealt with a comparison of knowledge production in the natural and social sciences and a special accent has been on social science output (Prpić 2009; Prpić and Petrović 2011). A new research topic has also focused on perceptions of science by the Croatian public and the social elite - politicians, top managers and scientists (Golub 2009; Prpić 2011) and the media presentations of science (Šuljok 2011; Šuljok and Brajdić Vuković, 2013).

Although the Institute for Social Research was for a long time the only scientific organization in Croatia to continuously develop systematic (empirical) research into S&T, studies of S&T have also been undertaken by a few sociologists from other scientific institutions. Some of these studies have dealt with mainstream philosophical and sociological topics, such as genetic technology and eugenics (Polšek and Pavelić 1999; Polšek 2004) or science wars (Polšek 2009; Matić 2001) and SSK - sociology of scientific knowledge (Matić 1997). Other studies have been focused on the Croatian science and higher education system, the innovation system and the knowledge society (Polšek 1998, 2003; Švarc et al. 2004; Afrić *et al.* 2011).

Most studies of the latter type have been carried out at the Institute of Social Sciences Ivo Pilar, which is becoming the second institutional centre in Croatia for sociological studies of S&T, especially for innovation studies focused on the national innovation system and policy within the Croatian socio-economic environment (Švarc 2009, 2006; Švarc *et al.* 2009; Lažnjak *et al.* 2011; Bečić and Švarc, 2012).

Whatever their topics and theoretical approach and wherever it is conducted, the most valuable common trait of Croatian sociological studies of science and technology is that they have been trying to develop and preserve a critical approach to the social context of science and technology in both the socio-historical systems of Croatian society – the socialist and the transitional, post-socialist context.

4. Interdisciplinarity in Croatian STS: A Feasible Perspective or an Illusion?

Different disciplinary approaches in Croatian STS have not led to interdisciplinary research into S&T. There was an attempt in the second half of the eighties (1986-1990) to connect research into science (and technology) and researchers from various disciplines and institutions in a mega-project on science, called *Bases of long-term R&D development* (Petak 2004). Yet it did not result in true interdisciplinary studies, but was rather a mechanical agglomerate of various scientific investigations or sub-projects. Some of them focused on the philosophy and history of science (in Croatia), some were preoccupied by scientometric and biblio-

metric analyses of biomedicine and/or natural disciplines, some dealt with the economic aspects of technological change and development, while others were interested in sociological studies of S&T.

Although it is not my intention to analyse the (inter)disciplinarity of the Croatian STS, fragmentation, as observed by Martin and co-authors (2012), also seems to be an appropriate description of the Croatian case. Contrary to the thesis that local orientation generates interdisciplinarity while international orientation stimulates disciplinary orientation (Sørensen 2012), in Croatian case both orientations seem to produce the same outcome – disciplinary fragmentation. The (inter)national orientation differs across the main STS disciplines. In the philosophy and history of science it is more local than in scientometric and bibliometric studies, and especially in the sociology of science and technology. Its roots, in my opinion, are the different disciplinary research foci in the Croatian scientific community. It is a small community and, consequently, a much smaller number of scientists study science and technology within each discipline. They can barely cover disciplinary priorities, which leaves almost no space for dealing with problems that could be of inter- or trans-disciplinary relevance.

Croatian sociological studies of science and technology seem to have been productive in the last forty years, but they show a sort of cognitive self-sufficiency that is not very promising. Though not interdisciplinary in a strict sense of the term, innovation studies also included a few economists from the eighties onward. This indicates that interdisciplinarity in STS could become a productive perspective if and when it is the result and not just the mechanical application of various disciplinary approaches to different subtopics of a broader STS theme. It is to be hoped that inter-, multi- and trans-disciplinarity could also be the (albeit distant) future of Croatian STS.

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