Janáč, J. and van der Vleuten, E. 2016. Transnational system building across geopolitical shifts: The Danube-Oder-Elbe Canal, 1901-2015. Water Alternatives 9(2): 271-291

Transnational System Building across Geopolitical Shifts: The Danube-Oder-Elbe Canal, 1901-2015

Jiří Janáč

Institute of Contemporary History, Czech Academy of Sciences, Prague, Czech Republic; janac@usd.cas.cz

Erik van der Vleuten

School of Innovation Sciences, Eindhoven University of Technology, Eindhoven, Netherlands; e.b.a.v.d.vleuten@tue.nl

ABSTRACT: We study the politics of water infrastructure through the Large Technical Systems (LTS) literature, which examines human agency in the dynamics of complex sociotechnical systems. We take into account the transnational turn in LTS-studies in the past decade. Transnational analysis is about the mutual shaping of the international, national, and local. Accordingly, we look at how key system builders – historical agents envisioning and working on the entire sociotechnical system – identified and negotiated international, national, regional, and local politics through the design process. We do this for the intriguing case of the Danube-Oder-Elbe Canal, the so-called 'missing link' between the North, Baltic, and Black Seas, with a design history spanning wildly diverging paradigms of political rule – from imperialism to fascism, communism, and 'EU-ropeanism'.

KEYWORDS: Large Technical Systems, water politics, transnational infrastructure, Central European history, transnational history, environmental history

INTRODUCTION

In our paper we approach the theme of this special issue – the relationship between water, infrastructure, and politics – through the Large Technical Systems literature. When this body of research emerged in the 1980s, it highlighted human agency in the making and dynamics of complex sociotechnical systems (such as water infrastructure) that became 'deep structures' in modern society. This endeavour was best captured in Thomas P. Hughes' concept of 'system builders', which invites us to study centrally positioned actors who identify key problems in sociotechnical system development, and who solve these by manipulating and aligning technical, social and environmental elements into an infrastructure (the 'system') that works in the real world (Hughes, 1979, 1983, 1986, 1987). As we shall see, studying system builders leads us to the politics of infrastructure – and the ways these politics could be negotiated through the infrastructure design process.

Since the 1980s, the LTS field has encompassed an increasing range of stakeholders – especially in water systems, characterised by potentially conflicting functions and uses – such as navigation, drainage, irrigation, energy supply, and biodiversity preservation to name a few. They make the politics of water systems a compelling topic. In the wake of globalisation studies, the field has also made a 'transnational turn' in the past ten years or so. We review these developments below. Here it suffices to note that we follow the branch of transnational analysis that queries the mutual shaping of the international, national, and local. Accordingly, we examine how system builders perceived and

negotiated international, national, regional, and local politics in transnational water system building through the design specifications of a single project.

We explore this question for the case of the Danube-Oder-Elbe (DOE) Canal, the so-called 'missing waterway link' between the North Sea, the Baltic Sea, and the Black Sea. This case is particularly instructive, because the canal's design history spans wildly diverging political paradigms. Today's readers may know it as a contested sustainable waterway project. By contrast, in the 1990s and 2000s, the heydays of European integration, it was chiefly known as European infrastructure: The *European Agreement on Main Inland Waterways of International Importance* (1996) included the project as *E-waterway* corridors E-20 (North Sea-Danube) and E-30 (Baltic Sea-Danube); the Czech accession treaty (2003) inscribed it in the EU's *Trans European Network* program – much to the discontent of environmental NGOs (Life for the Danube, Oder and Elbe Rivers Coalition, 2003). By that time, however, the canal had been under construction for over a century: The Austrian Imperial Waterway Act of 1901 had launched it as an imperial project. Since then, it had been subject to the politics of Central-Europeanism, Czech nationalism, Moravian regionalism, Nazism, communism, and UN Pan-Europeanism – before finally becoming a vehicle of EU-integration and sustainability. The history of the canal has recently been written based on an extensive archival study, highlighting the period following the First World War (Janáč, 2013). Thus we have access to over a hundred years of debate, enabling us to analyse the diverse paradigms of political rule and priorities.

In this paper, we revisit the DOE Canal's history, examining how transnational system builders interpreted and negotiated international, national and local politics in infrastructure design debates. We argue that our multi-functional and transnational systems approach, applied to a case covering greatly diverging political scenarios, allows us to transcend the boundaries of given functional, national, and political regimes that characterise many studies of water politics (e.g. White, 1996; Scott, 1998; Josephson, 2004; Mauch and Zeller, 2008; Pritchard, 2011; Pál, 2011; Zeisler-Vralsted, 2014; Teuscher, 2014).

This approach also allows us to address a second research question: were infrastructure builders merely implementing the geopolitical imperatives of their times, or were they pursuing their own agendas that provided continuity amid political changes, as recently suggested in work on technocratic internationalism (e.g. Kaiser and Schot, 2014)?

Before we turn to our case, the next section elaborates on the Large Technical System perspective on the politics of water infrastructure, and our use of the notion of transnational system building in particular.

AN LTS PERSPECTIVE ON WATER, INFRASTRUCTURE AND POLITICS

Large Technical Systems (LTS) authors initiated and developed the LTS framework of analysis in order to investigate the history and dynamics of sociotechnical systems, with emphasis on infrastructure systems. Later, they added an increasing range of other issues, such as LTS governance, social and environmental change, risk and vulnerability, urban sustainability, and Europeanization (e.g. Mayntz and Hughes, 1988; La Porte, 1991; Summerton, 1994; Coutard, 1999; Coutard et al., 2004; van der Vleuten and Kaijser, 2006; Högselius et al., 2013, 2016). LTS studies share with other sociotechnical systems theories a shift in analytical focus from highly visible artefacts (hydroelectric dams, nuclear reactors, computers) to sociotechnical systems (water systems, electricity systems, ICT systems) comprising various interwoven technical, social, and environmental elements. They differ from many other systems theories in their informal, actor-centred, and problem-centred approach, using qualitative follow-the-actor methodologies to track problem perceptions, conflicts, priorities and choices and in the making, governance, and usage of sociotechnical systems. Spotlighting human agency and choice (and its limits) in the development of obdurate sociotechnical structures, LTS research has long been known for humanising systems theory (Galambos, 1991: 177).

From an LTS perspective, we can study the entwinement of politics and infrastructure by following actors within or outside the system – from 'system builders' negotiating political priorities in the system design, to users subverting the system through usage meanings and practices, and outside observers and criticasters (Nye, 2004; van der Vleuten, 2004). In this paper we focus on system builders, because these actors envision and work at the level of the entire system; studying them will lead us to our topic of interest, the politics of infrastructure.

The concept of system building has been much debated. Hughes (e.g. 1979, 1983, 1986, 1987) developed the concept to spotlight how key individuals and organisations built sociotechnical systems through processes of transdisciplinary problem-solving. By identifying and solving technical, social or environmental problems that hamper system development, these agents manipulated and aligned heterogeneous elements into coherent systems; they spun the sociotechnical webs that structure modern societies. Yet Hughes was criticised for overly identifying with 'heroic' system builders and silencing unruly and critical actors, and for introducing an unwarranted teleology in his system ontology – assuming a system 'direction' defining which problems count as 'critical' (e.g. Hård, 1993; Summerton, 1994).

We distinguish between two responses to those critiques. First, LTS studies started to investigate system building as a conflicted and negotiated multi-actor process. Studies of water systems were decisive to this response. For at a time when Large Technical Systems were seen as functional systems (energy, communications, or transport systems), water system studies ran into multiple and conflicting functions such as navigation, fishing, flood protection, irrigation, drinking water supply, drainage, sewage disposal, biodiversity preservation, and so on. They started to investigate the multifunctionality of water systems. Inspired by the participative turn in water management and the rise of Integrated Water Resources Management, they queried the representation or participation of a wide variety of interests and stakeholders in water system building processes (e.g. Ravensteijn et al., 2002; Disco and van der Vleuten, 2002; Jakobsson, 2002; Kaijser, 2002; van der Vleuten and Disco, 2004; Mulder and Kaijser, 2014; Ravensteijn and Kroesen, 2015; Manders et al., 2016).

A second response to the critique on LTS of the 1990s took a methodological, rather than ontological, approach to system builders. It is this approach that we follow in this paper. Even though system building is a conflicted multi-actor process, studying centrally positioned individuals or organisations still has clear methodological advantages. These actors provide researchers with privileged insider access to articulations of problems, choices, and priorities that shape the politics of design (van der Vleuten et al., 2007). Studying key actors in infrastructure debates as system builders trains the researcher’s attention on system builder interpretations of key problems hampering system development, including political dilemmas, conflicting interests, cooperative and subversive stakeholders, and represented or ignored interests in the design process – the very politics of infrastructure on which we are focusing. So, if we here study selected individuals as system builders, it is for methodological, not ontological, reasons. This also implies that we are not interested in biography; we are studying system builders to discover their identification and negotiation of the politics of water infrastructure, no more, no less.

Finally, we need to briefly discuss the transnational turn in LTS and infrastructure studies. It is helpful to distinguish between at least two forms of transnational analysis that roughly correspond to two 'transnational turns' in the social sciences and humanities, both of which affect LTS research today (Saunier, 2008, 2013; van der Vleuten, 2008).

A first transnational turn stems from the political science of International Relations in the 1970s. It criticised the field’s bias towards formal state actors (politicians, diplomats, armed forces), and sought to include 'transnational relations' beyond the control of states, e.g. by multinational firms and non-governmental organisations (NGOs) and networks. Later, this form of transnational analysis came to

include intergovernmental as well as non-governmental international organisations, networks, and relations.

In current studies inspired by this tradition, transnational system building can refer to the politics of 'technocratic internationalism' – experts conducting international politics through technology by setting up networks and organisations such as the International Telecommunications Union or the International Railway Union (Schot and Lagendijk, 2008; Schot and Schipper, 2011; Kaiser and Schot, 2014). It may also refer to the role of international networks and organisations in governing 'transnational' or 'cosmopolitan' commons – infrastructure and resource spaces shared by several states (Disco and Kranakis, 2013). In the case of the River Rhine, for example, the Central Commission for Navigation on the Rhine's *Mannheim Treaty* (1868) governed a navigation commons; the Salmon Commission's *Convention* (1885) governed a fishing commons; and the International Commission for the Protection of the Rhine against Pollution's *Chemicals and Chloride Convention* (1976) governed a clean water commons (Disco, 2013).

A second transnational turn stems from globalisation studies in the 1990s, and it is this literature that informs our paper. Though sometimes overlapping with the former turn, this literature sprang from different concerns, with due implications for its analytic focus. Informed by the observation that the globalization upsurge of the 1990s coincided with a revival of national and local identities and dynamics, this branch of transnational analysis spotlights and questions the mutual shaping of the global, the national, and the local. For instance, the subject of Tyrrell's (1991) New Transnational History programme was not world history, but national U.S. history, studied from the perspective of interacting international, national, and local developments. Global and European transnational history insisted on the simultaneous study of social order across and within borders (van der Vleuten and Feys, 2016).

In this second meaning, a transnational turn in LTS studies is about questioning the co-construction of local, national, and international infrastructure (Van der Vleuten and Kaijser, 2005, 2006; Högselius et al., 2013, 2016). For instance, major infrastructure works such as the Channel Tunnel, the Gotthard Tunnel (Schueler, 2006), nuclear power plants (Hristov, 2014), and canal or river development projects (Disco, 2010; Lagendijk, 2016) were simultaneously entwined with local, national, and international dynamics and politics. In this perspective, the concept of transnational system building serves to problematise and query how key agents negotiated and aligned international, national, and local priorities through the system design process.

The case of the DOE canal project, by virtue of its long gestation period, allows us to study transnational system building under diverging political regimes in modern European history, and also to investigate continuity and change in the design process across radical political shifts.

IMPERIAL INFRASTRUCTURE

The DOE Canal became an object of geopolitics around the turn of the 20th century, as a crucial constituent of the Austrian imperial waterway network. In order to study the politics of canal design in this early period, we focus on a key system builder called Antonín Smrček (1859-1951). Smrček did not initiate the project, but became centrally positioned in debates about the canal design – especially after his appointment as Professor of Hydraulic Engineering at the newly founded Imperial Czech Technical University (currently Brno Technical University). Moreover, Smrček was not only a leading engineer, but also actively engaged in politics at different levels of the political machinery. The DOE project would cross the Main European Watershed in the Czech region of Moravia within the Austro-Hungarian Dual Monarchy. Much of the works would be located in that region. As a Moravian patriot, Smrček supported Moravian interests through the Moravian River and Canal Society, and canal politics also led him to run successfully for Moravian Diet (the regional Parliament) in 1906. A year later he was also elected to the Imperial Council (Austria's Parliament in the Dual Monarchy), which he served until 1918.

Finally, he participated on behalf of Austria in international organisations such as the intergovernmental Permanent International Navigation Congresses (today the World Association for Waterborne Transport Infrastructure) and the *Deutsch-Oesterreichisch-Ungarischer Verband für Binnenschiffahrt*. Blending engineering and politics, Smrček offers us an insider view on the complex politics of infrastructure.

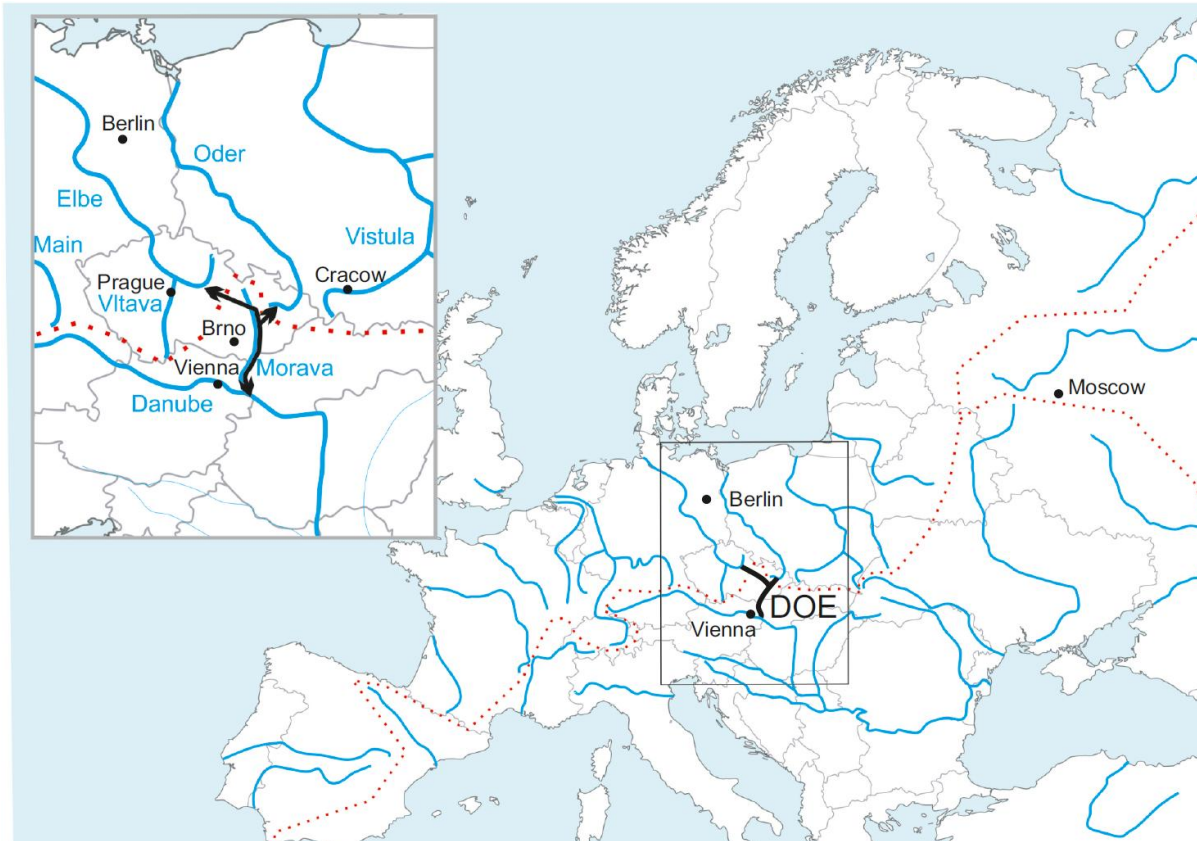
If we use the system builder approach heuristically to spotlight transdisciplinary and transnational articulations of problems that hamper system development, and their translation into design solutions, we note that Smrček identified and connected a number of international, imperial, and regional political tensions in early canal debates.

Smrček first observed the imperial and international politics of canal building at an early stage of his career, when he was working on several government projects in the 1890s.[1] At this time, nations and empires increasingly perceived infrastructure works in relation to military and economic nation and empire building – coined in the novel concept of geopolitics (Hugill 1995, 1999; Mattelart, 1996). Apparently, the Austrian Emperor Franz Joseph was slow to acknowledge the relationship between military and economic imperial power. His government, by contrast, did recognise the surge in imperial infrastructure planning abroad – not least railroads and waterways in the German and Russian Empires (Gerschenkron, 1977). In order to strengthen the Austrian Empire internally and externally, the Austrian government also planned ambitious railway and waterway schemes. The length of navigable waterways in the German Empire had doubled between 1875 and 1914 (Kunz, 1995), and Smrček observed a transfer of this 'canal renaissance' to the Austrian Empire. Indeed, he saw the advantages of Austria's latecomer position: "because Austria was late with the construction of its canals, now it can create an integrated, united network, built upon unified principles and standards" (Smrček, 1904b: 20). A decisive step was Austria's Körber administration acceptance of the 1901 Canal Act, together with a Railroad Act that same year. It is telling that the opposition in the unruly and centrifugal Imperial Parliament found it difficult to contest this infrastructure package; benefitting the imperial economy, it seemed to overrule the politics of fragmentation by ethnicity or class, at least for the moment (Gerschenkron, 1977: 78).

In a typical phrase for geopolitics, the 1901 Imperial Waterway Act would remove "a basic disability of Austria's economic geography" (Gerschenkron, 1977: 77). It outlined a Vienna-centred waterway system linking the Northern and Western parts of the Austro-Hungarian Empire to the Danube, the Elbe, the Oder, and other rivers. The centre-piece would be the Danube-Oder canal. In addition, it included branches to the Elbe, the Vltava, the Vistula (connecting Cracow in present-day Poland), and even the Dniester (in present-day Ukraine and Moldova). Thus the scheme, cutting through Europe's North-South watershed at the Moravian Gate (a depression between the Sudetes and the Carpathian Mountains), connected even the most distant parts of the Empire to Vienna (see Figure 1). The strategic advantages included cheap distribution of Silesian coal throughout the Empire; linking Galicia, separated from the rest of the Empire by the Carpathians, to the Empire's core; and connecting Austrian industries to Baltic and the North Sea ports. To Smrček, the imperial politics of the canal were evident: he found several design features (such as the location of the canal mouth near Vienna) nonsensical from a transport-economic perspective, but rather serving the imperial interests to make Vienna "the centre of all trade in central Europe" (Smrček, 1904b: 19).

[1] See archival group Antonín Smrček, Archive of Technical Museum in Brno (ATMB), Czech Republic.

Figure 1. The geography of the DOE Canal, situated in present-day Europe. The red dotted line represents the Main European Watershed (by Janáč).



The main international problem with the Austrian Imperial Canal Directorate's initial canal design, noted Smrček, was the incompatibility of the German and Austrian imperial waterway plans (Smrček, 1904, 1907). The Austrian design of the DOE connection reflected Austrian preferences for the Danube as the transport artery of the Danubian monarchy. Smrček, as member of the governmental advisory board, in 1903 successfully proposed standards (for locks, etc) based on 675 ton riverine boats – a standard also proposed by the *Deutsch-Oesterreichisch-Ungarischer Verband für Binnenschiffahrt* (DOUV, founded 1896), which strove for common standards on projects such as the Danube-Rhine canal and the Danube-Oder canal. However, projected works on East-German canals and the Oder worked with 400 ton boat standards. Smrček could only note bitterly that "for the foreseeable future, our big ships would not be able to navigate the Oder – while Prussian vessels would be able to use our canals" (Smrček, 1904b: 64-65).

This tension produced a deadlock, and for the time being Smrček's attempts to align Austrian and German imperial plans failed. As a system builder identifying subversive stakeholders, Smrček observed that many accepted the status-quo of non-connection. For instance, Austrian stakeholders "feared the competition of Prussian coal and corn" that the canal would certainly bring (Smrček, 1904b: 67-68).

A second problem that Smrček identified, and that would ultimately inspire his design solution, was the incompatibility of routing and design specifications with local and regional interests (Smrček, 1906, 1907). In the original canal plans, the Imperial Canal Directorate had aimed for the fastest and shortest possible transport route. To increase transport speed, the number of ship locks would be minimised. To shorten the distance, the canal would bypass most towns and local industries. The low number of locks consequently meant that the system required a particularly impressive ship lift; in 1904, the Canal

Directorate proposed an international competition to design a lift for single motor boats. Smrček challenged that plan on several accounts. Instead of motor-boats, he foresaw a future of towed barges. Moreover, due to bypassing local stakeholders, "the canal would serve only transit, but not local commerce/trade" (Smrček, 1906: 1). The scheme would also endanger agriculture, for a low number of locks meant long canal sections between them, which would be mostly below or just above ground level, negatively affecting the water regimes in adjacent fields. Smrček's observations were contested, but that is not the point here; they demonstrate the local politics in the imperial infrastructure. A public audit (part of the imperial planning procedure) in 1906 underscored this fact: Moravian stakeholders tended to disapprove of the project.

Smrček then worked on an alternative proposal that simultaneously addressed the international and the regional problems he had identified – solving political tensions through design. His alternative scheme used the standards set by the international community; he changed the routing to connect towns and local industries; increased the number of locks that would reduce groundwater problems and make the prestigious great ship lock project superfluous; and added reservoirs for flood protection and to benefit agriculture.[2]

In order to implement this scheme, Smrček mobilised regional elites as well as the international knowledge community. Regionally, he stressed the role of the canal in the modernisation of Moravia and the 'civilisation' of Moravian waters (Smrček, 1907), and mobilised support through the Moravian River and Canal Society. In addition, he led the regional opposition and mobilised the Moravian Diet; as noted, he went as far as to run for the Diet. At the same time, Smrček presented his case internationally as Austrian representative in the Permanent International Navigation Congresses and the DOUV (Smrček, 1906), which would put additional pressure on the Imperial government in Vienna. An international committee of Austrian, Czech, Polish (Austrian), and German experts was appointed, which in 1908 opted for Smrček's project (Smrček, 1940: 10). This decision, contrary to earlier international standardisation attempts, was respected by the Austrian government. Smrček's connection of international, imperial and regional political concerns in one design seemed to be successful.

Funding problems and World War I, however, thwarted the execution of the project (Jakubec, 2004) – which gives us the opportunity to study the design process in radically changed political contexts.

NATIONALISM AND CENTRAL-EUROPEAN INTEGRATION

World War I and the Paris Peace Conference (where Smrček represented Czechoslovakia) redrew Europe's geopolitical map. The German, Russian, Ottoman, and Austria-Hungarian empires were dissolved into a large number of successor states, and the key works of the projected DOE canal were now situated within the new state of Czechoslovakia.

Throughout the Interwar period, Smrček remained a central agent in the promotion and development of the DOE project. While he increasingly withdrew from active national politics (except as a government adviser), his canal work was actively followed and supported by Emil Zimmler – a hydraulic engineer heading the water management department of the Czechoslovak Ministry of Public Works. Smrček and Zimmler, one from Moravia, the other from Bohemia, became leaders of a group of hydraulic experts who, supported by local industries, promoted waterways at conventions in major Czechoslovak cities located on the canal.

In this new geopolitical context, Smrček observed a new set of political problems threatening his canal plans. A key problem was friction with Czechoslovakian nationalists, who associated the canal

[2] See ATMB, Smrček, b. 136.

scheme with the Austrian Empire. In response, Smrček tried to 'de-austrianize' the project, and rethought his plans from the perspective of the new Czechoslovak republic. For instance, in 1918 and 1919 he published extensively on the waterways as a solution to the land-locked condition of the new state (e.g. Smrček, 1919). In addition, a 1919 Act changed the routing. Instead of Vienna (in Austria), Bratislava (in Czechoslovakia) became the junction between the canal and the Danube. Even so, the canal's routing on Czechoslovak territory remained challenged by nationalists, now arguing that it served the German-speaking borderlands of the republic more than its ethnically Czech hinterland. Nationalists demanded that the canal would connect the Czechoslovak cities Prague and Brno. After a year of discussion, Smrček and other leading experts dismissed that suggestion as a (technically) "irrelevant, though attractive phantom" (Kračmer, 1924: 292). Either way the problem persisted: nationalists formulated the new Czechoslovak state in opposition to the German and Austrian 'other', and feared that the canal would serve these antagonists rather than Czechoslovakia (Dvorský, 1926).

Accordingly the DOE canal, though a part of national infrastructural development plans, did not receive priority status. There was an exception: the canalisation of the middle-Elbe would facilitate the connection to the sea of the Czechoslovak hinterland and even Prague, instead of just the German-speaking borderlands. The Morava River was expelled from the scheme, which would cause friction later, as we will see below. Either way, the Czechoslovak canal directorate (successor to the Prague branch of the Imperial Canal Directorate) remained understaffed and underfinanced, and the Elbe canalisation project consumed most of its resources.

In order to break this stalemate, Smrček and Zimmler turned – again – to international politics. These experts, despite the Czechoslovak authorities' reserved standpoint, sought cooperation with the German and Austrian authorities. In doing so, they adopted one of the most ambitious geopolitical visions of the time – of building a coherent 'Central Europe' (*Mitteleuropa*). Accordingly they redefined the canal from a nationalist to a Central European integration project. Smrček got involved in the *Mitteleuropäischer Wirtschaftstagung*, a Vienna-based organisation aiming at Central European economic integration, and at forging economic ties in former Habsburg territory. He started to lecture on 'Central European' waterways, and called for general acceptance of German standards for future trans-watershed connections in Central Europe (Smrček, 1930). In his DOE canal design, he changed the navigational standards from those based on Austrian 670 ton standard vessels to standards based on a 1,000 ton standard vessel (standardised lock measures: length 82 m x width 10 m x depth 2,20 m). The latter had originally been proposed for German waterways by Leo Sympher, and were already used in the Mittelland (Elbe-Rhineland) canal.[3] In 1931, the Czechoslovak government sanctioned this move in a new Canal Act, specifying that the middle Elbe canalisation should follow these German standards (Janáč, 2013: 53). The DOE canal itself, however, was not included the new Act.

In the 1930s, Smrček mobilised a number of political developments to get governmental support for the DOE project. In response to the Great Depression, governments increasingly recognised big infrastructure works as a legitimate way out of crisis (Schivelbusch, 2006). In order to overcome anti-German sentiments, reinforced by the rise of Nazism in Germany, Smrček bluntly argued that the canal would be built "either by us, or over us", since Moravia was 'predestined' for the waterway. Ultimately, he managed to persuade Czechoslovak stakeholders and the government; after/around 1935 the DOE-canal was chosen as a symbolic national infrastructural project.[4]

The local politics of the canal project, however, were still in motion. On the one hand, most of the stakeholder groups organised since 1901 backed the project and joined forces in the nation-wide lobby

[3] Protokol o poradě na MVP [Report of the meeting held at the Ministry of Public Works], March 18, 1920; The National Archives of the Czech Republic in Prague, Czech Republic (NAČR), archival group Ministry of Public Works (MVP), b. 156.

[4] Zápis ze zasedání Dunajsko-odersko-labského komitétu [Report on the meeting of Danube-Oder-Elbe Committee], October 20, 1936; NAČR, MVP, b. 292, page 8.

group Danube-Oder-Elbe Society in 1937, supported personally by Czechoslovak president Beneš. On the other hand, it was difficult to align the project with the plans of the Baťa company – a huge Czechoslovakian industrial conglomerate with over 65,000 employees worldwide by 1938 – for a large industrial centre in Otrokovice on the Middle Morava River. For Baťa, the extension of the Danube waterway into Czechoslovak territory through Moravia meant cheap access to world markets. Bringing back the Morava Riverbed (which had previously been pushed out of the canal scheme), Smrček (1940) noted, would negatively impact Moravian agriculture. The final government report confirmed Smrček's fears, that especially on the lower Morava, agricultural and navigational uses "cannot be satisfied at once".[5] While the flat terrain and agricultural concerns prevented the use of high weirs, too many short locks would slow down navigation to an unreasonable extent. Agriculture and navigation should use parallel infrastructures.

Despite mounting political tensions between the Czechoslovak and German visions of Central Europe, Czechoslovak engineers managed to harmonise the Czechoslovak canal project with the German plan for a central European network, and also harmonise it with the interests of local stakeholders. The so-called 'Czechoslovak lock variant' (with locks instead of ship lifts, Central European standards, and Czechoslovak route preferences) was finalized by the summer of 1938, and largely kept to Smrček's proposals.[6] However, once again the outbreak of war prevented its execution.

NAZI-GROSSRAUM CANAL

The Munich Agreement (or 'Munich Betrayal' from a Czechoslovakian perspective) of September 1938, whereby France and the UK accepted Hitler's claims to Northern Czechoslovakia (*Sudetenland*) as part of their appeasement policy, and the subsequent Nazi occupation of all Czech lands (henceforward the Protectorate of Bohemia and Moravia; *Slovakia* became a separate Nazi puppet state), implied another radical change in the geopolitics of the DOE canal.

We study this period from the perspective of Josef Bartovský, who became the central figure in DOE canal debates instead of Smrček, now almost 80 years old. Bartovský was a trained hydraulic engineer and a long-time employee of the Canal Directorate. In the 1930s he had become Head of the Ministry of Public Works' Water Management Department. Bartovský, unlike Smrček, was a career bureaucrat. But, like Smrček, he worked on the DOE project at various political levels. Besides his position in national administration, he acted as Czech representative on the Czech – German expert committee designing the canal in this period, and simultaneously presided over the above-mentioned lobby group, the Danube-Oder-Elbe Society. Bartovský saw himself as the leader of a 'second generation' of Czechoslovak hydrocrats: he strove for the optimal utilisation of Czechoslovak waters, perfecting the principles introduced earlier by Smrček, Zimmler and others (Bartovský, 1946).

Soon after the Nazi Occupation, Bartovský was tasked to align the national DOE project, now under way, with Nazi demands. Negotiations over the re-design of the canal project took place in an expert commission consisting of leading members of former Czechoslovak hydrocracy, led by Bartovský; representatives of Oder and Danube administrations; and the Reich's transport ministry. The commission met for the first time in December 1938, and remained active until autumn 1941. At that

[5] Splavnění Moravy: Technická zpráva [Canalisation of the Morava River: Technical report], 1936; NAČR, MVP, b. 292.

[6] Návrh časového postupu a pořadí přípravných prací pro brzkou realisaci stavby průplavu dunajsko-oderského [Proposal for the course of realisation and succession of preparatory works for a swift execution of the Danube-Oder Canal], March 30, 1938.; ATMB, Smrček, b. 128.

time, the war interfered and the development of the DOE was suspended – again.[7] Still, the Commission's activities and choices allow us to discuss DOE canal politics under Nazism.

Clearly, the Nazi authorities made quick execution of the Danube-Oder connection a priority. The DOE canal, and especially its Danube-Oder connection, was supposed to form an important link in the planned *Grossraum* waterway network, linking Germany, the *Altreich*, with south-east Europe, and linking up Vienna, Silesia and Berlin. Design changes included expansion of the canal's transport capacity, and a routing change towards the left bank of the Morava River. The canal's mouth to the Danube moved back from Bratislava to Vienna (as in the Austrian Imperial scheme).

Prioritizing the transport function of the canal, German delegates in the Commission constantly increased the projected canal's longitudinal profile and cross section. Single locks in the Czechoslovak project were to be substituted by twin barge train locks, each with a fall of at least nine metres. That is to say, significantly higher than the Czechoslovak proposal of three to ten metres.[8] The size of the canal design was enlarged accordingly – from the original 34 metres width to 45 metres in 1941. The number of locks was reduced to 18 on the Danube-Oder section, and three twin-ship lifts were added at both ends of the summit reservoir.[9]

As in earlier periods, the canal's international transport function clashed with national, regional and local interests. The Nazi authorities recognised the many functions of water, stating that water supply "must be in accordance with general water management planning".[10] Bartovský also argued that "it is no longer possible to separate the navigational undertakings from water management and vice versa".[11] Thus in 1940, the Protectorate Administration under his leadership started working on a General Water Management Plan. It is telling that though the overall plan was never completed, the part devoted to the Morava River and Oder River basins (i.e. the DOE canal part) was accomplished. Because the Morava and Oder River basins could not provide enough water for the anticipated navigational, industrial and agricultural purposes, choices had to be made. These choices prioritised water provision for the waterway as a transport artery, and for industry. Agriculture should get its water from other river basins.[12]

A number of issues remained unresolved. For instance, the canal's routing through the mining region around the city of Moravská Ostrava on the northern-most stretch of the canal on the Upper Oder was controversial. Mining representatives opposed any routing across coal deposits, which would

[7] Komise znalců pro přípravu DO průplavu - příprava pro 7. zasedání [Expert commission – preparation for the 7th meeting], October 31, 1942; Moravian Land Archive in Brno, Czech Republic (MZA), archival group H42, b. 122.

[8] Niederschrift betreffend zweite Tagung der Sachverständigen Kommission für den Bau und Betrieb des Oder-Donau-Kanals vom 10-13. Mai 1939 [Report on the second meeting of the expert commission for construction of the Danube-Oder canal], May 10-13, 1939; MZA, H42, b. 121, p. 4.

[9] Richtlinien für die Ausbildung eines Kanalregelquerschnitts für den Verkehr mit dem 1000t Schiff [Guidelines for the channel cross-section design for operating 1000t vessels], December 9, 1941; NAČR, MVP, b. 530.

[10] Činnost oddělení za poslední tři roky [Activities of the department (the Canal Department of the Water Management and Inland Navigation Section of the Ministry of Public Works) over the last three years], February 25, 1942; NAČR, MVP, b. 531.

[11] Josef Bartovský's manuscript: Přehled vodohospodářského a vodocestného plánování v Čechách a na Moravě [Overview of Water Management and Waterway Planning in Bohemia and Moravia], January 9, 1942; NAČR, MVP, b. 531, p. 7.

[12] The Water Management Plan for Moravia (Moravský vodohospodářský plán) covered the Protectorate land of Moravia (a part of former Czechoslovak Moravia-Silesia). Professor Bažant communicated with Czech members of the canal expert commission. Průplav O-D: Zásobování vodou – vodohospodářský plán moravský [O-D canal. Water provisioning – Moravian water-management plan]; NAČR, MVP, b. 535.

hamper future exploitation.[13] Even within the Nazi authoritative system of rule, Bartovský was unable to fully harmonise all interests.

The Commission's plan was subjected to on-site revision by experts and finally to public auditing. The central part of the project (with some unresolved route issues) was audited in 1941, and some collateral effects of the transport-artery design, such as the 180m wide body of the waterway elevated almost 15m over the landscape on the outskirts of the town of Přerov, met with criticism from local authorities – who otherwise firmly supported the project.[14] In response, the Nazi authorities simply prioritised the productive sector over citizens' interests.

Bartovský and other Czech engineers cooperated enthusiastically with German experts and Nazi authorities, leading to a grand canal design embodying clear political choices. These choices – for transport capacity and industry and against agriculture and citizen interests – were underscored by Bartovský himself in a curious but telling way: attempting to distance himself from his Nazi collaboration, Bartovský claimed after the war that he and his colleagues had intentionally pursued a canal design that "was so fundamentally over-dimensioned and over-priced that in the agreed form, it became absolutely unsuitable for rational utilisation" (Bartovský, 1946: 50).

GATEWAY TO THE USSR

In the late 1940s, the erection of the Iron Curtain triggered another geopolitical reconfiguration of the canal design plans. Czechoslovakia had now become part of Socialist Eastern Europe, and Cold War geopolitics isolated the DOE canal from the North Sea ports on the Elbe River (in West Germany) and Upper Danube River (in Austria and West Germany). The ideal of a Central European waterway network lost its appeal as Czechoslovakia reoriented towards the USSR: from a 'key to Europe', the canal became a 'gateway to the USSR'.[15]

Initially in the early 1950s, canal supporters in the Danube-Oder-Elbe Society attempted to align the canal project with the new ideology. They re-interpreted the DOE project as a Czechoslovak example of big Soviet multi-purpose hydraulic projects, ideologically associated with Stalin's Great Plan for the Transformation of Nature (Gestwa, 2010; Olšáková, 2016; for the Danube River, see Lagendijk, 2015). However, their efforts were hampered by three factors. First, after 1948 the new institutional and political map of the country cut old alliances between experts, businesses and municipalities. The Canal Directorate was disbanded in 1949, and influential canal proponents such as Smrček, Zimmler and Bartovský died in quick succession in the early 1950s. Second, the Czechoslovak communist government adopted Soviet industrialisation policies in 1951, and these prioritised heavy industry over canals as the economic basis for the socialist economy. Third, the responsibility for canal building was split between two ministries. Water-management was institutionalised in a Ministry of its own, while waterways now

[13] The delegate from the mining company Severní dráha Ferdinandova (Bergwerksgesellschaft Ferdinand Nordbahn) that had opposed the canal project (as direct competitor for their transport business) since Austrian times, presented these objections. The source of surprise was the unexpected opinion change on the part of other companies, which had accepted the routing at public consultations in the summer of 1940. Zpráva pro ŘVC o 6.zasedání komise znalců pro stavbu a provoz O-D průplavu [Report for ŘVC on the sixth meeting of the expert commission for the construction and operation of the O-D canal], December 20, 1941; MZA, H42, b. 122.

[14] Protokol o přehlídce trasy v trati Lanžhot-Přerov-Hranice a St.Ves - Mor. Ostrava-Hrušov konané v Brně ve dnech 12. a 13. července 1940 [Report on the inspection of the canal route Lanžhot-Přerov-Hranice a St.Ves - Mor. Ostrava-Hrušov, held on July 12-13 1940]; MZA, H42, b.91, p. 39.

[15] Kliment Velkoborský, unpublished manuscript: Vodní cesty Střední Evropy ve vztahu k možnostem dopravních styků se SSSR a lidově demokratickými státy [Central European Waterways and the possibility of the transport relations with the USSR], around 1950; MZA, H42, b. 282.

fell under the Ministry of Transport, dominated by railway engineers. Communist planners formally put the 'technologically unjustified' DOE project on hold in 1952 (Janáč, 2015).

The DOE project reappeared on the agenda in less than a decade, however. It was redesigned as a multi-purpose hydraulic structure, and aligned with the institutional and procedural set-up of socialist decision-making. We shall discuss this process by following the hydraulic engineer Oldřich Vitha (1924-2008) as our key system builder. Starting out as a leading advocate of water projects as big structures of communism (Vitha, 1950, 1952), Vitha became a leading figure in Czechoslovak water management, heading the Directorate for water-resources development from 1961 (Doležal, Švec and Bečvář, 2009). Vitha was a key figure in orchestrating the Sovietisation of the DOE canal design.

Vitha's point of departure was not inland navigation, but the Czechoslovak Water Management Plan developed between 1949 and 1954. That plan aimed at a 'national hydrological balance' and the maximal utilisation of available resources (Plecháč, 1999). By the late 1950s it was clear that rapid industrialisation had resulted in a steep growth of water usage. Extrapolated into the future, it seemed that rising industrial water demands would sooner or later cause a veritable water crisis (Vitha, 1965). Vitha identified the DOE scheme as the only possible solution to this problem: the canal could transfer water from the Danube into Czechoslovak territory and restore the national hydrological balance. According to several studies, the transfer of 2% of the Danube's annual flow would cover almost 50% of Czechoslovakia's water usage. The canal should especially supply water to southern Moravia (the country's agricultural base) and Silesia (its industrial core), two key economic regions with a negative water balance.[16] The canal, in short, became a water transfer technology serving the national hydrological balance, rather than an international trade artery.

And yet, Vitha brought back inland navigation after identifying emergent Soviet plans for an international, Eastern European waterway network, as a window of opportunity to realise his hydrological balance plans. The revival of Comecon in the mid-1950s, associated with increased planning coordination of a division of labour between socialist countries, initiated plans for cross-border transport infrastructure (Högselius et al., 2016). The Czechoslovak authorities were tasked to prepare a study (1957) and later a brand new DOE design (1962) along Soviet guidelines – i.e. to develop the canal as a multi-purpose hydraulic structure, including the transport function. The Czechoslovak and Comecon initiatives ran parallel until 1965, when the Czechoslovak Directorate was assigned to develop a final project design by 1968 (Janáč, 2013).

From the very beginning, Vitha had to cope with the particularities of the command economy and sector-based, long-term economic planning. Possible beneficiaries among the productive sectors in the national economy were supposed to share the costs. In order to persuade these projected co-investors, Vitha kept on emphasising the multi-purpose character of the waterway, which he called a 'water-management system'. He tried to make a compelling case for as many 'purposes' as possible. The final design, presented to the Czechoslovak government in 1968, identified 'water production' (water supply), transport, electricity production, and agricultural functions as important priorities. Vitha's concern, of course, was still to transfer water from the Danube up the Morava River and, across the watershed, to the Oder River Basin. His design maximised the use of the existing riverbed and reduced the number of ship lifts in favour of locks equipped with pumping units; the canalised river could transport more water than a new, separate canal, and turning a river into a set of reservoirs enabled easier harmonisation of navigation and water-management functions. Electricity production was included in the form of cooling facilities for several large thermal power plants and a single nuclear plant, located close to the summit pond of the canal; this should trigger the industrial development of

[16] Rámcová studie přečerpávání vod Dunaje na území Moravy [General Study of the Water Transfer from the Danube to Moravia], ŘVR 1963; NAČR, Presidium of the Communist party of Czechoslovakia 1962-66 (KSČ-ÚV-02/1), sv. 48, aj. 51-10, p. 5.

adjacent areas. As for agriculture, the DOE connection constituted the backbone of an irrigation system supplying water for 420,000 hectares of agricultural land. The project's transport function was, finally, dimensioned on Comecon standards for 1500 ton vessels. The capacity of the waterway became larger than ever before.[17]

However, as it turned out, Vitha failed to make the case for multi-purpose structure sufficiently compelling or keep the broad coalition of stakeholders together. The Transport Ministry declared the DOE inferior to its railway alternative in 1964.[18] The Ministry of Agriculture evaluated the effects of the DOE as marginal, if not completely irrelevant in 1963.[19] The Central Energy Authority rejected the proposed utilisation of the canal as a booster for the electrification of Moravia in 1963 and again in 1967.[20] There was growing opposition even among Czechoslovak water-management experts, who saw the canal as a competitor to planned Danubian dams (the budget could not afford both). Vitha's attempt to relieve this tension by presenting DOE as an important step in the gradual development of the Czechoslovak stretch of the Danube (the realisation of the DOE would start with constructing the Danube Dam at Bratislava) did not appease opposition among Slovakian politicians and experts.[21]

In order to overcome these difficulties and mobilise further support, Vitha initiated the Association of North Moravian Industries (mostly mining and iron industries) to support the DOE. However, neither the industries nor municipalities and regional political representations were directly involved in the decision-making and funding of the project, although they were all represented in the committee evaluating the 1968 design.[22]

Behind these developments was the reduced urgency of the impending water crisis, after water use trends were corrected in the 1960s, and Comecon planners chose railways rather than canal transport. With these national and international concerns out of the way, and Vitha's reassignment after his support of the Prague Spring (Doležal, Švec and Bečvář, 2009), the government put the DOE project on hold in 1972.[23]

[17] Průplavní spojení Dunaj-Odra-Labe: Generální řešení [DOE Canal: General solution, comprehensive version], ŘVR 1968; NAČR, archival group Federal Ministry of Foreign Trade – Department 20 (FMZO, odd. 20), b. 66.

[18] Realizace základních směrů rozvoje dopravy, včetně dálnice, kanálu Odra-Dunaj a letectví [Implementation of general directions of development of transport, including highways, Oder-Danube Canal and aviation], October 1964; NAČR, KSČ-ÚV-02/1, sv.87, aj. 91-1, p.13.

[19] Zpráva o rámcové studii přečerpávání vod Dunaje na území Moravy [Report on the general study of the water transfer from the Danube to Moravia], ŘVR, December 1963; NAČR, KSČ-ÚV-02/1, sv.48, aj. 51-10.

[20] Závěry z rozboru připomínkového řízení komplexního posouzení výstavby průplavního spojení Dunaje, Odry a Labe [Conclusion derived from the analysis of the consultation proceedings on complex evaluation of the construction of the DOE Canal], June 27, 1967.]; NAČR, FMZO, odd. 20, b. 65, s.10.

[21] Komplexní posouzení výstavby průplavního spojení Dunaje, Odry a Labe včetně dunajského díla rakousko-československého u Bratislavy z hlediska ekonomické efektivnosti a porovnání s československo-maďarskými vodními díly na Dunaji z hlediska časového pořadí etap výstavby [Complex evaluation of the construction of the DOE canal, including the Danube Dam at Bratislava, from the perspective of economic efficiency and in comparison with Czechoslovak-Hungarian dams on the Danube, with respect to sequence of their execution], December 15 1966; NAČR, FMZO - odd. 20, b. 65, p. 131.

[22] Průplavní spojení Dunaj-Odra-Labe: Generální řešení [DOE Canal: General solution, comprehensive version], ŘVR 1968; NAČR, FMZO-odd. 20, b. 66.

[23] Zpráva o výsledcích posouzení generálního řešení průplavního spojení Dunaj-Odra-Labe [Report on the results of the evaluation procedure for the general solution of the DOE Canal], January 29 1971.; Archive of the Water-management Research Institute, Brno, Czech Republic.

BACK TO EUROPE

The failure to construct the canal as a national multi-purpose infrastructure project opened the door for a gradual Europeanisation of the DOE project. A key agent in this phase was hydraulic engineer Jaroslav Kubec (born 1931), who had actively supported the project since the early 1950s. In his capacity as inland navigation expert of the Czechoslovak Transport Research Institute, he had worked on the canal as a socialist project in the 1960s; after the demise of that project, he led the United Nations Economic Commission for Europe (UNECE) DOE working group. The UNECE, which worked for pan-European economic integration across the Iron Curtain (Kaiser and Schot, 2014; Högselius et al., 2016), had identified the DOE project as a 'missing link' in the European waterway network already in the early 1960s. In the context of the *Détente* and the waning Comecon interest in communist waterways, the UNECE became the most important organisation on waterway integration in Eastern Europe (Janáč, 2013); it held this position until its replacement by the EU after the collapse of communism in 1989 and the start of EU accession negotiations with Czechoslovakia (and after 1993 the Czech Republic).

For Kubec, and also for Josef Podzimek of the Vltava River Board with whom he collaborated closely, the DOE project represented the legacy of past generations of hydraulic experts and the final step in completing what has been called the 'national hydraulic mission' (Molle, et al., 2009): not a single drop of water would leave the country without being put to work (Kubec and Podzimek, 2008: 179).

Kubec had pursued the introduction of push convoys on central European waterways since the early 1960s (Kubec, 1964), criticising the design of waterways for existing boat types. In his somewhat utopian and technocratic view, infrastructure should be designed for maximum performance (Kundrata, 1993). The final report of UNECE group, 1981, reflected this idea. The design standards were almost identical to its Comecon predecessor, though Kubec eliminated the remaining ship lifts on the Elbe branch (UNECE, 1981).

As for national and local politics, Kubec and Podzimek stimulated interest in the DOE among the traditional supporters of the project – the Silesian iron industry (Vítkovice Steelworks) and enterprises located along the Morava River. Their activities took advantage of the near completion of the Rhine-Danube Canal and increasing oil prices. Once again, the DOE was predominantly represented as a transport infrastructure. In order to overcome the socialist heritage of railway dominance, they put together a strong economic alliance of local stakeholders in the late 1980s. By the spring of 1989, 64 state enterprises established the joint stock company Ekotrans Moravia to execute the DOE project. Kubec, in what seemed to be an attempt to appease opposition from the railway lobby, framed the canal within the envisioned intermodal railway-waterway transport system (Kubec, 1989). At the meeting organised by Ekotrans in October 1989, all seemed to be in favour of the grand scheme.

However, the communist regime collapsed a month later. Kubec and Podzimek had to adjust the project to new challenges, characterised by growing public participation in decision-making. In the case of the DOE, ecological initiatives and NGOs organised resistance. The Czechoslovak ecological movement, the only official platform for protest against the communist government during the 1980s (Vaněk, 1996), celebrated important victories already before 1989, such as the cancellation of several damming projects in the early 1980s (Plecháč, 1999). In response, Kubec and Podzimek aspired to harmonise the project with ecological demands, organising meetings with titles such as 'waterway for environment and economic development'. The very name Ekotrans (ecological transport) underscores this effort. As they put it, their main task was to combine the "undisputed advantages of waterborne transport with an ecologically sound waterway design" (Ekotrans, 1991).

Podzimek invited ecology experts from Czechoslovak research institutes and universities in late 1989 and early 1990 to cooperate on a so-called 'antropo-ecological' canal design, but met with fierce opposition (Orel, 1990). It is ironic that Oldřich Vitha, our system builder from the early communist age, became – in his own words – "one of the most fervent opponents of the canal in its Ekotrans design", which he found "in all aspects absurd" (Vitha, 1991: 29). Vitha argued that the project's economic

effectiveness and ecological impacts were dubious, for the canal would pass through 25 protected nature reserves, and would disrupt the hydrological regime of the Morava and Oder Valley (Vitha, 1991). Other activists argued that the canal threatened the 'green infrastructure' – not merely Czechoslovak nature reserves, but also European environmental networks, represented by the Ramsar Convention for the protection of wetlands of international importance (five of which would be affected by the canal construction) and later the Birds and Habitats directive and the Natura 2000 network (Life for the Danube, Oder and Elbe Rivers Coalition, 2003). The system builders' anthropocentric approach to ecology collided with the activists' nature-centric approach.

On the other hand, European integration opened up new possibilities for funding. Kubec and Podzimek immediately identified the EU as a crucial stakeholder, capable of bearing a significant part of the construction costs (Ekotrans, 1991; Kubec and Podzimek, 2007). In order to promote the DOE as a European project, Kubec and Podzimek adhered to the minimal standards for waterways of European importance that were being developed. The new classification, developed as a tool for technical integration of waterways on the continent, was based on the push unit module principle and accepted by the UNECE and the EU in 1992 (ECMT, 1992). The new design conformed to Danube standards, based on larger vessels than euro standards (higher bridge clearance of 6.5 m; vessel draught of 3.5m etc) to develop the DOE as a full-fledged extension of the Danube into Czechoslovak territory, as promised to Ekotrans stakeholders. Regarding routing, cooperation with Viennese authorities resulted in the possible re-location of the mouth of the canal to the Danube from Bratislava back to Vienna (Ekotrans, 1991).

The decision to develop the DOE as a European waterway came with significant technical adaptations. For instance, the new design only integrated parts of the Morava Riverbed already reconstructed for navigation; as Kubec put it, "the vessels outgrew the river" (Kubec and Podzimek, 2007: 136). Water shortages also required designing the waterway as a water management system, based on the re-circulation of water. Such measures were presented as environmentally friendly – promising to minimise alterations to the hydrological regime of affected river basins and landscapes. Kubec and Podzimek argued that the much appreciated natural environment of meandering stretches of the Morava and Oder rivers, protected under the Ramsar Convention, would survive untouched. To this end, man-made canals would be located on the hillsides, away from ecologically sensitive river valleys (Ekotrans, 1991).

The environmental opposition celebrated an important success when Ekotrans withdrew from the DOE project in 1993 and disbanded soon after. Thereafter, Podzimek and Kubec kept on trying to keep the canal idea alive, and to change the image of the project. They remained active in mobilising local, national, and international support; in organisations such as the ARGE DOEK (Arbeitsgemeinschaft DOE Kanal), Association Danube-Oder-Elbe, and Porta Moravia, they gathered supporters of the project from countries along the canal route (Poland, Germany, Austria and Slovakia). Kubec managed to position the canal as a missing link in the European network when he co-authored the UNECE's European Agreement on Main Inland Waterways of International Importance in 1996 (Janáč, 2013). This position was later confirmed by the EU, which included the DOE canal in the accession treaty with the Czech Republic. This decision was not a result of detailed economic and environmental assessment, but of political considerations aimed at re-integrating Eastern Europe into European transport networks. That brings us to the canal's present status as a, still unbuilt, contested European sustainable waterway project.

CONCLUSIONS

In this paper we have explored the politics of water infrastructure from the perspective of transnational system building. This concept highlights the question of how international, national, and local politics are confronted, negotiated, and co-constructed through the design process, and suggests that the

researcher follows centrally positioned actors – system builders – as they perceive and address multiple political problems through design solutions. We studied such entanglements of water infrastructure and politics for the case of the DOE Canal. Thanks to the long gestation period of this project, we were able to track transnational system building efforts throughout radical geopolitical shifts.

Firstly, we conclude that our approach makes visible that the confrontation and mutual construction of the local, national and international politics of design can have different dynamics, depending on the context. By comparing the different periods addressed in this paper, we observe how, in the times of the Austrian Empire, the main dispute between imperial transport and local agricultural usages was settled through a debate on the number of locks. Interwar canal projections displayed clear Central Europeanist priorities in their standards, but regional interests in routing. The routing and (over)dimensioning of the Nazi canal design followed Nazi visions of a kind of integrated water-management *avant la lettre*, but prioritised international transport and local industry over agriculture and citizen needs. In the communist period, multi-functional water management was even more pronounced, and the canal became primarily a tool for transporting water and restoring the national and regional hydrological balance; agricultural, energy, and international transport functions followed. Europeanization of the project in the post-1970s reflected tensions between international transport and local, national, and international environmental networks. International standards prevailed, while the routing was changed to spare ecologically sensitive river valleys.

Secondly, if we follow the process of transnational system building across geopolitical shifts, we can address recent debates on the relationship between system builders and politicians. Studies on recent historical infrastructure have interpreted this relationship differently. Some have emphasised the primacy of system builders, and technical experts more broadly, even on the international scene: 'technocratic internationalism' refers to the depoliticising and technification of contentious issues in order to bypass the emotional and irrational political decision-making that had caused so many conflicts and wars. The International Telecommunications Union and similar organisations have been studied as examples (Schot and Lagendijk, 2008; Schot and Schipper, 2011; Kaiser and Schot, 2014). Others have shown, sometimes for the very same organisations (such as the ITU), that foreign policy officials had experts on a leash (Balbi et al., 2014).

Our study shows how these contradictory observations could be combined. On the one hand, system builders provided continuity through periods of radical political change. Smrček, Bartovsky, Vitha and Kubec – each in his own way and historical context – mobilised local, national and international politics to shepherd the canal project through the political turmoil. On the other hand, clearly these system builders were not able to bypass non-technical political elites – after all, they have not managed to build the canal so far. This observation underscores the value of studying system builders in a (so far) failure process, rather than the usual success stories.

Thirdly and finally, our system-builder perspective led us to observe different forms of public participation in the canal design process. We can distinguish two planning stages in the system building processes described in this paper. The first is a general planning period that (if successful) resulted in a green light for detailed surveys, followed by the mobilisation of potential stakeholders – who in return influenced the proposed design. In present-day wording, stakeholder participation was common practice, as opposed to citizen participation. A second phase consisted of on-site detailed planning, which in our case was only reached in the imperial, interwar, and Nazi eras. In the Nazi period, public auditing was, it seems, a rather formal procedure. In the imperial and interwar eras, system builders were capable of mobilising 'the public' to subvert the central authorities' designs (as Smrček did). Generally, however, system builders tended to keep the broader public out of the picture, and preferred to work in a close circle of experts. In the socialist era, for instance, the examination procedure of the 1968 general solution did not involve local auditing, but involved over 40 state administration institutions (both central and regional). Even in the post-1989 period, the canal has been developed 'in disguise', as environmental opponents often pointed out and criticised.

ACKNOWLEDGEMENTS

This research was supported by the Grant Agency of the Czech Republic, Project No. GA15-04902S; the Post-doctoral Fellowship Programme of the Czech Academy of Sciences, L300631451; and by the Foundation for the History of Technology SHT.

REFERENCES

Bartovský, J. 1946. *Vodní cesty a vodohospodářské plánování v Čechách a na Moravě. Přehled a bilance práce dvou generací, další úkoly dvouletka a pětiletka.* Praha: Společnost Dunajsko-oderského průplavu.

Balbi, G.; Fari, S.; Richeri, G. and Calvo, S. 2014, *Network neutrality. Switzerland's role in the genesis of the Telegraph Union, 1855-1875.* Bern: Peter Lang.

Coutard, O. (Ed). 1999. *The governance of large technical systems*. London: Routledge.

Coutard, O.; Hanley, R. and Zimmerman, R. (Eds). 2004. *Sustaining urban networks: The social diffusion of large technical systems*. London: Routledge.

Disco, C. 2010. From sea to Shining Sea: Making ends meet on the Rhine and the Rhone. In Badenoch, A. and Fickers, A. (Eds), *Materializing Europe: Transnational infrastructures and the project of Europe*, pp. 255-285. Basingstoke: Palgrave MacMillan.

Disco, C. and van der Vleuten, E. 2002. The politics of wet system building: Balancing interests in Dutch water management from the Middle Ages to the present. *Knowledge, Technology & Policy* 14(4): 21-40.

Disco, N. 2013. One touch of nature makes the whole world kin: Ships, fish, phenol, and the Rhine, 1815-2000. In Disco, N. and Kranakis, E. (Eds), *Cosmopolitan commons: Sharing resources and risks across borders*, pp. 271-316. Cambridge MA: MIT Press.

Disco, N. and Kranakis, E. 2013. Toward a theory of cosmopolitan commons. In Disco, N. and Kranakis, E. (Eds), *Cosmopolitan commons: Sharing resources and risks across borders*, pp. 13-53. Cambridge, MA: MIT Press.

Doležal, M.; Švec, Z. and Bečvář, V. 2009. In Memoriam ing. Oldřich Vitha, DrSc. *Vodní Hospodářství* 58(1): 16.

Dvorský, V. 1926. K otázce vodních drah uvnitř Československé republiky. *Sborník československé společnosti zeměpisné* 32: 116-120.

Ekotrans *Moravia,* 1991. *Vodní cesta Dunaj-Odra-Labe, příspěvek k evropské integraci*.

European Conference of Ministers of Transport (ECMT), 1992. *Resolution No. 92/2 on New Classification of Inland Waterways*, CEMT/CM(92)6/Final.

Galambos, L. 1991. A view from economic history. In La Porte, T. (Ed), *Social responses to large technical systems*, pp. 177-81. Dordrecht: Kluwer.

Gerschenkron, A. 1977. *An economic spurt that failed: Four lectures in Austrian history.* Princeton, N.J: Princeton University Press.

Gestwa, K. 2010. *Die Stalinschen Großbauten des Kommunismus Sowjetische Technik- und Umweltgeschichte, 1948-1967*. München: Oldenbourg.

Hristov, I.T. 2014. *The communist nuclear era: Bulgarian atomic community during the Cold War, 1944-1986*. Amsterdam: Amsterdam University Press.

Hughes, T.P. 1979. The electrification of America: The system builders. *Technology and Culture* 20(1): 124-161.

Hughes, T.P. 1983. *Networks of power, electrification in western Society, 1880-1930.* Baltimore: Johns Hopkins University Press.

Hughes, T.P. 1986. The seamless web: Technology, science, etcetera, etcetera. *Social Studies of Science* 16(2): 281-92.

Hughes, T.P. 1987. The evolution of sociotechnical systems. In Bijker, W.E.; Hughes, T.P. and Pinch, T. (Eds), *The social construction of technological systems. New directions in the sociology and history of technology*, pp. 51-82. Cambridge, MA: MIT Press.

Hård, M. 1993. Beyond harmony and consensus: A social conflict approach to technology. *Science, Technology, & Human Values 18*(4): 408-432.

Högselius, P.; Hommels, A.; Kaijser, A. and van der Vleuten, E. (Eds). 2013. *The making of Europe's critical infrastructure: Common connections and shared vulnerabilities.* Baskingstoke: Palgrave Macmillan.

Högselius, P.; Kaijser, A. and van der Vleuten, E. 2016. *Europe's infrastructure transition: Economy, war, nature*. Basingstoke: Palgrave Macmillan.

Hugill, P.J. 1995. *World trade since 1431: Geography, technology, and capitalism*. Baltimore: Johns Hopkins University Press.

Hugill, P.J. 1999. *Global communications since 1844: Geopolitics and technology*. Baltimore: Johns Hopkins University Press.

Jakobsson, E. 2002. Industrialization of rivers: A water system approach to hydropower development. *Knowledge, Technology & Policy* 14(4): 41-56.

Jakubec I. 2004. Říšský vodocestný zákon č. 66/1901 jako fenomén hospodářských dějin a DVT? Rozpravy NTM 189: 53-58.

Janáč, J. 2013. *European coasts of Bohemia: Negotiating the Danube-Oder-Elbe Canal in a troubled twentieth century.* Amsterdam: Amsterdam University Press.

Janáč, J. 2015. Průplav Dunaj-Odra-Labe jako velká stavba komunismu aneb Sovětští vodohospodáři řeší své stavby komplexně. *Dějiny a současnost* 37(2): 18-21

Josephson, P.R. 2004. *Resources under regimes technology, environment, and the state.* Cambridge, Mass: Harvard University Press.

Kaijser, A. 1998. Technological systems in the natural world: Water and windmills in the Netherlands. In Odhnoff, J. and Svedin, U. (Eds), *Technological systemic changes and economic theories*, pp. 41-60. Stockholm: FRN.

Kaijser, A. 2002. System building from below: Institutional change in Dutch water control systems. *Technology and Culture* 43(3): 521-548.

Kaiser, W. and Schot, J.W. 2014. *Writing the rules for Europe: Experts, cartels, and international organizations.* Basingstoke: Palgrave Macmillan.

Kračmer, J. 1924. Jak se bojuje proti revisi vodních cest a novým jejich návrhům. *Technický obzor* 32(17): 291-295.

Kubec, J. 1964. Vývoj studijních prací na vodní cestě Dunaj-Odra-Labe a jejich dnešní stav. *Doprava* 6(1): 34-42.

Kubec, J. 1989. Výstavba segregované rychlostní trati v Československu a vodní cesta Dunaj-Odra-Labe. *Ekotrans Moravia* 1(1): 37-39.

Kubec, J. and Podzimek, J. 2007. *Křižovatka tří moří: vodní koridor Dunaj-Odra-Labe = Meeting of three seas: Water corridor Danube-Oder-Elbe*. Praha: Your ARTillery.

Kundrata, M. 1993. Kanál DOL – Projekt, který zaspal dobu. *Veronica* 7(1): 1-3.

Kunz, A. 1995. The performance of inland navigation in Germany, 1835-1935. In Kunz, A. and Armstrong, J. (Eds), *Inland navigation and economic development in nineteenth-century Europe*, pp. 47-78. Mainz: Philipp von Zabern.

Lagendijk, V. 2015. Divided development: Post-war ideas on river utilisation and their influence on the development of the Danube. *The International History Review* 37(1): 80-98.

Lagendijk, V. 2016. Europe's Rhine power: connections, borders, and flows. *Water History* 8(1): 1-17.

La Porte, T. (Ed). 1991. *Social responses to Large Technical Systems*. Dordrecht: Kluwer.

Life for the Danube, Oder and Elbe Rivers Coalition. 2003. *Danube-Oder-Elbe Canal: An opportunity or a threat?* Bratislava: DAPHNE Institute of Applied Ecology.

Manders, T.N.; Höffken, J.I. and van der Vleuten, E. 2016. Small-scale hydropower in the Netherlands: Problems and strategies of system builders. *Renewable & Sustainable Energy Reviews* 59: 1493-1503.

Mattelart, A. 1996. *The invention of communication*. Minneapolis: University of Minnesota Press.

Mauch, C. and Zeller, T. 2008. *Rivers in history: Perspectives on waterways in Europe and North America*. Pittsburgh, PA: University of Pittsburgh Press.

Mayntz, R. and Hughes, T.P. (Eds). 1988. *The development of large technical systems.* Frankfurt am Main: Campus Verlag.

Molle, F.; Mollinga, P.P. and Wester, P. 2009. Hydraulic bureaucracies and the hydraulic mission: Flows of water, flows of power. *Water Alternatives* 2(3): 328-349.

Mulder, K. and Kaijser, A. 2014. The dynamics of technological systems integration: Water management, electricity supply, railroads and industrialization at the Göta Älv. *Technology in Society* 39: 88-99.

Nye, D. 2004. Electricity and culture: Conceptualizing the American case. *Annales historiques de l'électricité* 1: 125-137.

Orel, P. 1990. Vodní cesta míru. *Veronica* 4(1): 14-15.

Olšáková, D. (Ed). 2016. *In the name of the Great Work: Stalin´s plan for the transformation of nature and its implementation in Eastern Europe.* Berghahn.

Pál, V. 2011. To act or not to act: Water problems in north-eastern Hungary after 1945. In Myllyntaus, T. (Ed), *Thinking through the environment*, pp. 268-288. Cambridge: The White Horse Press.

Plecháč, V. 1999. *Vodní hospodářství na území České Republiky, jeho vývoj a možné perspektivy*. Praha: EVAN.

Pritchard, S.B. 2011. *Confluence the nature of technology and the remaking of the Rhône.* Cambridge, Mass: Harvard University Press.

Ravesteijn, W.; Hermans, L. and van der Vleuten, E. 2002. Participation and globalization in water system building. *Knowledge Technology & Policy* 14(4): 4-12.

Ravesteijn, W. and Kroesen, O. 2015. Design for Values in Water Water Management. In van den Hoven, J.; Vermaas, P. and van de Poel, I. (Eds). *Handbook of ethics, values, and technological design: Sources, theory, values and application domains*, pp. 847-867. Dordrecht/Heidelberg: Springer.

Saunier, P.Y. 2008. Learning by doing: Notes about the making of the Palgrave Dictionary of Transnational History. *Journal of Modern European History* 6(2): 159-180.

Saunier, P.Y. 2013. *Transnational history*. Basingstoke: Palgrave Macmillan.

Schot, J.W. and Lagendijk, V.C. 2008. Technocratic internationalism in the interwar years: Building Europe on motorways and electricity networks. *Journal of Modern European History* 6(2): 196-217.

Schot, J.W. and Schipper, F. 2011. Experts and European transport integration, 1945-1958. *Journal of European Public Policy* 18(2): 274-293.

Schueler, J. 2006. Travelling towards the 'Mountain that has borne a state': The Swiss Gotthard Railways. In van der Vleuten, E. and Kaijser, A. (Eds), *Networking Europe. Transnational infrastructures and the shaping of Europe 1850-2000*, pp. 71-97. Sagamore Beach, MA: SHP (Science History Publications U.S.A.).

Scott, J.C. 1998. *Seeing like a state: How certain schemes to improve the human condition have failed.* New Haven, Conn.: Yale University Press.

Smrček, A. 1904. *Der Pardubitz-Prerau-Krakauer-Kanal und seine Zusammenhang mit dem Donau-Oder-Kanal von Anton Smrček.* Berlin: Troschel.

Smrček, A. 1904b. *Průplav Pardubice-Přerov-Krakov a souvislost jeho s ostatními průplavy dunajskými*. Praha: nákl. vlast.

Smrček, A. 1906. *Na obhájení údolní trassy průplavu dunajsko-oderského.* Brno: Lidové noviny.

Smrček, A. 1907. *Zkracování Moravy ve státních rozpočtech – řeč poslance Smrčka v Moravském zemském sněmu.* Brno: Lidová tiskárna.

Smrček A. 1919. *Hospodářské úkoly československé republiky.* Č. Budějovice: J. Svátek.

Smrček, A. 1930. Vorschläge in Bezug auf eine raschere Durchführung der Mitteleuropäischen Kanalprojekte (Oder-Donau-Elbe, Rhein-Main-Donau, Donau-Weichsel). In *Bericht über die Verhandlungen der fünften Mitteleuropäischen Wirtschaftstagung in Breslau 1930,* pp. 129-139. Berlin: W. Rothschild.

Smrček, A. 1940. *Nástin historie vodní cesty Dunaj-Odra-Labe v souvislosti s úpravou řeky Moravy.* Praha: privately printed.

Schivelbusch, W. 2006. *Three New Deals: Reflections on Roosevelt's America, Mussolini's Italy, and Hitler's Germany, 1933-1939*. New York: Metropolitan Books.

Summerton, J. (Ed). 1994. *Changing large technical systems*. Boulder, Co: Westview Press.

Summerton, J. 1994. Introductory essay: The systems approach to technological change. Changing large technical systems. In Summerton, J. (Ed), *Changing large technical systems*, pp. 1-21. Boulder, Co: Westview Press.

Teuscher, A. 2014. *Schweiz am Meer: Plaïne fuïr den 'Central-Hafen' Europas inklusive Alpenuïberquerung mit Schiffen im 20. Jahrhundert*. Zürich: Limmat-Verlag.

Tyrrell, I. 1991. American exceptionalism in an age of international history. *The American Historical Review* 96(4): 1031-1055.

UNECE (United Nations Economic Commission for Europe). 1981. *Economic study of the Danube-Oder (-Elbe) connection*, UNECE document TRANS/SC.3/105. Geneva.

van der Vleuten, E. 2004. Infrastructures and societal change. A view from the large technical systems field. *Technology Analysis & Strategic Management* 16(3): 395-414.

van der Vleuten, E. 2006. Understanding network societies: Two decades of Large Technical System studies. In Van der Vleuten, E. and Kaijser, A. (Eds), *Networking Europe: Transnational infrastructures and the shaping of Europe, 1850-2000*, pp. 279-314. Sagamore Beach, MA: SHP (Science History Publications U.S.A.).

van der Vleuten, E. 2008. Toward a transnational history of technology: Meanings, promises, pitfalls. *Technology and Culture* 49(4): 974-994.

van der Vleuten, E.; Anastasiadou, I.; Lagendijk, V. and Schipper, F. 2007. Europe's system builders: The contested shaping of transnational road, electricity and rail networks. C*ontemporary European History* 16(3): 321-347.

van der Vleuten, E. and Disco, C. 2004. Water wizards: Reshaping wet nature and society. *History and Technology* 20(3): 291-309.

van der Vleuten, E. and Feys, T. 2016. Borders and frontiers in global and transnational history. Introduction to the special issue. *Journal of Modern European History* 14(1): 29-34.

van der Vleuten, E. and Kaijser, A. 2005. Networking Europe. *History and Technology* 21(1): 21-48.

van der Vleuten, E. and Kaijser, A. (Eds). 2006. *Networking Europe: Transnational infrastructures and the shaping of Europe, 1850-2000*. Sagamore Beach, MA: SHP (Science History Publications U.S.A.).

Vaněk M. 1996. *Nedalo se tady dýchat: Ekologie v českých zemích v letech 1968 až 1989.* Praha: Maxdorf.

Vitha, O. 1950. *O velikých stavbách komunismu v Sovětském svazu.* Praha: SČSP.

Vitha, O. 1952. *Veliký boj sovětskéholidu – stavby komunismu.* Praha: Svět sovětů.

Vitha, O. 1965. Perspektivní vodohospodářská bilance ČSSR. *Plánované hospodářství* 18(5): 37-43.

Vitha, O. 1991. Průplav Dunaj-Odra-Labe. Vývoj problematiky a názorů. *Veronica* 5(1): 25-32

White, R. 1996. *The organic machine. The remaking of the Columbia River.* New York: Hill and Wang.

Zeisler-Vralsted, D. 2014. *Rivers, memory, and nation-building: A history of the Volga and Mississippi Rivers.* New York: Berghahn Books.