

Industrial decarbonisation: Understanding the material politics of structural transformation in energy-intensive natural resource-based industry

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Background and main contribution

The paper emerges from the Green Industrial Sustainability Transition (GIST) project (www.gist2050.com) in which we study ambitious long-term structural transitions of energy-intensive natural resource-based industry (ENRI) in Sweden by exploring mitigation options, integration aspects, and potential development pathways and governance strategies for industrial decarbonisation. Although ENRI sectors are key to decarbonisation politics they have not yet received much attention in low-carbon transition research. In this paper, we aim, informed by a realist understanding of materiality, to explore the importance of materiality for understanding the structural conditioning of industrial transformations. Empirically, we focus our analysis on the Swedish iron and steel sector, which seems to provide a special case.

Context

The transformations of ENRIs have been largely overlooked in transitions research, although posing a number of characteristics that put distinct challenges for sustainability transitions. Considering the capital-intensive and long-term investment cycles, these industries are unlikely to expect spontaneous wide-spread niche-cumulation of radical innovation. The distinctive material and spatio-temporal characteristics embedded in global political economies, highlight the need for a better understanding of the structural conditioning and politics of ENRI transitions aimed at decarbonisation.

The Swedish steel industry is a case of special and interesting characteristics. In general, ENRIs are engaged in large technical systems, which are capital intensive and characterised by long-term investment cycles. In accordance with Pavitt's (1984) taxonomy of industrial firms, ENRI should be identified as scale intensive. Scale-intensive firms typically produce bulk materials, compete by economies of scale, and are geared toward incremental in-house process innovation. This ideal type corresponds well in certain aspects, in certain ENRI sectors. But since these sectors operate in complex global open systems as well as under specific local conditions, the general trajectories and characteristics identified by Pavitt does not always correspond with how they develop in real terms. For instance, the Swedish steel industry nowadays produces more specialized steel qualities than most other country.¹ Thus, the transition capacities and dynamics of this niche industry are different from those of, for instance, the Chinese steel industry which still concentrate more on bulk production.

Approach

In transition theory (e.g. the MLP; see Geels 2002; 2011), structure is conceptualised as socio-cognitive rules that coordinate and guide behaviour in local practise. Materiality thus becomes an epiphenomenon, denied autonomous causal efficacy, which need to be translated into socially significant rules to assert any causal influence. In contrast, this paper rely on a (critical) realist conception of materiality. Rather than conflating structure and agency, making routinized practice the central unit of analysis, we study the emergent properties of structure and agency, respectively, as well as their interaction. The neglect of the emergent properties of structures other than socio-cognitive rules, is a neglect of the causal influence that materiality exert in its own right (whether translated into rules or not) such as e.g. the spatio-temporal dynamics of the production and distribution system.

Material relations here represent relations that “can exist across differences in norms and rules, regardless of whether or not any of the participating actors realizes that they are embedded or not”, whereas cultural relations “all depend for their existence on their at least tacit acknowledgement by the participating agents” (Porpora, 1989). Material relations can thus exist and exert causal influence external to human agency whereas cultural relations necessarily are recognised by human agents and intersubjectively shared.

¹ The alloy steel production share in Sweden is approximately 60 %, while in the rest of Europe, the USA and Japan it is about 10-15 %, and even less in the rest of the world.

The fashionable allure to dissolve dichotomies such as structure and agency, or the material and social, by proclaiming them mutually constituted, is thus avoided for analytical reasons. The fact that they are interrelated is imperative, but to avoid simply stating a non-propositional philosophical invocation, it is important to analyse the distinct causal powers of emergent properties in their own right, as well as their interaction. To do so it is important to go beyond synchronic structural analysis towards a diachronic study of the historical emergence of structure, i.e. the temporal structuring and restructuring as structure and agency interact over time.

Power is understood as a relational property differentially conferred due to actor's relational position in the system of material and cultural structures. Power thus exist in virtue of structure. Power is not something held by individual parts of the system, independent of the relational organisation, but is rather a causal power of the structure. Structure is relational but also emergent. It is thus important to consider the specificity of different structures and the mechanisms they generate, something often overlooked by flat ontologies that invoke a neutral 'plane of immanence' across which fleeting assemblages – differentiated quantitatively as intensities – are distributed.

The conceptualization of structure as simply shared socio-cognitive rules fails to differentiate between when structures are more or less constraining on actors' potential to transform; every situation is reduced to an undifferentiated opportunity set potentially accessible by all actors. What is needed is the addition of material structures as 'power-conferring relations' that by way of uneven structural capacities and friction, due to actor's relational position in the system, influence the success, direction and speed of change.

This conception recognises materiality's causally autonomous efficacy, but does not ontologically privilege it as the dominant mechanism. Events actualise in open systems where a conjunctive multiplicity of emergent properties and contingent circumstances interact in a spatio-temporalized process. Spatiality and temporality is important not only as the necessary context of all actualisation, but sometimes/often it is possible to distinguish emergent spatio-temporal dynamics of transitions. Think of for example the global but polymorphic spatio-temporal dynamics of neoliberalisation (Peck and Theodore, 2007), or the spatio-temporal dynamics of new production processes for decarbonised steel that foster either more or less economies of scale – and thus centralisation or decentralisation.

Research questions and preliminary findings

In the paper we set out to explore (i) the material relations characterising the steel industry in Sweden, (ii) emerging strategies and practices aimed at decarbonisation in these industries, and (iii) what enabling and conditioning implications this might have with regard to transformative pathways towards decarbonisation and strategies for industrial decarbonisation.

For an effective analysis it is not sufficient to simply identify characteristics of the Swedish steel industry, we must also "supply an analytical history of their emergence" (Archer, 1995), i.e. a diachronic analysis of factors influencing industrial development. How have material relations historically played a role in the development of the Swedish steel industry, and what influence have they had on the characteristics of Swedish steel industry today? This study is based on public documents and secondary literature and will be supplemented with interviews with key actors.

Preliminary findings: The case highlights the crucial role materiality has played in the historical emergence of the Swedish steel industry, both during the expansion in the early 20th century and for the specialization after the structural crisis in the 1970s. Material conditions such as access to charcoal production, power production, and the high quality of the Swedish iron ore have been important structural factors for the development of the industry. It was first with better infrastructure (railways, power lines, etc) that larger production units, rationalisation and centralisation of a previously very localised and small-scale industry was enabled. The crisis in the 1920s led to further rationalisation and economies of scale, while the structural crisis in the 1970s spurred further specialization (see e.g. Fritz 1997).

However, this development has not been determined by material conditions, but rather enabled and conditioned the development of the Swedish steel industry in interplay with cultural relations, agency and contingent circumstances. It has not determined its development, or eliminated agency, but outlined the conditions of its operation. This is political since materiality, as part of the structural conditions, is compatible/contradictory with other emergent structures, and involves differential conferral of power.

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