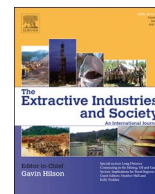




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Original article

## Competitors contained? Manufacturer strategies in the global rare earth value chain: Insights from the magnet filament

Erika Machacek<sup>a,b,\*</sup>, Niels Fold<sup>a</sup><sup>a</sup> Department of Geosciences and Natural Resource Management, University of Copenhagen, Øster Voldgade 10, Copenhagen 1350, Denmark<sup>b</sup> Centre for Minerals and Materials (MiMa), Geological Survey of Denmark and Greenland (GEUS), Øster Voldgade 10, Copenhagen 1350, Denmark

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## ABSTRACT

This paper connects the extractive industry of rare earth mining and processing with the global automotive industry in which magnets with rare earth content are key components. In the context of the hardly uncontested market leadership in rare earth mining by China, the strategies of second-tier European rare-earth magnet manufacturers warrant examination: they compete with their third-tier Chinese suppliers and aim for a favourable position with first-tier suppliers to automotive end-users. We use the governance typologies of the global value-chain framework to elucidate how European magnet manufacturers strategize and employ the ‘ability to codify’ variable. Codification significantly determines how global value chains are governed and who gains from access to and use of mined and processed rare earths: Our findings pinpoint the strategic use of information flows and knowledge by manufacturers to their competitive advantage in the magnet filament towards the automotive industry. Therefore we propose a focus on ‘intention to codify’ in exploring deliberately managed information flows for global economic restructuring processes. Such focus will provide a more holistic understanding of the global rare earth value chain and its many filaments.

## 1. Introduction

This paper addresses some of the dynamics within filaments of the global value chain of rare earths. The rare earth industry remains rather opaque, which is, among other things, a product of the wide variety of applications and industrial sectors in which rare earths are used (see [Klinger, 2015](#)). There is a need to examine the specific applications and the rare earth uses in specific nodes and filaments of these global rare earth value chains ([Machacek, 2015](#); [Machacek and Fold, 2014](#)). This paper chooses the distinct entry point of second-tier suppliers, a key part of the global value chain of rare earths to provide theoretical insights for global value chain theory. Specifically this paper examines the filament of rare earth magnets. They are manufactured in various ways: We examine the magnets that result from the processing method of injection-bonding. These magnets come to use as components in many end-user applications, most importantly in the automotive industry.

The manufacture of these components depends on close interaction and exchanges of information between users (buyers) and producers (suppliers) at specific segments. Some transactions are based on codified information such as technical standards (e.g. ISO requirements on material or process quality). Other transactions rely on close interaction between supplier and buyer, as one or both have specific tacit

knowledge that remains uncoded and that requires articulation to enable a transaction. Articulation is here defined as a process of conveying information that taps into tacit knowledge, yet without formalizing (codifying) that same information.

In this paper, we take up the invitation by [Ponte and Sturgeon \(2014\)](#) to support the further refinement of theories of global value chain (GVC) governance, and we focus specifically on the ‘theory of linking’ ([Gereffi, 2005](#)) and the micro- and meso-level of the three scalar dimensions delineated by [Ponte and Sturgeon \(2014\)](#). We examine the potential implications for global value-chain governance theory of a re-interpretation of the ‘ability to codify transactions’ variable to incorporate elements of ‘intentions to codify transactions’ ([Gereffi, 2005](#)). This focus on codification is important as it appears to have a significant impact on the governance dynamics in GVCs, not least in that of rare earths. We argue that the ‘ability to codify’ variable has been used to examine transactions/exchanges at value chain nodes from a technical perspective that tends to reduce the importance of strategic managerial intentions. The ‘intentions to codify’ represent an important aspect that needs to be incorporated on par with the technical concern for the ‘ability to codify’ in studies of industrial dynamics. This incorporation is key as it is human agency that drives information flows and thus, engineers the outcomes of the participation of suppliers and buyers in

\* Corresponding author at: Centre for Minerals and Materials (MiMa), Geological Survey of Denmark and Greenland (GEUS), Øster Voldgade 10, Copenhagen 1350, Denmark.  
E-mail addresses: [em@geus.dk](mailto:em@geus.dk) (E. Machacek), [nf@ign.ku.dk](mailto:nf@ign.ku.dk) (N. Fold).

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global value chains through negotiations of these flows at intra- and inter-firm linkages, from the segment of extraction to the segment of rare earth end-uses. An understanding of the nature of information exchanges at intra- and inter-firm boundaries is needed to comprehend the origins of different GVC forms of governance and their impact on competitiveness.

Examining the rare earth magnet production processes within the GVC framework allows for reaching the granularity of data needed to depict governance forms that contribute to the dynamics in this opaque industry. In particular, the strength of GVC analysis lies in fieldwork, which is of significance here to obtain data and to shed light on the complexity of the GVC of rare earths and its many filaments such as magnet manufacturing. The seminal work of Gereffi (2005) proposed five stylized forms of governance: market and hierarchical governance persist at the ‘extremes’, while the network forms in between are classified as modular, relational or captive governance. A low or high ‘ability to codify’ transactions is the sole distinction between the relational and modular forms of governance. However, the ‘ability to codify’ variable has hardly been conceptualized any further. Even more surprising, few GVC studies explicitly use the codification variable to shed light on information exchanges and thereby explain the dynamics of the integration and outsourcing of activities – or their impact on spatial patterns of production. In revisiting this variable, our aim is to strengthen the understanding of firm-internal strategies in the direction of preserving tacit knowledge (intangible capital) and competitiveness by allocating resources between activities under modular governance and those under relational governance. We explore what determines why companies manage the codifiability of transactions, that is, whether they deliberately increase or decrease codifiability. Enacting this binary role pursued by managers in firms allows for both the outsourcing of fragmented and low value-added processes and specialization in high value-added processes for product customization. This seemingly speaks to Ponte and Sturgeon’s (2014) multi-polar governance, an extension of Fold (2002) and Islam (2009), as it indicates that power can reside at several functional positions in the chain, such as at the second and first-tier supplier respectively, and even at the third-tier supplier, as we show later on.

We argue that these deliberate strategies influence exchanges of information of suppliers and buyers and that they are indicative of efforts to sustain firm competitiveness. We also argue that this process underlies the increasing separation of innovation and manufacturing as noted by Starosta (2010). By balancing resource allocation between lower and higher value-added activities, firms strive to occupy value-chain positions that strengthen their relational linkages with key buyers. This internal resource allocation appears to promote the rise in modularity throughout several segments in the value chain and, as a corollary, the importance of global contractors as claimed by Gereffi (2014).

Our theoretical argument is substantiated through an analysis of the strategies pursued by firms in the European rare-earth (REE) magnet industry in attempting to strengthen their positions within the global automotive value chain. We conceptualize their organizational transformations in the light of competitive pressures from Chinese magnet manufacturers. In particular, we aim to uncover simultaneously occurring processes in European magnet manufacturing of 1) the outsourcing of activities to actors embedded in the Chinese rare-earth industry, and 2) the integration of new functions to promote product differentiation and customization. Our empirical focus is on second-tier suppliers that have so far received little attention in GVC analyses – including studies of the automotive industry, though there are a few exceptions (e.g. Wad, 2008) – and that serve to drive home our theoretical explanation regarding modularity. From this second-tier supplier lens, we look towards their suppliers (third-tier) and their buyers (the first-tier suppliers to the automotive end-users). We argue that an understanding of the challenges faced by firms in this tier elucidates their strategic intentions and in turn reveals the tendency towards

modularization.

The article is organized into six sections. Continuing on from this introduction, the second section discusses the ‘ability to codify’ variable as a unique distinction between modular and relational market linkages. In the third section, our data-collection method and analysis are presented. Section four empirically outlines codification as a deliberate managerial decision with a twofold aim, first to transmit certain information necessary for codification in order to maintain modular linkages, and secondly to abstain from codifying information that taps into tacit knowledge. By controlling information transmission through an emphasis on articulation, it is possible to establish relational (and more profitable) linkages with core buyers. In section five the flows of information are discussed in terms of their effects on the organizational, spatial and temporal dynamics of GVCs. Section six concludes that an amended codification variable might facilitate a more nuanced perspective on dynamic processes associated with managerial intentions to balance information flows.

## 2. Codification, buyer-seller relationships and governance<sup>1</sup>

The scholarly focus on the buyer–supplier relationship within the GVC theoretical framework has predominantly been on relations between lead firms and first-tier suppliers, including analyses of the automotive industry (Humphrey, 2003; Sturgeon, 2003). In accordance with our theoretical argument and the empirical context (the European magnet manufacturers in the global automotive value chain) we seek to generalize these conceptualizations to second-tier suppliers. Due to their lesser degree of proximity to the lead firm, second-tier suppliers are arguably under relatively higher competitive pressure than first-tier suppliers, which are in more direct contact with the lead firm, as they tend to be invited to collaborate on, for example, product design.

Early on, when global value chains were termed ‘global commodity chains’ (GCC), governance was understood as the distinction between buyer and producer-driven governance structures (Gereffi, 1994). A buyer-driven commodity chain is associated with the exercise of buyer power, the iconic industries being characterized by high labour intensity such as retailing or the textile industry. These industries are under the command of ‘big buyers’ which occupy design, marketing and distribution functions while manufacturing is outsourced to a decentralized network of horizontally organized suppliers (Bair, 2005). A producer-driven commodity chain refers to industries of high capital and technology intensity, such as the automotive industry, with a powerful manufacturer tightly controlling vertically organised suppliers in a network of several tiers, which produce components (Bair, 2005).

Gereffi (2005) specified five forms of governance, namely market-, modular-, relational-, captive- and hierarchy governance, whereby market- and hierarchy governance are at the respective extreme ends and modular-, relational- and captive governance represent network forms with more equal but differentiated power imbalances between buyer and supplier. The authors derived these governance forms by adding the ‘ability to codify transactions’ variable to the previously defined variables of ‘complexity of information’ and ‘supplier capability’ developed earlier (see Sturgeon (2002), Sturgeon and Lee (2001) and Humphrey and Schmitz (2002)). Accordingly, the three variables can take on one of two values: high or low. The combination of variables and values yields five forms of governance which are empirically demonstrable (see Table 1). Moving from market via networks to hierarchy reflects a tendency towards increasing levels of explicit coordination and power asymmetry between buyer and supplier in favour of the former. Two further contributions from this work (Gereffi, 2005) are worth stressing: First, network forms differ from market governance as information flows across the inter-firm boundary extend

<sup>1</sup> In this article, our use of the term ‘governance’ is in line with the meaning given in Gereffi (2005).

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