Management of Global Value Chains and Risk: An Application to Emerging Markets

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Abstract

Management of global value chains by manufacturing firms requires detailed consideration of the relationships with partner firms and the risks involved in operating in different countries, especially emerging markets. Value chains in the mining equipment sector are particularly interesting, since production of many components is outsourced to third-party firms, and supply chains often include regional distribution centers and also after-sale service of equipment. The mining equipment business in the Democratic Republic of Congo (DRC) is populated by multinational manufacturers that operate in three value chain structures. Each arrangement presents a somewhat different risk and return profile: greater local presence offers greater upside profit opportunity, while exporting to another company in the DRC entails lower country risk. This study explores the majority of original equipment manufacturers (OEMs) selling into the mining industry in the DRC. Through interviews and secondary data, we create a detailed look at the operation of the global value chains used by these firms. The contribution of the paper is to further develop our understanding of the operation of global value chains, and to show how and why, despite similar circumstances, different MNEs pursue different strategies in the same country and industry.

Keywords: Global value chains; Risk management; Emerging markets; Mining; Equipment

1 Introduction

According to Gereffi et al. (2005) "The rising integration of world markets through trade has brought with it a disintegration of multinational firms, since companies are finding it advantageous to 'outsource' an increasing share of their non-core manufacturing and service activities both domestically and abroad" (p.80). Multinational manufacturers such as Apple and Toyota, Airbus and Levi Strauss, and many more utilize globally-distributed suppliers of all aspects of the value chain, from basic inputs, to product assembly, to final distribution to customers. Apple's value chain has been widely cited to demonstrate that Apple itself makes

almost nothing of the iPhone except orchestration of the global value chain (and of course design of the product as well as final sales of some of its iPhones through Apple stores). [1]

In the context of emerging markets, multinational manufacturers often source production inputs such as metals and chemicals from local suppliers where the raw materials are located. They also may use emerging market suppliers of assembly for products such as electronics and clothing. And at the downstream end of the value chain, they often use local stores and distributors to get their products to final customers, commercial or retail. The logic for these strategies is generally to minimize overall costs, although local emerging market knowledge is often valuable at the distribution/sales end of the value chain. And at this local market end of the value chain, Meyer et al. (2009) point out that institutional considerations have a large impact on the choice of entry modes for foreign multinationals in emerging markets.

Our interest in this paper is to look in detail at the global value chains of more than a dozen multinational mining equipment manufacturers that operate/sell in the market of the Democratic Republic of Congo (DRC). With such a focus we are able to explore sourcing, manufacturing, transporting, warehousing, sales and after-sale service efforts of these companies to serve customers in an emerging market. This fine-grained level of analysis has not been achieved in other studies of GVCs extending to emerging markets to the best of our knowledge. We also contribute to the understanding of global value chains more broadly, considering the ownership of the stages in the chain and ways in which original equipment manufacturers (OEMs) relate to their suppliers, customers, and intermediaries. Since risk perception was a major factor in driving the decision by OEMs to have a presence in the DRC or not, we contribute to the literature on risk perception and management in international business. This mining sector is increasingly important in the twenty-first century, as supplies of critical metals and minerals (e.g., copper and lithium) for electric vehicles and for national security concerns in multiple industries come to the forefront of policy decisions.

We explore two research questions in the paper: (1) what structure of the global supply chain is optimal for supplying the DRC market, given the risks and opportunities in this emerging market? And (2) how should risks be managed in operating the different value chain structures?

Global value chains have been examined from various perspectives over the past three decades. Initial studies tended to look at how multinational companies were contracting out for different parts of value chains, such as provision of raw materials, assembly of manufactured goods, and even transportation of intermediate and final products. Krugman (1995) talked about "slicing up the value chain" (p.333). Feenstra (1998) discussed the 'disintegration of the production process" across countries (p.32). Ernst and Kim (2002) call the relationships among the firms involved "global production networks" and looked at how MNEs use operations in various countries to build networks of suppliers and customers. Buckley (2009) focused on the incorporation of emerging markets into the 'global factory', which distributes production processes through multiple countries – although leaving control of the GVC in the hands of advanced-country MNEs. All of these analyses focused on the division of productive activities along a supply chain from raw materials to finished products, considering the different countries and companies involved in the supply chain for any product. A large number of the empirical studies focused on clothing and electronics, both of which have extensive assembly activities in emerging markets (Ernst & Guerrieri, 1998; Gereffi, 1999; Moxon 1974). In the mining sector a recent study looked at the GVC in copper from the perspective of copper mining companies in Peru, exploring the interactions of local mining companies, MNE mining companies, and the value chains into which they supply the mined copper (Bamber et al., 2024).

With respect to risk perception and risk management, the literature has focused much more on risk management strategies (Damodaran, 2007; Froot et al., 1993), while the issue of perceptions is much less studied (Renn & Rohrmann, 2000). The risk management literature considers strategies for either reducing risk or diversifying in order to reduce potential impacts. The risk perception literature is more focused on people's thinking about disaster risk or personal safety risk, where our interest concerns the risk of loss for a business due to operating in a risky country. Even so, there is some writing on the issue of cross-cultural differences in risk perception (Rohrmann & Chen, 1999; Keown 1989).

The rest of the article first describes our context of GVCs in the mining equipment business, with particular reference to the Democratic Republic of Congo as the target market, then a brief literature review relating to both GVCs and risk perception and management is presented. The qualitative method of our analysis follows, and then the empirical results are presented and discussed. Finally, we consider practical implications of our analysis and findings and note some limitations of the study.

1.1 Full Global Value Chains of Mining Equipment Manufacturers

The mining original equipment manufacturers' (OEM) GVC comprises 4 major activities which are R&D, manufacturing, distribution and sales, and after-sales service.

R&D enables OEMs to deal with expectations from the market by offering customers a solution rather than a product. This critical activity of the value chain is hosted mostly in home countries with the intellectual property (IP) managed by the headquarters and budget allocated to make sure that OEMs have funds to invest in product development and innovative technologies for their mining customers.

Sourcing and manufacturing include the supply of inputs, the manufacturing of components and the assembly of the machine. These could even be viewed as separate steps in the value chain, since they may be done in-house or contracted out. Key outsourced inputs include raw materials such as steel used to produce IP parts and components in-house. Other non-IP components are outsourced, typically from ISO-certified low-cost manufacturers in some emerging markets with good infrastructures for exports, access to cheap raw materials and low labor cost. Final assembly of the equipment is then done in-house by the OEM.

Sales and distribution are managed either in-house by wholly-owned subsidiaries or by independent dealers. Proximity to the mine where the end-customers operate is critical; OEMs have distribution centers generally situated in regional hubs and major ports. For example, South Africa is home to distribution centers for many OEMs servicing the local market and exporting into Southern Africa while major ports in Europe are used for international markets.

The aftersales stage is comprised of the post-sales services for the machine. These services can include supply of parts, repair, maintenance, tooling and training of operators and service personnel. The availability of these resources close to the machine is critical to ensure availability and performance to avoid downtime costing mining customers a lot of money. In host countries, OEMs can either run this through subsidiaries or outsource independent dealers able to invest millions of dollars in parts inventory kept in the host country.

In the mining equipment context, OEMs produce the machines mainly in their home countries but also have some manufacturing facilities worldwide. Most of the companies are from the

traditional homes of these machinery producers, namely advanced industrial countries dominated by the US, Japan, and Western Europe. They make most of their heavy mining equipment (trucks, excavators, wheel loaders) in home countries and from other locations in Europe, and North America. Smaller equipment for earthmoving and construction (graders, bulldozers, medium excavators, etc..) is made in China, Brazil, India, Mexico, Poland, etc. by the OEMs. A second group of the OEMs come from China, and they produce most of their equipment in their home country and have some sub-assemblies done outside within Asia for major components, outsourced to various suppliers.

All of these mining equipment OEMs combine own and outsourced components to build their equipment and do not contract a third party to manufacture/assemble the finished products. Once the final equipment has been assembled, it may be shipped to a central warehousing location, often in Belgium (for sales in Europe, Africa, Middle East and to some extent Asia) or in the US for sales in the Americas. Then final distribution is made to distributors in some markets or to OEM-owned warehouses in other markets. After-sale service is provided typically by contractors selected by the OEM or selected by the distributor and approved by the OEM. Appendix A shows this general structure of the GVC.

The mining operators (i.e., the customers) have two main reasons behind the procurement of new fleet from OEMs: replacing an ageing fleet or acquiring a new one for the expansion of the mine. Switching to a different brand can be added as third reason and can happen when the OEM is not able to support the equipment once in country; reasons can be technical such as the lack of skills for technicians or commercial such as increasing maintenance costs. This switch was easier in earlier decades; nowadays it comes with a catch – equipment is capital-intensive and fitted with the latest technology such as devices requiring a PIN. So, redesigning the configuration requires skills, money, and time for a successful execution, and this makes it more difficult to switch providers.

In the case of a new fleet either to replace an ageing one or going for an expansion of the mine, the competition is fierce between OEMs with local assets in the target country (wholly owned/FDI) and contracting/dealers. They bid for the same tenders and target any mine, even the ones under Chinese ownership.

1.2 A Focus on the DRC

An interesting twist to the disaggregation of production across borders is that MNEs operating in emerging markets that have extensive institutional weaknesses need to deal with inadequate labor pools, weak regulatory environments and insufficient capital markets (e.g., Khanna & Palepu, 2015). In this context, among other strategies, these firms may extend relationships with suppliers and customers that exist outside of the host country to overcome difficulties in local markets. A particular challenge for MNE decisionmakers exists in the mining equipment industry in the Democratic Republic of Congo (DRC). This industry is populated by OEMs from the US, China, and Europe, and their customers are almost exclusively mining MNEs with whom they have existing relations in other countries. The strategies of these companies for structuring their value chains and then entering and dealing with the risks of operating in the context of the DRC are quite different from each other. Understanding the reasons for these differences and recommending company strategies are the goals of this paper.

The mining equipment OEMs with sales in the DRC follow two broad strategies. They all produce their mining equipment (e.g., earthmovers, trucks, excavators, loaders) outside of the

DRC in a safer and larger-scale location such as the home country or in Europe. Most of the OEMs (except the Chinese ones) have distribution centers in either Belgium [2] or South Africa where equipment is held before shipment to the DRC. The products are then shipped to the DRC either (1a) directly to customers or (1b) to unaffiliated distributors, or (2) to the OEM's own local warehouse and distribution facilities. Service on the equipment is provided typically by the local distributor, but sometimes through contractors hired by the OEM's own office in the DRC. (See Table 1 which describes this process for 14 OEMs.)

We are interested in three phenomena in this situation. First, how does the OEM structure its global value chain to supply the DRC market; second, why does an OEM choose a local distributor or direct sales to the customer, versus operating its own warehouse, office and service operation in the DRC; and third, how does the OEM manage risks involved in doing business in the DRC?

For all three phenomena the ability to manage risks is critical to the profitability of the business, so a key question in our context is how to allocate risk to the supply chain partner that is best placed to manage that risk. MNEs operating in an emerging market may take advantage of foreign partners and transfer risk to them (Lindstrand & Hånell, 2017). In our study we see some of the OEMs following this strategy, but others do not. The management of risk in emerging markets has generally focused on operating modes, which can be categorized as either equity or non-equity modes (Benito et al., 2009). When we consider the detailed structure of the value chain leading to sales in the DRC, it appears to be more of a network, with suppliers, distributors and service providers linked together and not all owned by the same parent. This situation allows us to identify three broad categories of OEMs: those with an equity mode of operation and those with a non-equity mode of operation; and within the non-equity mode there are OEMs that export directly to final customers in the DRC and others that export to distributors, which then sell to ultimate customers. This detailed look at the supply chain structure is novel and has not been investigated previously.

1.3 Context for the Study

The context for the study is the mining industry in the Democratic Republic of Congo, although the OEM supply chains operate throughout the world, as discussed in the Introduction above. (See Appendix A for the description of one OEM global value chain.) The DRC is an emerging market economy listed by the UN and World Bank as a poor country, which is located in Central Africa. The country is predominantly French-speaking, with a population of 97 million in 2023 (ranking fourth in Africa). It is the second largest country in Africa in terms of geographical size, with an area equivalent to that of Western Europe. The DRC is regarded as one of the riskiest countries in which to do business (e.g. PRS 2023), and it has only recently emerged from six decades of military rule (World Bank, 2022). Despite this the DRC has attracted many of the world's major mining companies in search of minerals such as copper, cobalt and lithium, which are in increasing demand due to efforts to deal with climate change via production of electric vehicles and use of other low-carbon technologies.

The mineral wealth of the DRC is of global significance and has attracted much attention, especially with regard to cobalt. Calvao et al. (2021) suggest that cobalt demand has grown dramatically; its utilization has tripled in the last decade and is expected to double again by 2035 and increase further because it is a key ingredient for: anti-pollution devices, 5G telecom rollout, growing implementation of 4IR and portable electronics, and most importantly, the increasing production of EVs (electric vehicles). The DRC produced approximately 70% of the

Table 1 List of key mining OEM MNEs servicing the DRC as of 2022

#	OEM origin /main HQ	Ways of servicing the DRC	OEM	R & D	Main source of key inputs	Main location of the manufacturing of the outputs/ assembled equipment	Main location of the parts distribution center feeding the DRC network
1	Sweden	Equity/FDI	Sandvik	Sweden*	Engine**, transmission**, body*	Sweden	South Africa
2	Sweden		Epiroc	Sweden*	Engine**, transmission**, body*	Sweden	South Africa
3	Scotland		Weir Minerals	US*	Steel**, Body*, wear parts*	US (Portland)	Belgium, South Africa
4	US	Contracting	Caterpillar	US*	Engine*, transmission*, body*	US (Illinois, Arkansas, Europe, China, India, Brazil, Mexico)	Belgium, South Africa
5	Japan		Komatsu	Japan*	Engine**, transmission*, body*	US (Illinois), Japan (Ishikawa, Hyogo), Germany (Dusseldorf)	Belgium, South Africa
6	Japan		Hitachi	Japan*	Engine**, transmission*, body*	Japan (Tsuchiura Works)	South Africa
7	US		Cummins	US*	Turbochargers*, filtration*, aftertreatments*	UK (Daventry), US (Seymour)	Belgium, South Africa
8	Scotland		Terex	Scotland*	Engine**, transmission**, body*	Scotland (Motherwell)	Netherlands
9	Sweden		Volvo	Sweden*	Engine**, transmission**, body*	Sweden (Eskilstuna)	Belgium
10	China		Shantiu	China*	Engine**, transmission*, body**	China (Jining)	China
11	Korea		Doosan	Korea*	Engine*, transmission**, body*	South Korea (Seoul)	Belgium

Table 1 (continued)

#	OEM origin /main HQ	Ways of servicing the DRC	OEM	R & D	Main source of key inputs	Main location of the manufacturing of the outputs/ assembled equipment	Main location of the parts distribution center feeding the DRC network
12	Germany Switzerland	Exporting	Liebherr	France*	Engine**, transmission*, body*	France (Colmar), US (Virginia New Ports News)	France
13	China		Liugong	China*	Engine**, transmission**, body*	China (Liuzhou)	China, South Africa
14	China (new entrants)		• NHL • XCMG • SANY	China* China* China*	Engine**, transmission**, body*	China (Shandong) China (Xuzhou) China (Changsha)	China

Company interviews, company documents, published sources

*Inhouse/owned by the OEM

**Contracted/outsourced

world's cobalt output in 2023. It also is the 4th largest producer of copper (after Chile, Peru, and China) and a significant producer of lithium.

The DRC mining sector has been dominated by foreign mining MNEs since the time that the government liberalized that sector in the early 2000s. This coincided with significant increases in the prices of commodities used for batteries and other 4IR technologies (Rubbers, 2020). The liberalization of the mining sector has been attracting MNEs and FDI from both emerging markets (South Africa and India) and developed markets (United States, Canada, Australia, United Kingdom, Switzerland, and China) for large-scale mining operations concentrated in the Katanga province (the 'African Copperbelt'), in the southern part of the DRC.

The rapid expansion of MNE mining interests in the DRC required extensive supplier networks, as the DRC has limited technical or manufacturing capabilities to support the mining industry. As a result, there has been a major inflow of mechanized mining equipment from abroad into the DRC (Fessehaie, 2015). The providers of the mechanized mining equipment, the original equipment manufacturers (OEMs), are MNEs; their customers (the mining companies) are MNEs as well.

OEMs in the mining equipment industry are firms that manufacture using a combination of own labelled and outsourced components, producing a final branded output or item of equipment that is sold on the market (Story et al., 2017). OEMs are also expected to service and warranty their expensive equipment, and this ability is often a source of competitive advantage (Wilson, 1999). [3] OEMs have relationships with the mining MNEs that exist beyond the DRC, and in many cases predate the expansion to the DRC. Examples of OEMs in the mining sector are Caterpillar, Hitachi, Liebherr, SANY, and Komatsu (Market Research Reports, 2020).

Mining equipment manufacturers service their customers in the DRC through importing their equipment and providing continued maintenance and after-market service attached to the product. The acquisition of this type of equipment is accompanied by extensive maintenance agreements and guarantees. The industry is capital intensive, and there is significant risk involved with the equipment once it is imported into the DRC: equipment may be stolen, damaged or destroyed due to war, social conflict or criminality. The OEMs differ in their strategies for dealing with this risk, from selling through the home office directly to the customer in the DRC, selling to a distributor that operates in the DRC, to operating local warehousing and service operations and selling from that local operation to the mining customers. The risks are clearly different, since in the first two cases there are no OEM facilities or personnel located in the DRC. And in the last case, the OEM does have facilities and typically inventory of equipment in the DRC, along with some personnel.

The contribution of this paper is to conceptualize the value chains used by companies that operate in difficult/risky countries, and to explore managerial reasons for different supply strategies. MNEs operating in emerging markets have been studied for some time, but previous studies have not explored the value chain details as here. We notice several strategies being pursued by similar companies in the same country, the DRC. This is not explained by extant theory. These approaches, for example, do not take into consideration the customer of the MNE who has to deal with operational risk. Our approach combines both risk management and value chain analysis and shows how an MNE may hand over country risk to its customer; it may share the country risk; or it may assume this risk itself. We see all of these alternatives used in emerging markets such as the DRC. The paper responds to a suggestion from Kano et al. (2020)

in looking at global value chains; they recommend research on the microfoundations of GVC governance, as well as value creation and distribution of the GVCs.

2 Literature Review

2.1 Global Value Chains

The disaggregation of production processes from purchase of raw materials to final distribution of products and services has been explored extensively in recent years under the headings of global value chains and global production networks. Porter's discussion of value chains in the 1980s (e.g. Porter, 1985) brought attention to the fact that any business can be analyzed as carrying out a series of steps from obtaining initial materials needed to produce a product or service all the way to final sale to customers, with support activities needed at each stage of the process. Grosse (1989, 2016) explored value chains as they extend into emerging markets, typically finding the inclusion of emerging markets either at the raw materials or final market stage of the chain (or at the stage of offshore processing of products or services). This idea of emerging market participation in GVCs grew dramatically with the development of offshore assembly of clothing and electronics, particularly in Asian countries and in Mexico (Dillman, 1983; Farrell, 2005).

Much of the literature on global value chains has focused on their implications for employment. The initial wave of offshore production in China once that country opened up to international business in 1978, and more so when China joined the World Trade Organization in 2001, correlates quite clearly with a decline in US manufacturing employment (Autor et al. 2016). Similarly, firms in the EU and Japan have moved assembly of their clothing and electronics offshore, mostly to Asian countries, and sometimes to owned subsidiaries, other times to third-party contract manufacturers.

Looking at the structure of global value chains, Gereffi et al. (2005) identify three aspects of the value chain that may lead companies to choose different alternatives. They argue that (1) the complexity of information and knowledge transfer required for a product may lead to a structure which favors a tighter link between value chain stages; (2) the extent to which the information/knowledge is codified may lead to weaker links between the value chain stages; and (3) the more important are capabilities of the supplier to deliver what the customer needs, the tighter the links between the value chain stages. In the present context this view indicates that OEMs may choose closer control over the delivery of their equipment to mining companies when the equipment's function and use need greater knowledge transfer by the OEM. And when the equipment is more standardized, there may be less need for the OEM to control the final stage of the value chain.

Looking at the relationships between members of global value chains, Kano (2018) considers how the orchestrating firm in the GVC (the OEM in our case) deals with suppliers, service providers and customers to pursue its objectives and to account for power differences between the various organizations. She points out that "The role of the orchestrating firm's head office is thus better described as that of a joint value orchestrator/GVC community leader, responsible for both making ownership/location decisions and for deploying social mechanisms to implement those decisions" (p. 700). This issue is particularly relevant in our context as the orchestrator deals with intermediaries to get the mining equipment from the factory to the ultimate mining company customer.

In the economics literature a number of papers have explored the question of how far firms will/should go in expanding along the value chain. Antras and Chor (2013) looked at demand elasticity for final products in the value chain, finding that firms facing higher demand elasticity tend to own downstream parts of the value chain and outsource upstream activities. Baldwin and Venables (2013) talked about 'snakes and spiders', production processes in which the value chain is tightly linked by engineering concerns (snakes), versus production processes in which the value chain can be divided up spatially and across organizations without difficulty (spiders). The snakes tend to be much more vertically integrated, while the spiders have much more outsourcing of activities (similar to the argument of Gereffi 2005).

2.2 Risk Management in GVCs, Focusing on Emerging Markets

Risk management by MNEs in emerging markets has largely focused on methods for dealing with country risk, beyond the normal risk management concerns for operating in developed countries (Zhu & Sardana, 2020). Since the companies in this instance are all importing industrial equipment into an emerging market, their focus is on minimizing the risks involved with getting the equipment to the country, possibly holding it until pickup by the customer, and getting paid by the customer.

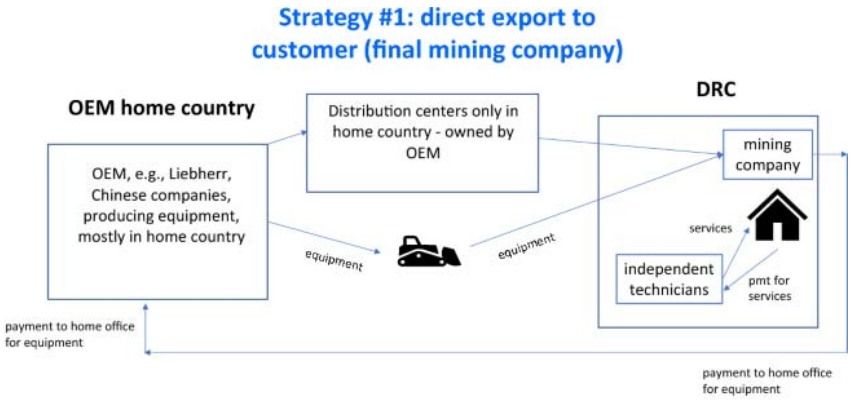
This is an interesting phenomenon in our situation because, even while all companies are using the import method of getting their products to the emerging market, the full supply chains of obtaining inputs, producing equipment, transporting it to distribution centers, final distribution to the DRC, post-sale equipment servicing, and payments, are quite varied among the OEMs. Figure 1 depicts the situation under study here. [4]

We have identified three strategies used by the OEM companies in the DRC. They include: (1) direct export to the customer; (2) export through a local independent distributor onward to the customer; and (3) export to a local OEM-owned facility and sale onward to the customer. The first two strategies can be considered non-equity forms, because the OEM owns no resources or facilities in the host country. The reasons for choosing each of these strategies are discussed in the analysis below.

Emerging market risks are linked to weak institutions and policy uncertainty and instability (Luo et al., 2019). Organization of supplier and customer networks consequently is important for the sustainability of a business in this context. The risks can be classified as either country risks or counterparty risks. Country risks are those derived from the political and economic situation in the host country, which are often aggravated by the corruption of government officials (Cuervo-Cazurra, 2016). Government-related risks include tax rule changes, repudiation of contracts, inconvertibility of currency and asset expropriation (Deligonul, 2020). Country risks are not confined to the actions of governments and can include society-generated risks such as civil war, riots and labor unrest (Stosberg, 2005). When there are weak institutions then these risks are more likely and their effects may be greater.

Counterparty risks are those risks that relate to the probability that a counterparty would not be able to pay or otherwise honor their contract (Driga et al. 2010; Sayah, 2017). In an emerging market a default by a network partner could be devastating to the other members of the supply chain, and it is in the interests of all the members that counterparty risks are either shared, allocated to the partner most able to manage a risk, or alternative arrangements are made to reduce the risk. This is made more complex in a high-risk country context such as the DRC

where supply chain participants are not all affected equally by the country risk and may not perceive the country risk similarly. [5]



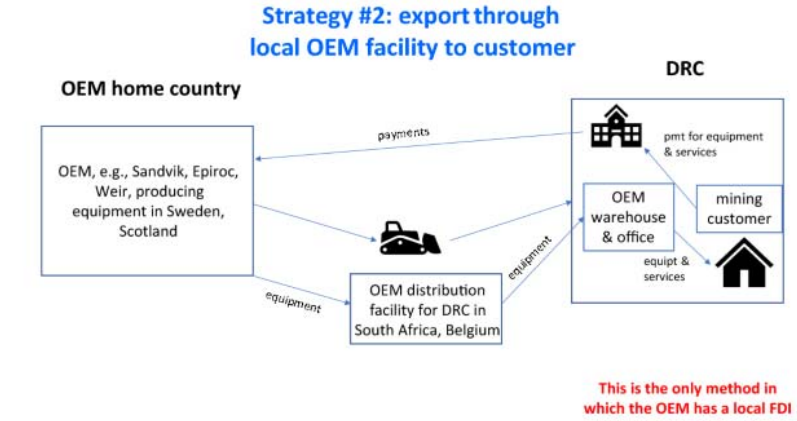


Fig. 1. Three Supply Chain Strategies for Serving the DRC

2.3 Operating Modes in Emerging Markets

2.3.1 Equity Modes of Operating Internationally in the DRC

Equity modes can be defined as operating modes involving ownership, investment and control of operations in foreign markets for MNEs (Agarwal & Ramaswami, 1992). Building on this view, Hollender et al. (2017) suggested that equity modes (or equity investments) are those operating modes involving the commitment of the MNE's owned assets and resources in a foreign country. Resources in the context of equity mode can be described as capital investment in terms of cash, facilities, land and equipment (Yan & Gray, 1996). Unfortunately, this distinction does not enable us to understand whether an MNE uses the local affiliate as a production location, or if it only functions to receive products (and services) from the home country, such as a distribution center.

It may turn out that the ability to commit to capital investment in foreign markets can grant greater power to MNE headquarters to control and influence the management of the local activities in the host country (Child & Yan, 1999). From this perspective, equity modes require that MNEs with headquarters in home countries commit to resources involving cash, facilities and other tangible and non-tangible assets in the host country, and that they have the ability to manage both resources and operations there. The host country-based entity from this MNE is expected to deal with country risks and execute the home country headquarters strategy.

Equity modes have been suggested as preferred modes for MNEs wanting to have more control over their operations in foreign markets. To achieve this, MNEs are expected to commit to resources in foreign countries. Buckley (2016) noted that the subsidiary or entity owned by the MNE in the host country has to combine corporate strategy and host country dynamics that might require a different set of FSAs (firm-specific advantages). These FSAs could include political connections, ability to deal with ambiguities, ability to raise funds and strong ties with the diaspora via networks (Adarkwah & Malonæs 2022). MNEs with equity investment want control of assets and operations in host countries. To achieve this, they can leverage their own distribution network to have their affiliates on the frontline to drive corporate strategy while at the same time dealing with risks. According to Teece (1986), MNEs adopting equity investments can have these four advantages: first, the legal rights regarding ownership and the management of the entity, second, the returns to expect as shareholders based on level of equity participation, third, the management of risks; and fourth, the ability to select new partners for JV creation.

From this perspective, MNEs with equity investments can control their foreign operations, obtain more revenue, and in turn reinvest into the business. Committing to assets in the host country can be challenging when dealing with capital intensive industries such as mining equipment production and servicing customers in unstable emerging markets. [6] From this perspective, Teece (1986) mentioned two challenges for equity modes; first, the challenge to exit due to high levels of resource commitment; and second, the opportunistic behaviors that can emerge in equity joint ventures with the potential of generating the use of mutual hostages.

2.3.2 Non-Equity Operating Modes in the DRC

Non-equity modes of operating are those operating modes that do not require any equity investment from foreign firms to operate abroad (Erramilli, 1990). However, even if non-equity modes do not require the commitment of assets and resources from MNEs' home countries,

collaboration with partners in foreign markets is an imperative, and this can be achieved by building a non-equity network. In an international supply chain, the non-equity modes are predominantly contractual or export. Contractual modes include operating modes such as strategic alliances, licensing, franchising and contract manufacturing. These forms involve a contractual agreement implemented between brand owners and their appointed non-equity agent to distribute and service products in defined markets in exchange for financial gain. (Kumar & Subramanian 1997).

Export modes are defined as operating modes involving the sale of products produced by MNEs in their home market to partners situated in foreign markets without committing to any assets abroad (Hambrick, 1982). From this perspective, Driscoll and Paliwoda (1997) pointed out that when it comes to export modes, the MNE produces the products in its home country and ships them to partners in host country, which is called direct export if the partner is a final customer, and indirect export if the partner in the host country is an agent.

Non-equity modes have been suggested as preferred modes for MNEs operating in unstable and volatile environments (Brouthers, 2002). From this view, avoidance is a risk management strategy that MNEs can use to limit exposure. MNEs adopting non-equity modes still seek business from foreign markets, so they can leverage the help of their partners from the host country on the frontline representing them, generating revenues while reducing risks.

Anderson and Gatignon (1986) argued that with non-equity modes, MNEs headquartered in the home country have no control over the brand and operations in the host country. From this perspective, Hill et al. (1990) elaborated that this lack of control can lead to coordination challenges that put performance of the MNE at risk. Furthermore, while avoiding local facilities can help share the country risks with non-equity partners, these MNEs still have counterparty risks to manage for goods supplied to the partners in unstable markets.

From the discussion above, we identify two research questions related to OEMs operating globally and entering and operating in an emerging market:

Research Question #1: What structure of the supply chain is optimal, given the risks and opportunities in the emerging market? In our case, should an OEM export directly to its DRC client; should it set up its own distribution and service facility in the DRC; or should it operate through a third-party distributor in the DRC?

Research Question #2: How should the OEM manage the risks involved in operating this supply chain? The risks include country and counterparty risks in the DRC in particular.

3 Method

We used a qualitative approach for this study as it was appropriate for an exploratory study (Marshall & Rossman, 2016). A multi-case approach allowed participants to give deeper meaning to their experience, and exploratory case studies were useful to investigate the supply chain organization and the risk management used (Gray, 2017; Saunders et al., 2016).

The unit of analysis was the OEM MNE, and we talked with individuals responsible for strategy in the DRC. 13 individuals from 11 mining OEM companies, with knowledge of the company's activities in the DRC, were interviewed. [7] Three of the individuals were DRC-based and involved with operations at distribution network level, while ten were overseas-based

supporting the distribution network. Subsequent to the initial survey, additional information was collected about four more OEMs selling in the DRC. These last companies are not reported in the interview data, but they are included in the table and in the analysis.

Individuals composing the interview sample included:

Label	Location	Responsibilities
01	South Africa	Africa Sales Director
02	South Africa	Africa Sales Director
03	Holland	Africa Exports & Managing Director
04	South Africa	Africa Middle East Head of Chinese mining business
05	DRC	DRC Mining Project Manager
06	South Africa	Southern Africa Cross Border General Manager
07	Ivory Coast	Africa Central & West machine sales
08	South Africa	Africa Middle East Chinese business development manager
09	DRC	DRC Head of Sales and Support
10	South Africa	Africa Middle East Business Improvement Leader
11	DRC	DRC Mining Sales Manager
12	South Africa	Africa Middle East Business Unit Director
13	South Africa	Africa Central & West Sales Manager

We used purposive sampling to obtain a population with the necessary knowledge to generate rich data to assist in answering the research questions. This was complemented by snowballing to select more participants from the extended network with the requisite skills and knowledge. Junior and less-experienced candidates were disqualified despite being available, as convenience sampling was not entertained as an option because the more junior people had not been exposed to critical constructs such as risk assessment and management. This rigour helped build a population of solid candidates, some in charge of the entire Africa Middle East region. Interviews lasted for approximately one hour. We asked respondents questions about (1) how they organize the global value chain for their product, with specific reference to the fit in the DRC, and (2) how they perceive and manage the risks involved in doing business in the DRC. The questionnaire is available on request from the authors.

We collected data with semi-structured interviews and triangulated with secondary data including company financial statements, intelligence reports and news articles. Multiple trips were conducted to the DRC, South Africa and the European Headquarters of OEM MNEs that were represented in the sample. This was necessary to answer the overall questions about how OEM MNEs manage supply chains and country and counterparty risk in an emerging market. The OEMs are well represented in the list of largest OEMs in mining globally (Market Research Reports, 2020). The multimethod approach adopted in this study helped triangulate data from interviews with secondary data (Yin, 2018). For instance, claims made during interviews about operating modes, even headquarters of MNEs and brands represented in the DRC, were checked against websites for validation.

4 Results and Findings

It became clear early in the data gathering that the OEM MNEs could be categorized according to operating mode, which was equity or non-equity based. That is, they invested into the DRC or they exported or used a local distributor on whom they relied to provide after-sales service

to the mining MNEs. This categorization was useful as it reflected the perception and approach to managing country and counterparty risk. The sample that participated in the research were sorted into three categories of equity investors and non-equity operations using either distributors or direct sale to final customers. They are shown in Table 2 below.

After discussing the risk management practices used by these companies, we will return to discuss reasons why different companies used different entry and operating structures.

4.1 Non-Equity (Direct Exports or Sales to Distributor) OEM Perception and Management of Country Risk

The main difference among the three groups was the perception and management of risk, which in turn determined the operating models. First, the perceptions and attitudes to country risk of the three categories of OEMs are compared. Then their choices for managing country and counterparty risk are described.

4.1.1 Risk Perception

The perception from MNEs with non-equity structures is that the DRC is significant to their mining OEM business but carries a high degree of risk. The host country risks were identified as: security, economic volatility, geopolitical uncertainties, high-risk for investment, ease of doing business, government corruption, poverty, political issues and logistics challenges aggravated by poor infrastructure.

Participant 13, Central & West Africa Sales Manager at a US OEM stated:

"*I was born in the DRC. The first things that come to my mind are war, corruption, challenges and high risk for investment".*

Despite this perception of risk, the DRC was still attractive and could not be avoided by any of the MNE OEMs. Participant 10, Business Director at a US OEM elaborated:

"*The DRC is one of the most mineral-rich countries in the World. They are a significant player in our OEM business. All OEM's are operating a fleet in the DRC, and there are new mines each year. It ranks in the Top 3 mining countries for me if not the most important in Africa because of vast mineral resources".*

Participant 11, the head of Chinese Business for Africa Middle East in a US-based OEM that sells to Chinese mining companies agreed and explained the Chinese companies' attitude to DRC country risk:

"the market for OEM equipment in the DRC is going to increase dramatically. Even if there are such difficult conditions, I believe Chinese mining companies will still invest in the DRC for copper and cobalt. China is more strategic about the DRC. The difference between China and capitalist countries is that Chinese companies are led by the government and the production is more strategic than making a profit". The latter view reflects an underlying perception of risk in the DRC that was common to all the non-equity OEMs. [8]

Table 2 Comparison of Risk Management by Mining OEMs in the DRC

	OEMs with equity investment in DRC (warehousing; after-sale service)	OEMs with non-equity networks (i.e., direct exporters or sales through distributors)
Perception of country risks	Pro-opportunity orientation	Anti-risk orientation
	FDI	Non-FDI
	Perceives low risk for investment	Sees high-risk for investment, insecurity, instability, volatility, geopolitical uncertainties, concerns around ease of doing business, government corruption, poverty, local political issues, and logistics challenges aggravated by poor infrastructure
	Focuses on mineral wealth, large- scale mines, location specific advantages, the encouraging DRC mining charter, global need of DRC commodities for decarbonization, better understanding of the DRC	
Management of country risks	Acceptance: Internal management within the OEM	Avoidance: Sharing with non-equity partners; no assets in DRC
	FDI	Non-FDI
	Wholly owned subsidiary or JV	Contracting or exporting; no assets in DRC
	Own tangible assets in DRC	Support given from abroad
	Have FSAs to deal with institutions in host country	Not exposed to local institutions, by using DRC independent distributor
	Use private security, patrols to protect their assets in DRC	Pushing local partners to own and protect the equipment assets in DRC
	Operations are in Katanga province, stable, low to medium risks	Avoid safety and security concerns in high-risk country with no local presence
	Logistics challenges with poor infrastructures	Efficient logistics from Europe (e.g. airfreight from Holland in a day)
	No transactions done in local currency; they use USD or Euro	No transactions done in local currency; they use USD or GBP
Management of counterparty risks	Remain within equity relationship	Remain between non-equity partners
	FDI	Non-FDI
	The DRC affiliate could face customer-related risks that the parent would have to deal with	Risk remains between OEM headquarters and distributor or final customer
	The risk is dealt with through insurance contracts, payment in hard currencies outside of DRC, and deep knowledge of counterparties	Can be shared with non-equity partners
		The risk is dealt with through insurance contracts, payment in hard currencies outside of DRC, and deep knowledge of counterparties

4.1.2 Risk Management

The findings show that participants from mining OEMs without equity in the DRC believe that DRC is a high-risk country, and this makes them unwilling to invest. OEM MNEs without equity do not own assets in the host country and they use independent DRC-based partners for sales and distribution, and they support their products from abroad. This group of OEMs avoid country risk by transferring it to contracted, independent non-equity partners (i.e., distributors or final mining clients).

Participant 06, Southern Africa General Manager for Cross-Border business explained:

"*We have an independent distributor. They source the products from our various factories and PDCs (Parts Distribution Centers). So, we do not own any local assets, we have an independent distributor, and we are supporting them from factory level."*

Eight out of 14 participants have no intention of localizing into the DRC. They identified country risks as barriers to localization. When talking about specific country risks that influence their investment decisions, participants listed uncertain environment, currency, safety, logistic challenges, poor infrastructure, skills deficits, liability of foreignness, security concerns, political stability, institutional voids and looting – plus the risk ranking which is high for the DRC.

Participant 12, Managing Director at a Netherlands-based MNE stated:

"*Doing business in the DRC is extremely high-risk. We have political, currency, safety and logistics risks. The challenge lies in the logistics because of lack of infrastructure. On the contrary, we can fly any item from Holland within one day if we do have stock and get it delivered next day at Lubumbashi with almost half of the cost. Because most of the mining customers have customs duty exemptions, it does not make sense to stock in the DRC*". [9]

In sum, due to country risks, most MNEs with non-equity structures in the DRC have no intention to localize into the DRC. They avoid these risks by leveraging independent dealers or selling directly to final customers.

4.2 Direct Investor OEMs' Perception and Management of Country Risk

4.2.1 Perceptions

OEMs with equity in facilities in the DRC had a different attitude to risk and risk management, and the point was made that much of the perceived risk was due to a combination of misunderstanding the DRC or overstating risks. The views of equity OEMs about the future prospects of the DRC were positive, and they all had a view that could be described as an "opportunity" orientation as opposed to the non-equity group that had a "risk management" orientation. This orientation is demonstrated by the comments of two participants. Africa Director at a Scottish MNE (Participant #2):

"*DRC is a big mining country, with the biggest opportunities in terms of quality and quantity in Africa. Big mining country with large equipment that requires support. It is a place to be as an OEM to make sure you are properly represented".*

Specific *political* risks included: license repudiation, political instability, 2023 political season, insecurity in DRC East, unrest and challenges presented from illegal miners and mining. Regarding the perception of risk in the DRC, findings show that the Katanga province where mining MNEs operate is low-risk and quiet, contradicting what many people think.

Participant 08 stated:

"*There is always risk in investing and establishing a business. Wherever you find yourself living in America or in the UK, there is always some potential risk. However, when it comes to the DRC, a lot of people have their mindset that there is always fighting here, but that is not true. There is no major risk. DRC is a very safe environment and I personally encourage anybody who has money and wants to do business the right way to be very confident in investing in this part of the world; they will never regret it"*. This attitude we call an "opportunity orientation".

4.2.2 Risk Management

Equity OEM operating models differ from that of non-equity OEMs as they do not shift the country risk to another party. This requires country risk management strategies. For instance, the manager at a Scottish OEM mentioned 3 things: (1) Use SOS International for country risks assessment, (2) service to local mines is covered under a global risk umbrella policy they do have in place with the mine MNE home country, (3) location choice/operations are in DRC South, which is safe and secure instead of DRC East, which is unsafe. Another respondent noted that his firm also charges a country risk premium of 10% above the prices charged to clients in non-risky countries.

MNEs with operations in the DRC own assets and resources to manage their operations. These include staff, buildings, inventory, OEM certified facilities, inventory, bonded warehouses, workshops and fleet to support their mining OEM operations.

Participant #9, Business Area President mentioned. "*The rapid development of the business and the need for further geographical coverage of the Democratic Republic of the Congo made us decide to establish a fully-fledged customer center*. W*e believe in good business opportunities on the Congolese market, and our new company will provide a strong base for future growth."*

As far as risk management is concerned, to protect tangible assets in the DRC, MNEs with equity investments use private security, patrols and technology to reduce the possibility of theft, vandalism or damage of equipment. Several MNEs use telematics to protect cars and stock-in-transit, and mining in the Katanga province is geographically distant from the dangers of war/terrorism in the north-eastern part of the country.

Participant 09, an expat living in the DRC and having worked in different countries explained how risk was managed:

"*In fact, I have had the privilege of working across a lot of countries in Africa and I was a bit surprised to see that it is much riskier to even operate in South Africa, Nigeria and Mali compared to the DRC. From a security standpoint at the moment, for the Katanga region, I would disagree with anybody who says that the DRC is a very high-risk area. It is rather in the eastern part where there is a lot of security concerns because of a lot of fights either for*

minerals or land disputes. We operate as an OEM in all our locations, and we have not had any concern."

These findings reveal that participants from MNEs with equity investments in the DRC believe that there are no country risks significant enough to influence their level of investment into the mining OEM business.

Participant 02, Africa Sales Director at a Scottish MNE stated:

"*Most of these customers and big mines are MNEs all of them are owned by global mining MNEs, none of them is local. The contract with local mines is under the umbrella of the mining MNE's home country. We service these mines globally and the ones in DRC fall under this same umbrella. The country tends to send a signal of risk, if you do not know the country, most of the mining activities are in the Katanga province, which is very stable, no war. If you go to platforms that we use internationally such as SOS International, you will notice that the Katanga province is rated as medium to low-risk.*

4.3 Non-equity OEMs and Counterparty Risk

Counterparty risks from non-equity OEMs sit with the mining equipment company's home office supplying the distribution network for the DRC. To reduce these risks, MNEs have in place offshore management, and risk-sharing with distribution network partners. When it comes to risk-sharing within these supply networks, strategies include granting terms to offshore entities, getting insurance offshore, and absorbing losses through bad debt provision.

Participant 07, Sales Manager for Central and West Africa at a Chinese MNE elaborated:

"*For DRC-based partners we do not take risks; we do not deal directly with companies in the DRC. Most of our customers are well-known private or state-owned mines with offices offshore (South Africa, Mauritius). Our insurers deal and manage risks with offshore offices"*.

In sum, counterparty risks are the risks associated with distributors or customers not fulfilling their commitments to OEM suppliers. This risk can be limited when the participants in the supply chain have extensive longstanding relationships outside the country. This becomes a challenge for OEMs with an operating model that has shifted the risk to a local distributor. The local distributor becomes a participant in the supply chain, but the reliability of that partner is not the same as that of the mining MNE (ultimate customer), and the local partner is vulnerable to the country risks in the DRC.

4.4 Equity OEMs Management of Counterparty Risk

The management of counterparty risks is slightly different for equity OEMs as their counterparties are the mining MNEs directly. The OEMs have long standing relationships with those mining MNEs, often in other jurisdictions, so they look at the counterparties from a global risk perspective, rather than a DRC-specific one. For the management of counterparty risks in the DRC, Equity OEMs have in place: (1) bank guaranties, (2) insurance policies, (3) network of third parties and well-known consulting MNEs with branches in the DRC such EY (Ernst & Young) for advisories, (3) law enforcement through legal teams, (4) risk-sharing with equity partners/HQ and subsidiaries as worst case through the absorption of the damage by the entity with a stronger balance sheet.

5 Discussion

The global value chains of these mining equipment manufacturers were quite similar in many respects. As shown in Appendix A, these companies produce and assemble their own equipment, typically in the home country of the company. They outsource many parts of the business, from supply of components to local after-sale services of their machines to transportation of machines and parts to customers and to distribution centers. They keep R&D and product design in-house. This is not very different from the global value chain structure of Apple or Levis—but these equipment manufacturers are more similar to Apple [10] in keeping their R&D in-house and contracting out for many components, as contrasted with Levis, that mostly outsources materials to produce their clothing rather than using major components such as engines or electronic equipment.

The data show that risk appetite was the main determinant of operating model in a perceived high-risk geography such as the DRC. Both equity and non-equity OEMs identified the same challenges to operating in the DRC; these challenges include weak institutions, instability and poor infrastructure. Even so, the growth and prospects of the mining industry in the DRC, specifically the expansion by mining MNEs, has made the DRC too attractive to ignore. OEMs with equity investment accept the risks and believe that they are able to manage them based on their local knowledge. Non-equity OEMs are unwilling to invest, and they shift the risk to local distributors or to the final customers, the mining companies. Ahsan & Martina (2011) argued that this approach is the most preferred when operating in volatile and high-risk environments, however our data show that this holds for non-equity OEMs only. Even so, some of these OEMs have a wait-and-see attitude, and they have stated a willingness to invest if the risk profile of the DRC changes. The differences among the three categories of OEMs in the DRC were summarized in Table 2 shown previously.

In the section addressing non-equity forms of operation, the findings show that these OEMs have adopted risk avoidance strategies with the expectation that partners that they team up with will develop and win business opportunities in the foreign country. These partners represent the OEMs, invest, and are on the frontline to manage risks in host countries. By doing so, the implication is that the OEMs push the maximum amount of risk possible onto the non-equity partner in the host country. This leaves the independent distributor or the local company with not only risks to manage alone, but also rewards to gain when the OEM is not willing to be locally present. This is a kind of no-pain, no-gain outcome.

The findings in the section on equity investors have revealed that mining OEMs using FDI in the DRC take a risk-acceptance approach. By doing so, they are well-represented, have full control of operations and confer the management on their own executives who are countrymen knowledgeable about country risk management in the DRC context. To operate in the foreign market, they have adopted equity positions composed of wholly-owned subsidiaries and joint ventures which give them ownership and control of the local affiliate (Brouthers & Hennart, 2007).

Secondly, security and war-related concerns were mentioned as country risks. The findings have revealed that there are indeed security concerns, but these are localised in the Eastern part of the DRC, due to ongoing conflict there. Mining operations in the Katanga province in the south are stable, and carry medium to low risk as per SOS International (SOS International 2022).

According to Johanson and Vahlne (2009), Liability of Outsidership concerns the gap in knowledge regarding the market dynamics in the host country. This is consistent with the findings that suggest that understanding the local market is key. Without this knowledge, it would be challenging for MNEs to conduct successful market entry when servicing the DRC. We would argue that over time the non-equity OEMs will shift to more equity-based models as they find that the costs associated with servicing a growing market from abroad and sharing revenues with independent distributors are not justified by perceived risks that did not materialise. We argue that this view of risk is due to a liability of outsidership. Fleury and Li (2020) argued that Liability of Outsidership can derive from a gap in local knowledge of customs, business standards, supply chain and business connections. MNEs with non-equity networks have been avoiding this risk prior to committing to large investment. For instance, they have independent partners on the frontline to identify opportunities. The findings have mentioned logistics challenges aggravated by lack of robust infrastructure. Building on this, it takes partners with local knowledge to move heavy equipment and manage expectations from miners in the DRC, without which outsiders might make unrealistic promises based on their experience of efficient logistics working in their home countries.

According to Verbeke (2020), collaboration with global partners in foreign markets helps share best practices and knowledge needed to penetrate those markets. From this view, by collaborating with mining MNEs, OEMs receive support from overseas customers before committing to assets in the host country. This does not explain the variation in strategies, but our data has shown that the decision to collaborate is largely dependent on the OEM's own perception and ability to manage country risk. MNEs with non-equity structures will over time build trust and learn to qualify opportunities and secure payment from their DRC-based non-equity partners. MNEs starting with non-equity modes can move from outsiders to insiders, for example, going from export to JV and then wholly-owned subsidiary. Adarkwah & Malonæs (2022) argued that new sets of FSAs have been generated from emerging markets, and these can include political connections, ability to deal with ambiguities, ability to raise funds, strong ties with the diaspora via networks. In our context the key was the ability to deal with ambiguity rather than having connections.

5.1 Responses to the Research Questions

1. What structure of the supply chain is optimal? It was clear that the US-based OEMs (non-equity OEMs) were not interested in having their own facilities in the DRC, as contrasted with some of the European OEMs that do have local operations there. Chinese OEMs mostly had existing business relations with Chinese mining companies, so they exported directly to those customers and were not active in pursuing new business from other non-Chinese mining companies. According to the interview results, the US-Europe difference may be because the US companies are more concerned about managing the risks of the DRC, while the three investing European firms are more interested in taking advantage of the large and growing market for mining equipment there (the opportunity versus risk-management outlooks). It may also be that the OEMs who use distributors have sales primarily to global mining companies that they work with worldwide, and a local presence in DRC is viewed as unnecessary for those clients. Our evidence was insufficient to draw strong conclusions on this point. The two US-based OEMs have a first mover advantage in servicing the DRC relative to other OEMs. They have been there for almost a century, and they are happy with their existing independent dealers with strong financial capabilities including the ability to invest in facilities as per OEM standards and repay the factories without defaulting. As long as the OEM believes that it can manage risks adequately, then the best strategy would be to have a local operation (FDI). Equity

investment is more attractive because through subsidiaries the technology is more protected and streams of revenue are multiple (factory sales of machines and parts to subsidiaries, after-sale parts and service from subsidiaries, retail sales of machines from subsidiaries, sales of IP (training, subscriptions, branding, tooling). This would not apply to the Chinese OEMs, if they only want to serve existing (Chinese) mining company customers.

2. How should the OEM manage the risks in operating its supply chain? Risk management choices followed the logic of the risk-averse firms passing off country risk to either the final customer or to an independent distributor in the supply chain by not having facilities in the DRC. [11] The opportunity-focused firms accepted the country risk of operating in the DRC, at the same time as they used risk insurance from third parties and payment for their equipment outside of the DRC in currencies such as dollars and euros. Although it was not discussed above, all three categories of OEMs generally used political risk insurance from private-sector providers to manage some of the risk involved with their DRC sales.

5.2 Practical Contribution of the Study

The study provides the following practical managerial implications for MNEs operating in emerging markets and in the DRC in particular:

- The framework developed for management of risks in the mining OEM context can provide valuable guidelines for MNEs involved with the DRC and those willing to operate in the DRC. This can be adapted for application to other industries involving tangible products such as manufacturing and retail sales and also intangible services, where in each case the three methods of serving the market are possible.
- Logistics challenges aggravated by lack of infrastructure have been mentioned as a risk. The DRC government should address this in order to attract more FDI and facilitate the movement of products. The OEMs cannot resolve this challenge themselves, unless they respond as the mining companies do, building local roads and electric power supply to serve their own needs and often needs of the local community.
- The reality of country risk suggests, despite overgeneralizations about the riskiness of the DRC, that in fact war and conflicts are localized in the Eastern DRC, while the Katanga province in the south where the mines are located is stable. MNEs should leverage the Katanga location advantages.
- Mining in Katanga province is booming and offering decades of future opportunities due to mineral wealth endowment and increasing global demand for copper, cobalt and lithium from the DRC for energy transition. This is an opportunity that miners, OEMs and other partners should investigate for investment into the DRC.
- MNEs with non-equity networks seem to be missing an opportunity and being short-sighted by expecting an independent partner to manage their brand in the host county and leaving the partner to take much of the profit from the business.

6 Limitations of the Study

The following limitations can be dealt with in future studies. First, the DRC was chosen as the context, and generalization based on this single country may not apply to other emerging markets. However, the DRC is a large country, the second largest in Africa with a size equivalent to Western Europe. Furthermore, other emerging markets have many similar characteristics where the findings from this study may apply.

Second, the study addressed the management of risks in the mining OEM industry, and generalization of these findings to other industries such as services (e.g. digital technologies) and raw materials production may not apply. The framework developed in this study for management of risks in a supply chain setting can be applicable to other industries dealing with tangible goods such as automobiles, cell phones, and clothing.

Third, only country risks and counterparty risks were explored in the DRC context. The risk-sharing phenomena and strategies examined here may not cover all of the risks in supply chain networks, which could be explored elsewhere.

Notes

1. See, for example, Rassweiler, Andrew, 2016. Apple's Supply Chain Cost of Making the iPhone 7, https://www.supplychain247.com/article/apples_supply_chain_cost_of_making_the_iphone_7. September.
2. Belgium is often selected because of historical colonial ties to the DRC. Also, Belgium has the port of Antwerp, which all the major OEMs use to supply Europe, Africa, and the Middle East.
3. OEMs with local representation in host country (either through independent dealer or wholly owned subsidiaries) keep parts and technicians in-country. Exporters either sell that inventory to the mine upfront, together with the machines or keep it at the regional hub such as South Africa and deploy them with technicians to the mine when needed. Because of this there is some delay from exporters in attending to warranty and unplanned repairs, a competitive disadvantage.
4. During warranty period, GFA suggests that OEM service should be done by OEMs; independent technicians can step in after warranty period. So, the OEM is still in charge of service (through on-site technicians) and getting paid offshore. If mines involve independent technicians during the warranty period, they might lose that OEM warranty, a risk that no mine would take. Therefore, service by the OEM is maintained, and payment is offshore as for equipment.
5. In fact, all of the OEMs bill their DRC customers in foreign currency, typically dollars or euros, and they take payment offshore to avoid possible capital controls in the DRC.
6. In our situation the OEMs are not considering the manufacture of their equipment in the DRC, but only the operation of local distribution, to receive the equipment from abroad, sell it to mining companies, and provide service to them.
7. The interviewees included Africa sales directors, DRC heads of sales, business development managers, and a managing director.
8. Participant 11 is a Chinese native, working for a US MNE supplying components to Chinese OEM, a "new entrant". The US company he works for is sticking to export via independent dealer/non-equity partner. Chinese OEM partners he deals with are currently doing direct export. The fleet is increasing and ageing, so major repairs and expected volume will require a facility in the DRC for service, major repairs and rebuild.
9. This efficient logistics infrastructure was observed by one of the researchers during his July trip to Amsterdam and Rotterdam ports in Holland July, 2022.
10. Apple's GVC and the fit of China into the manufacturing process is discussed in Grimes and Sun (2016).
11. There is a difference in level of protection of the aftersales technology in the host country-see Table 2.

    Exporters: grant limited access to the mines for basic service and have escalation matrix with OEMs for complex cases.

OEM exporting through an independent dealer: have 2 options: 1) annual renewal of access, 2) Dealership contact that can expire or terminate so that without a valid contract the dealer won't access the technology. OEM with own equity investment: Link the access to the contract of employment so that it can be revoked once the service personnel is no longer part of the organization.

References

Adarkwah, G., & Malonæs, T. (2022). Firm-specific advantages: A comprehensive review with a focus on emerging markets. *Asia Pacific Journal of Management, 39*, 539–585.

Agarwal, S., & Ramaswami, S. N. (1992). Choice of foreign market entry mode: Impact of ownership location and internalization factors. *Journal of International Business Studies, 23*(1), 1–28.

Ahsan, M., & Martina, M. (2011). Multinational enterprises' entry mode strategies and uncertainty: A review and extension. *International Journal of Management Reviews, 13*, 376–392.

Anderson, E., & Gatignon, H. (1986). Modes of foreign entry: A transaction cost analysis and propositions. *Journal of International Business Studies, 17*(3), 1–26.

Antras, P., & Chor, D. (2013). Organizing the global value chain. *Econometrica, 81*(6), 2127–2204.

Autor, David, Dorn, David, & Hanson, Gordon. (2016). The china shock: Learning from labor market adjustment to large changes in trade. *Annual Review of Economics, 8*, 205–240.

Baldwin, R., & Venables, A. (2013). Spiders and snakes: Offshoring and agglomeration in the global economy. *Journal of International Economics, 19*, 245–254.

Bamber, Penny, Fernandez-Stark, Karina, & Molina, Oswaldo. (2024). Innovation and competitiveness in the copper-mining GVC: developing local suppliers in Peru. *Industrial and Corporate Change, 33*(4), 940–964.

Benito, G. R., Petersen, B., & Welch, L. S. (2009). Towards more realistic conceptualisations of Foreign operation modes. *Journal of International Business Studies, 40*, 1455–1470.

Brouthers, K. D. (2002). Institutional, cultural and transaction cost influences on entry mode choice and performance. *Journal of International Business Studies, 33*(2), 203–221.

Brouthers, K. D., & Hennart, J.-F. (2007). Boundaries of the firm: Insights from international entry mode research. *Journal of Management, 33*(3), 395–425.

Buckley, P. J. (2009). The impact of the global factory on economic development. *Journal of World Business, 44*, 131–143.

Buckley, P. J. (2016). The contribution of internalisation theory to international business: New realities and unanswered questions. *Journal of World Business, 51*(1), 74–82.

Calvao, F., Macdonald, C., & Bolay, M. (2021). Cobalt mining and the corporate outsourcing of responsibility in the democratic Republic of Congo. *The Extractive Industry and Society, 8*(1–10), 100884.

Child, J., & Yan, Y. (1999). Investment and control in international joint ventures: The case of China. *Journal of World Business, 34*(1), 3–15.

Cuervo-Cazurra, A. (2016). Corruption in international business. *Journal of World Business, 51*, 35–49.

Damodaran, A. (2007). *Strategic Risk Taking: A Framework for Risk Management*. FT Press.

Deligonul, S. Z. (2020). Multinational country risk: Exposure to asset holding risk and operating risk in international business. *Journal of World Business, 55*(2), 101041.

Dillman, Daniel. (1983). Assembly industries in Mexico: Contexts of development. *Journal of Interamerican Studies and World Affairs, 25*(1), 31–58.

Driga, D. Nita., & Dura, C. (2010). Credit risk analysis at the level of an operative branch of the bank. *Academy of Economic Studies, Bucharest, Romania, 13*(2), 378–390.

Driscoll, A. M., & Paliwoda, S. J. (1997). Dimensionalizing international market entry mode choice. *Joumal of Marketing Management, 13*, 57–87.

Ernst, Dieter, & Guerrieri, Paolo. (1998). International production networks and changing trade patterns in East Asia: The case of the electronics industry. *Oxford Development Studies, 26*(2), 191–210.

Ernst, D., & Kim, L. (2002). Global production networks, knowledge diffusion, and local capability formation. *Research Policy., 31*, 1417–1429.

Erramilli, K. (1990). Entry mode choice in service industries. *International Marketing Review*. https://doi.org/10.1108/EUM0000000001535

Farrell, Diana. (2005). Offshoring: value creation through economic change. *Journal of Management Studies, 42*(3), 675–683.

Feenstra, Robert. (1998). Integration of trade and disintegration of production in the global economy. *Journal of Economic Perspectives, 12*(4), 31–50.

Fessehaie J, (2015) Regional Industrialization Research Project: Case Study on the Mining Capital Equipment Value Chain in South Africa and Zambia, Centre for Competition, Regulation & Economic Development (CCRED)

Fleury, M. T. L., & Li, J. (2020). Overcoming the liability of outsidership for emerging market MNEs: A capability-building perspective. *Journal of International Business Studies, 51*(1), 23–37.

Froot, Kenneth, Scharfstein, David S., & Stein, Jeremy C. (1993). Risk management: Coordinating corporate investment and financing policies. *The Journal of Finance, 48*(5), 1629–1658.

Gereffi, G. (1999). International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics, 48*, 37–70.

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy, 12*(1), 78–104.

Gray, D. (2017). *Doing Research in the Business World*. Sage.

Grimes, S., & Sun, Y. (2016). China's evolving role in apple's global value chain. *ARea Development and Policy, 1*(1), 94–112.

Grosse, R. (1989). *Multinationals in Latin America*. Routledge.

Grosse, R. (2016). *Emerging Markets: Strategies for Competing in the Global Value Chain*. Kogan Page.

Hambrick (1982). Environmental scanning and organisational strategy, Strategic Management Journal, 3

Hill, C. W., Hwang, P., & Kim, W. C. (1990). An eclectic theory of the choice of international entry mode. *Strategic Management Journal, 11*(2), 117–128.

Hollender, L., Zapkau, F., & Schwens, C. (2017). SME Foreign market entry mode choice and foreign venture performance: The moderating effect of international experience and product adaptation. *International Business Review, 26*(2), 250–263.

International SOS, 2022. *Monthly Security Forecast*. Philadelphia, PA. July.

Johanson, J., & Vahlne, J. E. (2009). The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership. *Journal of International Business Studies, 40*(X), 1411–1431.

Kano, L. (2018). Global value chain governance: A relational perspective. *Journal of International Business Studies*, *49*, 684–705.

Kano, L., Tsang, E. W. K., & Yeung, H.-C. (2020). Global value chains: A review of the multi-disciplinary literature. *Journal of International Business Studies, 51*, 577–622.

Keown, C. F. (1989). Risk perception of Hong Kongese versus Americans. *Risk Analysis, 9*, 401–407.

Khanna, T., & Palepu, K. (2015). *Winning in Emerging Markets*. Harvard Business Press.

Krugman, P. (1995). Growing world trade: Causes and consequences. *Brookings Papers on Economic Activity, 1995*(1), 327–362.

Kumar, V., & Subramaniam, V. (1997). A contingency framework for the mode of entry decision. *Journal of World Business, 32*(1), 53–72.

Lindstrand, A., & Hånell, S. M. (2017). International and market-specific social capital effects on international opportunity exploitation in the internationalization process. *Journal of World Business, 52*(5), 653–663.

Luo, Y., Zhang, H., & Bu, J. (2019). Developed country MNEs investing in developing economies: Progress and prospect. *Journal of International Business Studies, 50*, 633–667.

Market Research Report (2020). Leading Mining Equipment Manufacturers in the world, https://www.marketresearchreports.com/blog/2020/07/27/top-mining-equipment-manufacturers-world-and-market-insight.

Marshall, C.& Rossman, G. (2016). *Designing qualitative research*. Thousand Oaks (Cal.): SAGE.

Meyer, K., Estrin, S., Bhaumik, S. K., & Peng, M. (2009). Institutions, resources, and entry strategies in emerging markets. *Strategic Management Journal., 30*, 61–80.

Political Risk Service, 2023. *International Country Risk Guide*. Liverpool, NY. https://www.prsgroup.com/explore-our-products/icrg/

Porter, M. (1985). *Competitive Advantage*. The Free Press.

Renn, O., & Rohrmann, B. (2000). *Cross-Cultural Risk Perception*. Springer.

Rohrmann, B., & Chen, H. (1999). Risk perception in Australia and China: An exploratory cultural study. *Journal of Risk Research, 2*(3), 219–241.

Rubbers, B. (2020). Governing new mining projects in D. R. Congo. A view from the HR department of a Chinese company. *The extractive Industries and Society, 7*, 191–198.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students*. Pearson: Harlow.

Sayah, M. (2017). Counterparty credit risk in OTC derivatives under Basel III. *Journal of Mathematic & Finance, 7*(1), 1–38.

Story, V. M., Raddats, C., Burton, J., Zolkiewski, J., & Baines, T. (2017). Capabilities for advanced services: A multi-actor perspective. *Industrial Marketing Management, 60*, 54–68.

Stosberg, J. (2005). *Political Risk and the Institutional Environment for Foreign Direct Investment in Latin America*. Peter Lang.

Teece, D. J. (1986). Transactions cost economics and the multinational enterprise: An assessment. *Journal of Economic Behaviour and Organization, 7*, 21–45.

Verbeke, A. (2020). The JIBS 2019 Decade Award: The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership. *Journal of International Business Studies, 51*(1), 1–3.

Wilson, T. (1999). International After-Sales Service. *Journal of Global Marketing, 13*(1), 5–28.

World Bank (2022), https://www.worldbank.org/en/country/drc/overview, The Democratic Republic Of Congo, accessed August 20, 2022.

Yan, A., & Gray, B. (1996). Linking management control and inter-partner relationships with performance in US-Chinese joint ventures. In J. Child & Y. Lu (Eds.), *Management issues in China: International enterprises* (pp. 106–127). Routledge.

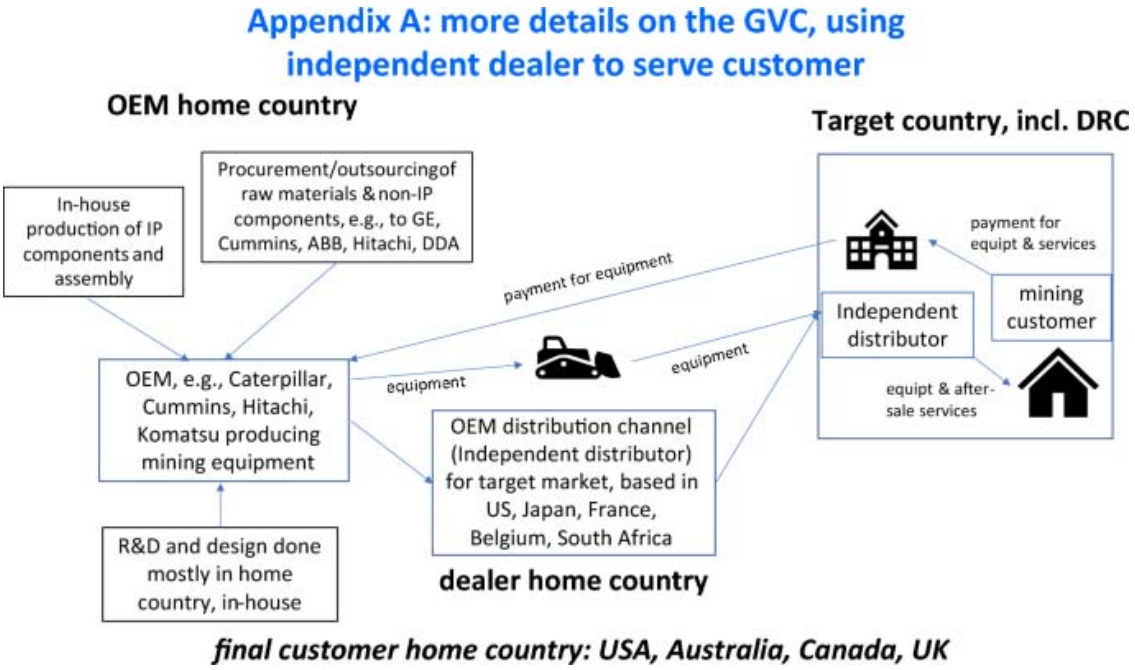
Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods*. Sage.

Zhu, Y., & Sardana, D. (2020). Multinational enterprises' risk mitigation strategies in emerging markets: A political coalition perspective. *Journal of World Business, 55*(2), 101044.

Appendix A

1.1 Full Global Value Chains of Mining Equipment Manufacturers

The full global value chain for a mining equipment manufacturer is reasonably similar across the three types of firms using exports, local operations, and independent distributors in the DRC, as shown in Table 1. The MNE equipment producers design and produce most of their own vehicle bodies, and do most of their own R&D. But they contract out small and large components such as engines, transmissions, wheels and tires, and glass.



Assembling of the mining equipment is mostly done in-house. This vertical integration is generally in Triad countries. The OEMs own R & D and the brands for the major components (engines, transmissions, turbochargers, fuel systems…). While engines and transmissions are largely contracted out to suppliers, vehicle bodies are produced by the OEMs themselves.

Fabrication of loose parts: Emerging Markets play a big role here due to their mineral wealth; they supply most of the raw materials and host some factories due to cheap labor. These factories are either owned by Triad country companies or in JV with locals for parts manufacturing that is exported to Triad countries to produce sub-assemblies and major components. R & D and design are owned by the OEM MNE.