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Who drives the green shift? EV and battery policymaking and systemic marginalisation of auto suppliers in South Korea

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ABSTRACT

The swift global transition to electric vehicles (EV) and batteries in the automotive industry highlights the nature of governments' efforts towards a green economy, marking a transition from environmental regulations to industrial policies. This shift has led to renewed interest in industrial policies, especially in East Asian developmental states, like South Korea. The EV and battery industries in South Korea have grown rapidly along with the government's efforts to mobilise the entire economy through aggressive green industrial policy, particularly during the Lee Myung-bak administration (2008–2012). Big Korean automobile and electronics manufacturers have participated directly in setting the country's industrial agenda, leading the green industrial policy with their business interests. However, the process of EV and battery policymaking also marginalized auto suppliers in the existing manufacturing sector from agenda setting. Focusing on business' *structural* power, this paper explains how big business elites systematically alienate small and medium-sized suppliers from the new growth policy thanks to their strong information monopoly in the hierarchical structure of production in the automobile industry and EV policies in South Korea.

1. Introduction

The global automobile value chain has been undergoing a profound shift, consolidating a future orientated towards electric vehicles (EV). In the beginning, this shift aimed to respond to the increasing environmental regulation, the market saturation of fossil-fuel cars, increasing energy costs, etc., and was led by a group of end car manufacturers. The frontline of these automakers was mostly from East Asia (Japan, South Korea, and China). A second and bigger wave of this shift came when other automakers – mostly from the advanced Western economies including the EU, UK, and USA – decided to step on the accelerator pushed by the upcoming end of EU's tolerance towards fossil-fuel cars, the turbulence of global logistics, as well as changes in market demands and job creation, particularly since the outbreak of the recent pandemic. Accordingly, securing batteries and necessary raw materials, the key component of EVs, became an urgent issue for automakers and governments. The trade tensions surrounding critical minerals and the restructuring of supply chains, including the US-China competition and the EU's recent efforts to reduce dependence on Chinese batteries and minerals, highlight the sensitivity and competition amongst countries amidst the global industrial shift in EV and battery production Agusdinata and Liu (2023); Torjesen (2024).

One significant implication of such government intervention via influential policies[1] is that green industry policy should no longer be understood solely within the realm of *environmental regulations*, but rather as *industrial promotion and trade policy*. The return of industrial policy prompts a reevaluation of previous discussions on industrial policies carried by the supply side, particularly reigniting interest in East Asian developmental states. Despite facing increasing competition and growing production capacities from economic power-houses, in fact, firms from the main three East Asian countries still maintain their supply capacity for EV and batteries across the world Ortiz (2024). They established this capacity during the initial sprint, thanks to strong government policies supporting these and other emerging sectors. Such government support is evident in trade disputes, such as the 2010 conflict between China and Japan over rare earth elements (Andersson,

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[1] For instance, the EU has taken a series of actions and policies, from the establishment of the European Battery Alliance in 2017, the Important Project of Common European Interests in 2019 and 2021 to support European battery and material companies, and the Critical Raw Materials Act in 2023. The US's Biden administration also adopted the America's Supply Chains in 2021 that included promotion and regulation of semiconductor, battery, and critical raw materials. In 2022, the US government launched the Inflation Reduction Act (IRA) and announced the recipient list of the EV subsidy making it clear that this would only benefit US brands.

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2020), as well as in government investments in foreign mines. An example is the Korean government's outreach to resource-rich Latin American countries like Argentina, Bolivia, and Chile Narins (2017).

In particular, the performance of South Korean EV/batteries manufacturers is remarkable, given the countries' scarce raw materials and small domestic markets compared to their competitors. In 2022, Hyundae/Kia's three pure electric vehicle models (or BEV, battery electric vehicle) ranked 10th to 12th in sales, which placed the Hyundai Motor Group (hereafter, HMG) at the fourth place in the top Auto Groups for EV sales in Europe European Alternative Fuels Observatory (2022; 2023). In the US market, HMG maintained the second largest volume after Tesla in the first half of 2023, despite its exclusion from the EV subsidy list under IRA Wayland (2023). Meanwhile, the South Korean battery trio – LG Energy Solution, Samsung SDI, and SK On – still leads the global market even if they are watching the rise of, for example, Swedish Northvolt and French ACC, but also of Chinese battery makers who began aggressive investments in the EU due to their disconnection from the US market. The three South Korean firms produced 42.5 % of EU batteries, which occupied 63.5 % of the EU battery market.

The fast industrial shift from brown to green, especially in South Korea, became a symbol of the triumph of the "developmental state" (Haggard, 2018), a government-industry complex with a deeply ingrained developmental mindset (Thurbon, 2016) – leading to what has also been called "developmental environmentalism" Kim and Thurbon (2015). In fact, South Korean automobile and electronic champions successfully realigned their business from an early stage thanks to their strong coordination with the state since the mid-2000s. A clear promoter of this, the Lee Myung-bak administration (2008–2012) came into power with the economic slogan "green growth", centred on a thick package of industrial promotion for 'new growth engines', including EVs. Since then, the government and industry have jointly focused on the larger goal of ranking 4th in the global green car market. This collaboration has led to increased investment in R&D projects for EVs and batteries, building upon individual corporate R&D efforts, and the provision of tax incentives and purchase subsidies.

However, this paper cautions against an overly optimistic interpretation of the success of developmental states' industrial policies, which risks overlooking two important aspects. The first, substantive one, is that such success casts a long shadow, represented by suppliers who are excluded from the policy process. The second, and more theoretical, issue concerns the analysis of existing developmental states, which is often overly state-centric. By shifting the perspective to large corporations and paying closer attention to suppliers and their relations to big business, one can gain a deeper understanding of these two aspects simultaneously.

1.1. Research question, aim, and argument

While South Korean EVs and batteries are aggressively expanding globally, domestic manufacturing struggles to advance due to significant trade-union resistance against massive layoffs and inadequate adaptation capacity amongst domestic auto suppliers. This issue, also faced by other automotive powerhouses like Italy, Japan, France, and Germany, is particularly pronounced amongst South Korea's small-medium enterprises (SME) auto suppliers. Finally, a decade after the Lee administration's introduction of its EV policy, suppliers began voicing concerns about the industry's shift towards EVs. Only recently the government started taking action to also adjust traditional suppliers. This contrasts sharply with the rapid transition of larger corporations, which have benefited significantly from supportive government policies. In other words, South Korean EV policies have prioritized end products and producers, dismantling the existing automobile industry from the top, without offering incentives for comprehensive industrial restructuring.

The research aims at identifying which mechanisms in industrial policymaking allowed automotive SMEs' interests and survival to be considered less important, and even be ignored. Without diminishing or disagreeing with the necessity and inevitability of a shift towards EVs and the overall green economy, the research attends to South Korea's (and it's lead firms') fast growth – that has seen them occupying, in less than a decade, the first mover's position in the new industry – in order to foreground its shadow. To do so, the research highlights the process of industrial policymaking to promote the EV and battery industry, strongly led by big business groups. It investigates and traces how automobile SME suppliers have been marginalized in the policymaking process, leaving their interests out from the agenda-setting stage and the policy formation that took place during the Lee Myung-bak administration from 2008.

To trace this, the research focuses on the power of big business that derives from their position in the structure of production – namely, business' *structural* power. While the role and actions of businesses have not been neglected in the process of industrial development, existing discussions have mostly treated them as auxiliary partners of development processes or as actors of rent-seeking in money politics. However, as the power of businesses shifts with industrial development, there is a lack of detailed analysis on the dynamic operation of corporate influence, particularly in terms of its impact and methods. By revealing the strong structural power of South Korean big business elites, particularly those from HMG, Samsung and LG, the author argues that a systematic monopoly of information along the hierarchical production structure in the country afforded big businesses a strong structural power in the EV policymaking process while marginalizing SME suppliers.

The following sections begin with a discussion about *information* as a source of business structural power by way of a closer analysis of interfirm relationships. Then the paper illustrates how big business elites from big groups hold strong information power in the government's EV policymaking. Finally, it identifies the information monopoly in South Korean industry by analysing contract types and trade practices between big businesses and their suppliers, before emphasizing theoretical and empirical contributions of the research in conclusion.

2. Business structural power: Systemic monopoly of information

2.1. Return of industrial policy and business structural power

In contrast with the state-centric view often predominant, the paper pays more attention to *business* power to understand the case of green car policymaking in South Korea. In particular, the concept of business *structural* power is useful in understanding how EV policymaking is led by big business and the corresponding systemic marginalisation of SME suppliers.

Business structural power, for my purposes, can be understood as the privileged access of big business elites to policymaking processes that is dependant upon the power of their capital to threaten policymakers with disinvestment in the economy Culpepper (2015); Culpepper and Reinke (2014); Fairfield (2015b); Kang and Jo (2021); Lindblom (1977); Strange (2015); Young (2015). Positional dominance of big businesses over the state is particularly related to their production activities in that they can sabotage production Nitzan and Bichler (2009); Veblen (1908a, 1908b).

This invisible power influences policymakers' perception of the importance of a certain firm or sector, in turn resulting in the avoidance of policies that might hurt big business interests. In its ultimate form, according to Lindblom, business in government is evidence of their solid and far-reaching privileged position that big business occupies in society. Lindblom illustrated business participation in policymaking as government officials, paid/unpaid policy advisors, or business councils through the cases of the USA, UK, Germany, France and Japan Lindblom (1977; 2002). Business' structural power is different from the instrumental power of business elites – the political mobilisation of assets by large businesses or sectors to directly influence the political process (Fairfield, 2015a; Fuchs, 2007), which usually results in money politics,

cronyism, and business consultations in the development process in South Korea e.g., Haggard et al. (1992); Kang (2002); Khan (2000).

In the context of industrial promotion policy, this research finds that industrial information possessed by big businesses is a crucial source of structural power. Information is closely related to the issue of the possessor of the information. The role of 'technocrats' or so called "pilot agency" already showed, in early studies of the developmental state, the importance of information and its possessor as a premise for an effective development policy Amsden (1989); Evans (1995); Johnson (1982). The development coalition literature also highlights the function of the coalition to deliver information between the government and business and reduce uncertainty for business elites in making their investment decision Sen and Te Velde (2009). Nevertheless, information possessed by business elites has usually been considered as their source of *instrumental* power (Fairfield, 2015a); less attention was paid to its nature as a source of *structural* power in the increasing reliance of governments on the business sector due to the information asymmetry between them. The following section introduces the theoretical framework that the paper adopts to trace the information monopoly in the production structure of South Korean automobile industry and how this led political elites to invite big business elites from the 'big three' to the position of policymakers themselves.

2.2. Information hierarchy in the industrial structure

The present research investigates the information hierarchy within the industrial structure to identify the mechanism that concentrated information in the hands of big businesses. Firstly, Aoki found from the Japanese and US cases that informational hierarchy can be largely divided into vertical and horizontal according to how lead firms and suppliers interact Aoki (1986; 1988). In the Japanese automotive industry, where firms are organised loosely to provide each production line with more autonomy so that problems in the process can be dealt with more swiftly, information is relatively *horizontally decentralised* amongst the suppliers. Meanwhile, in US firms, information is more *centralised* and *vertically* controlled by lead firms' management because production is more divided and specialised based on function and importance in the process. These comparative studies showed that a lead firm's response to market competition decides the way it transacts with subcontractors and establishes relationships with its suppliers; which also decides the distribution of rents and access to information (Aoki, 1988, 1998; McMillan, 2012). It follows from these studies that a first important step to tracing information hierarchy is to identify how subcontracts are mostly handled.

Contract and component manufacturing types tell us the flow of information that is shared and exchanged between clients and suppliers across the supply chain. At first, four types of contracts developed by Asanuma (1989) and Fujimoto (1999) are useful to measure the current dispersion or concentration of knowledge in the industry. To unpack the black box in manufacturing auto-components, these authors categorised four types of contracts based on design. Detailed-controlled manufacturing refers to the transaction in which suppliers only manufacture the components following clients' instructions, while supplier proprietary contract means that the suppliers sell ready-made components. Consignment and design-approved contracts include suppliers' component design and development, requiring a higher level of knowledge and skills. The difference between the two: whereas consignment suppliers conduct design and manufacturing according to the request of clients, design-approved suppliers suggest their technology and design first to the lead firm and reflect feedback in customisation. Also, the clients hold the property rights of component design in a consignment contract, but the design-approved manufacturers possess the property rights of the design.

Moreover, contract types predict how information is shared and exchanged between clients and suppliers in the supply chain and beyond (Kim et al., 2008, p. 159). Contract types give us an intuitive description of interfirm relationships (ibid., pp. 71–72) based on the complexity of transaction, codifiability and suppliers' capacities Gereffi et al. (2005). Information sharing could be facilitated or hindered by interfirm relationships. The detail-controlled method fits a captive relationship and supplier proprietary for market linkage. A consignment contract is considered as being between captive and relational, while a design-approved contract implies relational or modular governance between clients and suppliers. The interfirm relationships tend to be consistent unless a significant technological breakthrough occurs on the supplier's side or a change in the lead firm's business strategy. Therefore, interfirm relationships reproduce the current way of information exchange itself. For example, as the comparative studies between the US and Japanese automobile productions by Aoki (1986) show, detailed-controlled manufacturers are more common in a more hierarchical US production, and provide suppliers with very limited information purely for manufacturing a certain component. As the contract type becomes closer to design-approved in the relational production in the Japanese case, more information about the new product and business direction is shared with suppliers.

2.3. Data

To identify the information hierarchy in the South Korean automobile industry, the research first sheds light on contract types throughout the production system. A survey was conducted to understand the contract and transaction types and information reliance of automotive SMEs, and the survey result is complemented by interviews with tier 1 and 2 suppliers.[2] The survey was conducted as part of a project regarding the electrification of the local auto industry in Incheon in 2017. Questions regarding interfirm relationships and information acquisition were included in the survey conducted with 101 SME component suppliers out of about 500 in the region. The survey is limited to the Incheon area, well known as a region in which GM Korea is dominant. However, interestingly, nearly 70 % of suppliers in this region are doing business with Hyundai and Kia as their final client lead firms, which is higher than their transaction with GM Korea of 57 % (multiple responses). The figures are followed by Ssangyong (31 %) and Renault-Samsung (21 %).

The survey and interviews are complemented by government documents, local press, and reports by NGOs, trade unions and business associations. For the purpose of this paper, the research scope is limited to the domestic automobile and electronics market in South Korea with a focus on interfirm relationships. It does not discuss external factors, such as the global market and foreign competitors, nor the intra-firm hierarchy of information of chaebols (family-controlled business groups that dominate South Korea's economy), such as intelligent activities and insiders' meetings. The data about the relationships between lead firms and suppliers also remains selective to those regarding information dynamics although acknowledging broader practices that reflect the interfirm relationships.

3. Business-led green car coalition in the late 2000s

The Lee Myung-bak administration's green industry policy aimed to develop a new industry as an export engine by mobilizing the entire industry, marking the first such large-scale effort in about 40 years since the industrial policies of the 1970s. Simultaneously, it promoted economic growth through a pro-business policy. This administration's electric vehicle (EV) policy spurred the South Korean EV and battery industry to take a leap forward in international competition. However, the government-business relationship manifested during the policy

[2] Interviews with H firm (CEO, 11 April 2017), DF firm (chairman, 16 April 2017), K firm (executive director, 17 April 2017), DD firm (director, 18 April 2017) and T firm (employee, 21 April 2017)

decision process significantly differs from how it has traditionally been described in the literature of South Korea's developmental state and industrial policy. Surprisingly for many, the green car policymaking was "directly" led by big business elites from large business groups. Not only through their influence, but especially as they themselves held positions of decision-makers as ministers, high-ranking bureaucrats and policy advisors. Notably, the Ministry of Knowledge and Economy (MKE) and its policymaking agencies were staffed with private industry experts, directly and indirectly related to the big three and other chaebol groups who already had their interests in EV and batteries.

Even before the Lee MB government, business ideas related to green cars had also been discussed as a new business sector to explore in the exclusive presidential meetings of each business group. Since the early and mid-2000s, large lead firms realised the limitation of growth in existing industries and began to look for new growth engines. HMG began to develop EVs since the 1990s and hydrogen fuel-cell vehicles since 1998 HMG (2021); I. Kim (2021). However, the search to diversify a business portfolio was more prominent amongst smartphone makers, Samsung and LG, due to the rapidly changing product and technology (Yoon et al., 2007). Samsung and LG had also planned to foster the lithium battery business from 2002. Particularly, LG Chem had the vision to enter the market of electronic car batteries, and LG's strategy was accelerating the convergence between the electronic and the chemical sector through ICT Jeong (2002); T. Lee (2005).

As soon as President Lee Myung-bak, an ex-business elite himself, took office, he appointed Lee Yunho as the Minister of the Ministry of Knowledge and Economy.[3] Minister Lee worked for LG for 20 years until 2007, as well as for the Federation of Korean Industries (FKI), the most influential business association in Korea, as a full-time/representative vice-chairman before his ministerial appointment in 2008. Given his career and a strong attachment to LG group and FKI, it is not surprising that the Lee MB government adopted LG's industrial vision for new growth engines, which was first presented in FKI's monthly forum in November 2007 FKI (2007); Kang and Jo (2021).

Furthermore, the president and the minister established a planning group under MKE, the New Growth Engines Planning Board, to investigate and select manufacturing sectors to promote FKI (2007). 360 experts from the industry, academia and research institutes participated in the advisory board and emphasised the value of 'private-driven' policymaking. amongst them, there was the president of the Planning & Technology Division of SK Energy. A former director of the R&D Business Labs at Hyosung Group also joined the board MKE (2008). The planning board worked on investigation and analysis and submitted a report, 'The Vision and Development Strategy for New Growth Engines', to the government in September 2008. 22 industries were chosen in the report, and EVs stood at the centre of the industrial promotion plan.

Following the framework and action plans, the Office of Strategic R&D Planning (OSP) was established under MKE in 2010 to allocate and manage the government's R&D projects and budgets. For this prestigious position, the government appointed a former chief technology officer (CTO) of Samsung Electronics who is known as the pioneer of the South Korean semiconductor industry and the most important contributor to Samsung Electronics' becoming the number one global company in electronics N. Kang and Jo (2021); MKE (2010b). OSP invited other business elites including a former CEO of Hyundai Autonet (currently, Hyundai Mobis) and a former SK executive director to the Key Industries Division and the ICT Division respectively as MDs MKE (2010c). At the same time, the Green Car Forum was launched in March 2010 co-headed by the president of Hyundai Motor Bae (2009); MKE (2010a). The forums gathered more than 500 experts from private and public sectors to submit the Green Car Roadmap to the government in December MKE (2010d).

All this attests to a structure of industrial policymaking that was inevitably dependant on large business groups, especially a handful of big business elites. Such strong business structural power emerged because these groups were those who had the industrial information that the Lee MB administration was seeking to formulate their new industrial plan. For example, Minister Lee Yunho established NGEPB (New Growth Engines Planning Board) with experts from industry, academia and public/private research institutes who emphasized 'private-driven' policymaking Kang and Jo (2021); MKE (2008). From the perspective of business structural power, business elites possessed the policy goods – sophisticated industrial information – that the government needed for sound industrial promotion policy. The next section introduces the findings that show a systemic monopoly of information in the automobile production – and the associated systemic exclusion of SME suppliers from the information hierarchy, and how this stems from the captive interfirm governance characterizing the production structure.

4. Industrial information monopolised by big business in the captive industrial structure

4.1. Market monopsony and hierarchical production structure

Hyundai Motor's management is slightly distanced from the global trend in which automakers increasingly rely on outside module companies. The acquisition of Kia in 1999 and the corporate split from the Hyundai Group in 2000 created a fertile environment for HMG to carry forward vertical integration in the automobile sector as well summarised by the corporate motto, "from molten metal to automobile".[4] Vertical integration contributed to saving production costs and appropriated more added value by occupying the top tiers in the supply chain. The group established its own component manufacturing companies, representatively Mobis, Wia, Dymos and Autonet between the end of the 1990s and the early 2000s. Through these component companies, the group itself embarked on the modularisation of production. This was for transaction costs and quality control, as well as for information protection and industrial security. Many of the important suppliers have merged into major international players since the 1997 Asian financial crisis, which caused profound concern in the group about losing control over the domestic market and information leaks Jo and Kim (2013).

As a result, the number of its affiliations increased to 40 in 2006 and 57 in 2013, although it slightly dropped to 53 in 2017 from only 16 in 2000 when the group was split from the former Hyundai Group.[5] At the centre was Mobis, the group's leading R&D firm and module company, which alone employed 4794 employees with a net profit of about KRW 243 billion in 2001. The net profit jumped to about KRW 2251 billion in 2012 with increasing sales. After jumping into green car development, the group has strengthened its component manufacturing by expanding affiliates and taking over tiers 1 and 2 component makers to complement other parts in order to complete the value chain Seoyoon Lee and Park (2015); B. Park (2015); Y. Park (2016). With managerial support, Mobis declared that the company would develop its own models of key components for the green car in 2016 J. Kim (2016). In the next year, the company became a producer of main components including motors, battery systems, hydrogen-fuel feeders, powertrain fuel-cell systems,

[3] Formerly the Ministry of Commerce (MoC) and currently the Ministry of Trade, Industry, and Energy (MOTIE).

[4] Group's website: http://www.hmgjournal.com/Tech/Item/circulate-iron-motor.blg

[5] Figures from Fair Trade Commission and TS2000, a professional corporate database.

and others. Accordingly, a vertical supply chain of HMG's green cars is almost complete for its HEVs, BEVs, PHEVs and FCEVs,[6] respectively Jeongmin Lee (2017); Mobis (2017).

Positioned in the top tier of the supply chain, HMG has strengthened their power over SME suppliers in the automobile industry. Several statistical data show their influence on South Korean industry. In automobile making, about 4740 firms out of the overall 5000–6000 auto suppliers in tiers 1 – 3 were Hyundai Motor's suppliers between 2005 and 2006 (Kim, 2007, p. 644). In 2007, 71.8 % of the entire automotive industry consisted of SMEs outside the big business group and other assemblers (KOSTAT); nearly 80 % of those SMEs were related to Hyundai Motor, Kia Motors, or both. SME component suppliers' reliance on lead firms was so high that about 35 % of SME subcontractors generated more than 80 % of their sales from transactions with HMG's lead firms and affiliates in 2007. In 2009, the group alone occupied about 76.2 % of sales in the Korean automobile market Lee (2011b).

In this sense, the South Korean automobile industry is better understood as a monopsony, where there is only one final buyer or significantly fewer buyers compared to suppliers. Also, it has a captive governance where the lead firm has a strong hold over its suppliers whose capacity is less competent, and the suppliers are dependant on the lead firm's conditions, monitoring and control. This implies a worse bargaining power of suppliers in adjusting prices and conditions of transactions with the lead firm Gereffi et al. (2005); Hernándeza and Pedersen (2017); J.-Y. Lee (2016). Although many tier 1 suppliers were established with the birth of the industry in South Korea as they were families or friends of Hyundai and Kia's owner families, even they are not free from HMG's control. For example, during the interviews, managers from tiers 1 and 2 component makers complained about the extremely small number of buyers in the domestic market. Firstly, they pointed out that their sales and performance are tied too heavily to the clients; therefore, the ups and downs of Hyundai and Kia were also transferred to the suppliers' business (interview with tier 1 K firm and tier 2 T firm). Furthermore, despite relatively mutual relationships compared to the other suppliers, tier 1 was still in a weaker position to make a price deal with lead firms, and it is hard to refuse the pressure to lower the production cost by unit. In this asymmetric relationship, it is not easy to expand their business outside current clients without having copyright issues, even making an extra contract with the other side of lead firms in HMG (interview with tier 2 T firm). The flow of information in the industry reflects such captive relationships amongst lead firms and suppliers under HMG's control.

4.2. Survey result: A vertical hierarchy of information in the Korean automobile industry

The 2017 survey results show that industrial knowledge and technology have formed a hierarchy centred around the lead firms. Firstly, contract types tend to reflect suppliers' positions in the value chains according to their capacities in the South Korean automotive industry. Table 1 shows that suppliers with their own design capabilities are closer to the lead firms higher in the supply chain. While the proportion of design-approved contracts increases as the suppliers go up the value chain, the overall subcontracts tend to be more detail-controlled in tier 3.[7] The survey result indicates that more than the majority of SME suppliers answered that their production methods are detail-controlled (27.7 %) or consignment (30.7 %) while 26.7 % answered design-approved.

Table 1
Contract types and suppliers' positions in the automotive industry (2017).

Position in the supply chain	Contract types				Total
	Detail-controlled	Consignment	Design-approved	Supplier proprietary	
Tier 1	3 (3.0)	6 (5.9)	9 (8.9)	1 (1.0)	19 (18.8)
Tier 2	15 (14.9)	17 (16.8)	12 (11.9)	7 (6.9)	51 (50.5)
Tier 3	8 (7.9)	5 (5.0)	5 (5.0)	2 (2.0)	20 (19.8)
Tier 4	2 (2.0)	3 (3.0)	1 (1.0)	5 (5.0)	11 (10.9)
Total	28 (27.7)	31 (30.7)	27 (26.7)	15 (14.9)	101 (100.0)

Source: Author's own.

The results in Table 1 imply not only suppliers' knowledge and capacity at the given time, but also the degree to which subcontractors may access the information through contracts. The closer the contract type is to design-approved, the more information suppliers may access about new products and market direction. Tier 1 suppliers enjoy their positional advantage in acquiring information and reflecting it for their own business in advance. According to HM's tier 1 wiring harness manufacturer K firm,[8] the firm dispatches about 100 employees to the lead firm every year for technical cooperation in developing new cars. As their contract is closer to design-approved, the supplier can obtain more information on new products and the business direction of the client through guest engineering. The firm enjoys its positional advantage in acquiring information and reflects it in its own business in advance before others in tiers 2 or 3 (interview with tier 1 K firm). Meanwhile, detail-controlled manufacturers are given very limited information only about the manufacturing of a certain component.

The survey clearly shows a systematic reliance on the information in automobile manufacturing. Regarding the question asking information source, about 73 % of SME suppliers chose final clients as their main information provider (Table 2). Although client firms were the most important source of information in all manner of production, the reliance is particularly high amongst the detail-controlled subcontractors with 82.1 %, followed by the consignment subcontractors with 77.4 %. In contrast, central/local governmental institutes as well as universities had very low influence in advancing the informational capacity of suppliers compared to their peer firms and subcontractors.

On the contrary, when asked about the extent to which the information about technological change and R&D is shared, nearly half of the respondents (45.5 %) answered low or very low, while only 15.9 % of respondents said high or very high. Interviews with tier 1 suppliers also back up the result (Table 3). Suppliers with R&D capacities said that they do not have any incentive to cooperate with their suppliers or other firms. They were acquiring necessary information from the lead firms – Hyundai and Kia – which is complemented by personal and formal networks with global component leaders. Nonetheless, the firm was reluctant to share its knowledge with lower-level suppliers and

[6] Electric Vehicles (EVs) encompass a range of technologies. Hybrid Electric Vehicles (HEVs) blend internal combustion engines with electric motors for improved efficiency. Battery Electric Vehicles (BEVs) are entirely electric are powered by large batteries. Plug-in Hybrid Electric Vehicles (PHEVs) combine the features of HEVs and BEVs, with the ability to charge the battery externally for short electric-only drives. Fuel Cell Electric Vehicles (FCEVs) use hydrogen to generate electricity, emitting only water vapor, though they face challenges in hydrogen supply and infrastructure.

[7] It is assumed that supplier proprietary is dominant in tier 4 because they produce basic, universal components with low complexity of transaction. However, because their capacities are also low, also because of the monopsony, they are in hierarchical or captive relationship with their clients, not market linkage, in terms of power asymmetry.

[8] The companies being interviewed were anonymized with initials.

Table 2
SME suppliers' source of information by production method (2017).

Contract types	Source of information						Total
	Clients	Sub-contractors	Peer supplies	Public institutes	Business associations	Universities	
Detail-controlled	23	1	2	1	1	0	28
	(82.1)	(3.6)	(7.1)	(3.6)	(3.6)	(0.0)	(100.0)
Consignment	24	5	2	0	0	0	31
	(77.4)	(16.1)	(6.5)	(0.0)	(0.0)	(0.0)	(100.0)
Design-approved	20	2	5	0	0	0	27
	(74.1)	(7.4)	(18.5)	(0.0)	(0.0)	(0.0)	(100.0)
Supplier-proprietary	7	2	5	1	0	0	15
	(46.7)	(13.3)	(33.3)	(6.7)	(0.0)	(0.0)	(100.0)
Total	74	10	14	2	1	0	101
	(73.3)	(9.9)	(13.9)	(2.0)	(1.0)	(0.0)	(100.0)

Source: Author's own.

Table 3
The degree of information shared by production type (2017).

Contract types	Degree of information share (technology and R&D trend)					Total
	Very low	Low	Medium	High	Very high	
Detail-controlled	3	15	7	2	1	28
	(10.7)	(53.6)	(25.0)	(7.1)	(3.6)	(100.0)
Consignment	4	12	13	2	0	31
	(12.9)	(38.7)	(41.9)	(6.5)	(0.0)	(100.0)
Design-approved	1	6	11	8	1	27
	(3.7)	(22.2)	(40.7)	(29.6)	(3.7)	(100.0)
Supplier-proprietary	2	3	8	1	1	15
	(13.3)	(20.0)	(53.3)	(6.7)	(6.7)	(100.0)
Total	10	36	39	13	3	101
	(9.9)	(35.6)	(38.6)	(12.9)	(3.0)	(100.0)

Source: Author's own.

universities through joint R&D projects unless it needed to recruit human resources from other firms and local universities or to answer the pressure to collaborate with its suppliers by local or central government (interviews with tier 1 K firm and DD firm). A tier 2 supplier said that the firm has its capacity for market research, however, the main source of information was open information released by lead firms and the government (interview with tier 2 DH firm).

Moreover, the survey results show the informational captivity of SME suppliers through their awareness and attitudes towards the potential threats that the industrial shift would bring to their businesses and positions in the supply chain. As shown in Table 4, most respondents expected more than a moderate degree of impact on their current business due to changes in technology – automotive electrification (69 %), connectivity (62 %) and weight lightening of automobiles (77 %). Despite the awareness, suppliers were relatively less responsive to potential changes. Only about 26 % of the respondents answered those changes would highly influence their business; 17 % answered that they are preparing for the change. The disparity between suppliers' awareness and readiness was concerning their estimation of component replacement. Whereas only about 26 % of suppliers thought there would be a big change in components in future cars, about 41 % and the other 34 % estimated a medium or low level of replacement of existing components.

Table 4
SME suppliers' preparation for the expected technological changes (2017).

Change in auto technology	Very low	Low	Medium	High	Very high	Total
Electrification	15	17	27	25	17	101
	(14.9)	(16.8)	(26.7)	(24.8)	(16.8)	(100.0)
Connectivity	20	19	34	21	7	101
	(19.8)	(18.8)	(33.7)	(20.8)	(6.9)	(100.0)
Weight lightening	9	15	35	28	14	101
	(8.9)	(14.9)	(34.7)	(27.7)	(13.9)	(100.0)
Increasing alternative parts	18	16	41	20	6	101
	(17.8)	(15.8)	(40.6)	(19.8)	(5.9)	(100.0)
Readiness to the change	11	28	45	15	2	101
	(10.9)	(27.7)	(44.6)	(14.9)	(2.0)	(100.0)

Source: Author's own.

The finding is interesting given that experts estimate that automobile components will dramatically reduce from the current 20,000–30,000 – 5000–7000 or even less. Furthermore, the ratio of ICT components will increase to occupy about 50 % of production cost in green cars, bringing a momentous challenge to traditional auto suppliers. However, suppliers' awareness of their relationships with clients in the future also reveals the short spread of industrial information or suppliers' incapability to prepare for the foreseeable changes. Only 25.7 % were worried that they might be excluded from the transaction for such changes while most of the respondents expected unchanged or even closer relationships with clients.

From their misinterpretation of the shift, it can be inferred that the information has been delivered to suppliers in a way that could maintain stability in the supply chain by hiding or reducing potential threats from them. An interview with a tier 2 supplier also points out the adverse information hidden by clients and the government. Firstly, it is hard to obtain such (negative) information about the change from their clients and the government. Even if they knew the change and any influence, they cannot make use of the information (interview with tier 2 H firm). In conclusion, the 2017 survey results reveal a vertical, even hierarchical, information structure existing in the automobile industry.

4.3. Informal and illegal practice of subcontract

The vertical hierarchy of information through subcontract is related to the lead firm's efforts to reduce the cost – the cost of production and monitoring. In South Korea, subcontracts are a way for big businesses to reduce costs, leaving marginal profits to suppliers. Also, this approach allows to internalise the technical skills and knowledge of suppliers, sometimes even the outcome of their R&Ds. This section elaborates on how the monopsonist production market further strengthens information capture via informal and often illegal subcontract practices, tenacious despite long-standing policy efforts to eradicate them. The section enriches the findings by expanding the investigation to the electronics industry led by Samsung and LG which also has a similar structure to the automobile industry. The findings are consistent in the two foundational industries for EVs.

Firstly, despite the growth of South Korean component makers, captive interfirm relations in the production structure extract R&D capacities and resources and concentrates them in the centre. Because of the tight financial situation prevailing amongst suppliers, they cannot allocate sufficient budget for R&D capacities to develop new products and technology. Thus, many suppliers need the intervention or

cooperation of big firms, which makes suppliers' dependence and subordination deeper. However, as discussed above, even tier 1 suppliers experience challenges in using joint patents with their client lead firms. For example, one of LG's suppliers almost finished the new development when it signed a contract with LG including joint R&D and share of the patent as a bundle for component manufacturing. Due to the contract, the supplier had to decline other offers from overseas firms. However, LG began to secretly upgrade the product via its Material Production Engineering Research Institute (LGPRI) to produce the component with another supplier Miyoung Kim (2013); S. Park (2018).

The other issue is management interventions by lead firms. Besides the request to submit designs for the bidding proposal or partner assessment, lead firms often request supplier managerial information such as production cost, human resources, financial status, and others. This often leads to requests for cost reduction that suppliers cannot refuse in the fear of termination of contract KBiz (2017). Regarding information requests, technical exploitation is another route by which lead firms absorb supplier information via their strong capital and bargaining power. The chaebol lead firms and affiliates use several legal and illegal ways to internalise supplier knowledge (Kwon, 2017, pp. 16–23). In the case of signing contracts, for example, lead firms sometimes ask for bidders to submit component designs or prototypes. After declining the proposal, the design is sneaked over to their own component affiliates for self-production or to other suppliers. Sometimes, lead firms and other client firms in the higher tier cancel the manufacturing transaction if they find other ways to produce the component cheaper even after the supplier has developed a requested product Lee (2018); PSPD (2017).

Technical theft also happens frequently in proceeding with contracts and production amongst subcontractors. Tier 1 suppliers also follow the lead firms' practice, including sudden cancellation of contracts after product development by a subcontractor. For example, Hyundai's tier 1 partner DayouAP cancelled the contract with a handle cover maker after the tier 2 subcontractor asked them for an increase in the price per unit. The client firm took the prototype and handed it over to a new subcontractor without compensation for the already spent R&D cost by the original subcontractor PSPD (2018). Samsung's tier 2 supplier also illustrates the same story. The initial contract was terminated after product development, and the product was illegally used in the client's factory in China without permission. Engineers from Samsung Electronics and the tier 1 client stayed on site and monitored the process of development and production Woo (2017).

When lead firms or major tier 1 companies seek a supplier's entire capacity, their scouts can expand focus even to departments or the workforce beyond individuals at the practitioner level. They may even use financial strength for forceful mergers. In such cases, the client firm disrupts the target supplier's management by reducing contract sizes, cancelling orders, or withholding payment. This diminishes supplier value, leading banks to quickly recover loans from struggling companies. Component firms near bankruptcy are then sold at lower prices, enabling large business groups and tier 1 partners to assimilate supplier technology and knowledge Choi (2014); Han (2017); J. Kang and Shin (2012); Kichan Kim et al., 2012; Kihong Kim, 2012; D. Lee (2012); Lee (2011a). For instance, DAS, a direct partner of HMG, pushed its initial subcontractors to fall into a huge financial deficit through severe cost reduction. By doing so, DAS helped SM, its specially related subcontractor, to take over the subcontractors in trouble for their scrap value Seo (2018). The above legal and illegal practices systematically establish a hierarchy of information to the bottom of the production structure, in conjunction with possession of contractual conditions.

5. Discussion

The paper investigated the mechanism by which South Korean EV policymaking marginalised SME suppliers from agenda setting. From the perspective of big business power, the discussion developed from the phenomenon that the business elites from HMG, Samsung, and LG have strong structural power to push government elites to include them in bureaucratic positions as ministers and policy advisors with the power of decision-making, as Lindblom (1977) says. The paper identified the information monopoly in South Korean automobile and electronics industry. The information monopoly has developed along with the captive interfirm governance in production structure, which is maintained through subcontracts and informal/illegal practices that bound suppliers' intellectual capacity only to the chaebol lead firms. The survey results, interviews, and the archive data show the systemic captivity of information of suppliers summarised below.

Firstly, there is a systemic absorption of information from the bottom of the supply chain. The overall subcontract in the automobile supply chain, like in electronics, operates in such a way that suppliers' intellectual property and capacity to use the technology is usually tangled in a specific model or components that are produced by big lead firms. The survey results indicate that the majority of subcontracts are in the form of consignment and design-provided, therefore, the design is owned by the client as explained by Asanuma (1989) and Fujimoto (1999). Interviews and NGO/trade-union/Kbiz reports also tell us that even tier 1 firms, whose contract type is often more design-approved or joint R&D, cannot make the best use of patents under the tight control of lead firms. The restriction and information absorption spreads down to the end of the production via the chain of subcontracts.

Information control from the top also occurs via customary unfair trade practices. The market monopsony of HMG, Samsung, and LG weakens the bargaining power of their suppliers, particularly over cost reduction and conditional requests for entry to bidding and renewal of a contract including submission of suppliers' managerial information. Intellectual exploitation also happens in the legal boundary, such as the recruitment of practitioners in suppliers and M&As. However, frequently, the internalisation of skills and technology takes illegal forms, including the hostile devaluation of a firm, intentional cancellation of a contract, design theft, etc.

On the other hand, chaebols are in a position that can easily absorb SMEs' knowledge while also holding control over information from the market and customers. Due to the vertical informational hierarchy that Aoki (1986) identifies, most of the suppliers are reliant on the big lead firms and tier 1 firms as almost the only source of market and technological information. Nevertheless, information shared with suppliers is limited to the extent necessary for component manufacturing. Negative information, for instance, about the potential consequence of shifting to EVs was not adequately delivered to suppliers either by lead firms or the government. The interviewees for this research just began to consider the survival or exit strategy only after a decade since the Lee administration declared its aim to rank globally in the EV industry. A tier 2 firm even went bankrupt one year after the interview, partially due to the burden of business expansion to the EV market by entering the motorcycle market in India.

To conclude, business elites from the big three have built a monopoly of industrial information in the economy, which makes them the only valid possessor of information that the government needs to form industrial policy. Meanwhile, SME suppliers could not play as an outside option for the government to diversify the source of information and balance the power against the chaebol in policymaking. Although government meetings with business associations, especially FKI, occurred frequently for EV policy as well as for the overall new growth engines in the Green Growth Plan, the verifiable official meeting between NGEPB and Kbiz, an association of SMEs, took place only once on the 4th of September 2008 NGEPB (2008). The marginalisation of domestic suppliers from Korea's fast race in the global EV and battery market already began from the agenda-setting stage in the making of EV policy almost fifteen years ago. Industrial policy, which was centred around big business groups to increase the export of end products and key intermediate goods, faced the risk of beneficiaries' moving away from the domestic market due to their local production strategies. At the same

time, it did not lead to a gradual adaptation and restructuring of the domestic supply chain.

6. Concluding remarks

This paper sheds light on why the strong industrial policy that enhanced the global competitiveness of the South Korean EV and battery industry failed to support the survival and adaptation of SME suppliers, by focusing on the aspect of business structural power. It reexamines the formation of Korea's development alliance to complement the limitations of existing state-centric analyses, contributing to a more diverse understanding of the industrial development process. Specifically, it reveals how the balance of power between actors can change within the dynamics of industrial development, demonstrating that policy processes and outcomes that seem path-dependant are actually based on qualitative differences from the past. Meanwhile, by applying the theoretical concept of corporate structural power, which has mainly been discussed in IPE and tax policy literature, to the field of industrial policy, it suggests its potential theoretical expansion. The marginalisation of SMEs is an outcome of the country's rapid industrial development during the past half-century, which established an industrial landscape with only a handful of chaebols at the centre.

Recently, major Korean EV and battery manufacturers released their domestic investment plans. These plans are largely driven by the US IRA and political and diplomatic challenges in the Chinese market against Korean makers. However, there are doubts regarding whether domestic production will effectively support this crucial opportunity to solidify and integrate the new industry comprehensively within the country. The Korean governments before and after the Lee administration have emphasised shared growth between big businesses and SMEs; a tremendous amount of policy funding has been provided to SMEs. However, the evaluation of the green car policy emphasises that such monetary policy tools must be reviewed and improved to support SMEs to escape from the technological capture in the monopsonist and hierarchical supply market.

At the same time, although the paper is limited to the case of South Korea and its domestic industrial dynamics, its implications reach beyond. Firstly, this situation may echo other countries whose economies have been dependant on traditional manufacturing, including the automobile sector. The large-scale green transition currently taking place globally is inevitably centred on large firms with significant production capabilities and capital, in the interest of efficiency. Car manufacturers in the U.S. and EU, who were reluctant to giving up engine-driven cars despite continuous environmental regulations, began a significant shift towards EV in the wake of the pandemic. Only then did the green transportation policies in both regions gain momentum, showcasing the influence of major corporations in industrial transitions. Pichler et al. (2021) also note that while the EU's automotive policy focuses on European champions, there is a lack of initiatives aimed at transforming the substantial structure of the industry. The South Korean case illustrates the potential negative consequences that can arise when there is a rapid shift to green industries and products without a proactive "way-out" or adaptive policy in place.

In addition, because of the high completion of the supply and manufacturing in its domestic production, the Korean case can be a simple but compressed snapshot of the global manufacturing supply chain, in which big global capital sits on the top, establishing a hierarchy of production and information. In particular, in the sector of EVs and batteries, the information issue will turn one to question and evaluate the policymaking process, particularly in emerging markets which increasingly rely on FDIs by giant multinational companies for a fast industrial shift. The fall-out of companies from this new trend illustrates that the initial technological capture turns back on the suppliers without rewarding their reliance on government policy. Also, the case can be an opening to evaluate why the global division of labour does or does not bring an expected outcome, such as a spillover effect, by joining the new value chain.

CRediT authorship contribution statement

Kahee Jo: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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