Green Innovation in State-Owned Enterprises

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Green innovation is an advancement in environmental sustainability that has a positive impact on both economic development and the environment. For this reason, governments and societies put growing attention to green innovation. Green innovation has a positive impact on enterprises; however, there is no consensus for what concern the efficiency of green innovation in state-owned enterprises. The latter is relevant because of the predominant position of state-owned enterprises in high-polluting and energy industries, and their connection with governments and their policies.

organizational change energy transition

state-owned enterprise

entrepreneurial identity

1. Green Innovation

Green innovation refers to advancements in environmental sustainability that have a positive impact on both economic development and environmental protection (Tang et al., 2018; Yin et al., 2018). For these reasons, governments and societies put growing attention to environmental problems and sustainable development.

Government environmental regulation and awareness of environmental protection have an important impact on enterprise innovation (Ai et al., 2020; Shao et al., 2020). Green innovation is a key factor in economic growth and environmental protection policies (Magat, 1978). For example, Green R&D tax incentives or the levying of emission tax can encourage green innovations in enterprises (Song et al., 2020; Shen et al., 2020). Accordingly, consumers grow awareness of environmental protection and prefer environmentally friendly products (Li et al., 2016). Studies explored the impact of finance (Zhou et al. 2022; Hou et al. 2022; Yang et al. 2022), foreign direct investment (Luo et al. 2021; Xu and Li 2021), and knowledge sharing (Bao et al. 2022; Liao and Li 2022) on green innovations (Castellacci and Lie 2017; Takalo et al. 2021). At the level of enterprises, studies are concentrated on the impact of green innovations (Guinot et al. 2022). For example, green innovation enhances corporate reputation and sustainable development, and, from a strategic perspective, improves the competitive advantage of firms (Sellitto et al. 2020; Tu and Wu 2021; Awwad et al. 2022). Enterprises are in an unprecedented situation to transform the idea of sustainability into green innovations (Landoni, 2023).

There are external and internal factors that prompt green innovation in enterprises. External factors are environmental regulation and policies (Chen et al. 2022), green finance (Dong et al. 2022; Zhang et al. 2022), integration with the supply chain (Hong et al. 2019; Sun and Sun 2021), and the regime of open innovation (Yang and Roh 2019). Internal factors are absorptive (Chen et al. 2014; Du and Wang 2022) and the control (Li et al. <u>2018; Ma et al. 2022; Wang et al. 2022</u>) capacities of the firm, strategy (<u>Yahya et al. 2022</u>), and the role of digitalization (<u>Gao et al. 2023</u>).

Enterprises, especially pollution-intensive firms, therefore, must use a critical approach to green innovation to achieve win-win outcomes for both economic activity and environmental benefit (Zhai & An, 2020; Zhao et al., 2022). Green innovation has a positive impact on enterprises (Arenhardt et al., 2016; Xie et al., 2015); Green innovation that turns into new patent applications has a significant positive effect on enterprise value (Hao et al., 2022). However, there is no consensus for what concern the efficiency of green innovation in state-owned enterprises.

2. State-Owned Enterprises and green innovation

Governments use State-owned enterprises (SOEs) to address market failures and foster economic development (Atkinson and Stiglitz, 1972) and may intervene in the operation of SOEs to fulfill social functions (Lin et al., 1998; Marcel, 2019), such as environmental protection, which conflict with profit maximization (Shleifer and Vishny, 1994). SOEs are a tool for wider economic policies, including economic development and wealth redistribution within the country. SOEs operate to meet societal needs and provide public value (<u>OECD 2018</u>). In terms of public value creation, SOEs have a strategic role in driving environmentally sustainable growth. SOEs are most prevalent in strategic sectors such as energy, minerals, infrastructure, utilities, and network industries and services (<u>PwC 2015</u>).

Despite being at the forefront of governments' actions for environmental protection, SOEs are often major emitters, as many oil and gas big businesses are state-owned, particularly in the merging markets, for example, the BRICS (Brazil, Russia, India, China, South Africa) countries. Oil and gas SOEs rank as the top entities for the carbon emission intensities of all the oil and gas producers (Dietz et al., 2021). However, a case study of oil and gas SOEs from the BRICS found little capacity to produce green innovation and greater effort in the search for oil and gas drilling innovations (Jaffe et al., 2022). Nevertheless, because they are major emitters, SOEs are at the same time relevant to the national decarbonization efforts of governments (Clark & Benoit, 2022). Sustainable and clean sources of energy are of critical importance for global welfare (Markard et al. 2004; Marques et al. 2020; Sala et al. 2023). Most studies on energy transition focus on the role of policies driving energy transition at country and international levels (Rana et al. 2020; Maris and Flouros 2021; Cheng et al. 2022) and on the global concerns over the negative impact of fossil fuels on the environment (Apergis and Payne 2011; Imasiku et al. 2019; Estévez et al. 2021).

More promising is the effect of state ownership on the green innovation of enterprises. Studies found in the context of the mixed-ownership reform in China that the injection of state-owned capital in private enterprises can significantly promote green innovation (<u>Yu et al., 2022</u>; Hu et al., 2023), and similarly foreign shareholders have a positive impact on green innovations in SOEs (Yuan, et al., 2021).

Another factor that influences green innovation in SOEs is political connection. In the case of SOEs, the characteristics of executives who were government bureaucrats (Fisman, 2001; Fan et al., 2007) drive the decision-making process concerning green innovation (Faccio et al., 2006). Political connections are relevant in the case of China, where the government appoints the executives of SOEs (Boubakri et al., 2013). An empirical study on Chinese SOEs reported the significant impact of SOEs' political connections on green innovation (Zhang et al. 2022).

3. Environmental, social, and corporate governance of State-Owned Enterprises

SOEs have a different approach to sustainability than private enterprises. SOEs are viewed far from innovative because of their alignment with governments' political strategies; SOEs suffer from inertia and risk-averse behavior, particularly in a sensitive sector like energy. However, recent studies see SOEs as innovative actors (Landoni 2020).

Enterprises fully or partially owned by the state (SOEs) perform significantly better than non-SOEs when it comes to ESG (Environmental, Social, and Governance) scores, and the ESG scores increase with the size of the share owned by the state (<u>OECD 2020</u>).

SOEs have a higher measurement and disclosure of non-financial information because they communicate through publicly available platforms, which makes them more likely to achieve higher ESG ratings because of enhanced reporting activities. This is in line with the previous literature, stating that high-sustainability companies exhibit greater communication transparency (Eccles et al. 2014), and it suggests a connection between a company's ESG score and its size (Dorfleitner et al. 2015). Other studies reported that firms with a higher quality of governance produce more green innovation (Amore and Bennedsen, 2016; Freire, 2018; Xia & Yang, 2022). Furthermore, another study found state ownership to be an important factor influencing sustainability reporting (Castelo et al. 2014). A report conducted by PwC also found that state ownership was correlated with better reporting regarding sustainability targets (PwC 2015).

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