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Policy Brief

PARTNERING FOR GREEN RECOVERY: INDUSTRIAL SYMBIOSIS AS ESG STRATEGY IN A POST-COVID-19 ERA

Task Force 9

Global Cooperation for SDG Financing

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Abstract

Considering most Environmental, Social and Governance (ESG) strategies on the environment are limited to waste management, Group of 20 (G20) governments and the private sector should partner and embed the culture of sustainability and transform towards a circular economy. Industrial symbiosis (IS) serves as a way to transition to a circular economy as it encourages firms to operate towards zero emissions. This paper proposes state-led industrial symbiosis networks (ISNs) to promote IS as part of firms' ESG strategy. It is necessary to support firms in shifting their paradigm and raising awareness of the advantages of sustainable industrial transformation. The drivers and challenges of a state-led ISN, we propose five policy recommendations to advocate IS: prioritising strategy on the green industrial cluster, policy integration, development of a task force, the establishment of a digital network and business involvement.

Challenges

There is an increasing trend in a number of firms to pursue a circular economy as resource productivity demand for climate action amongst consumers has grown immensely. The adoption of Environmental, Social and Governance (ESG) measures has also increased as an indicator for investors, policymakers and stakeholders to safeguard businesses from future risks. To disclose ESG-related information, firms can use reporting frameworks, among others the Sustainability Accounting Standards Board (SASB), which provides a waste-management standard for industry-based sectors. Most standards are concerned only with immediate waste treatment and management that have potential environmental damage. This effort could be accentuated by measuring efforts that address the sustainable solution to the energy crisis, such efforts include engaging in an Industrial Symbiosis Network (ISN).

Industrial Symbiosis (IS) is a collaboration initiative on the exchange and reprocessing of waste and other excess resources (i.e., by-products) from one firm into valuable inputs for another (Chertow, 2000). IS aims to generate zero emissions among the collaborating firms within the ISN. The ISN changes the cycle of manufacture-consume-dispose towards manufacture-consume-recycle-manufacture (Mauthoor, 2017). Stimulating a transformation in the business cycle and embedding IS in a firm's ESG strategy requires integrated regulatory support and incentives facilitated by government and private actors.

State-led ISNs have been successful in several countries, ranging from single project/small scale (e.g., the TEDA-eco centre in China) to national systems (e.g., the NISP the United Kingdom). Although the potential applications for IS are high, a study conducted by Jooyoung, Hernández and Posada (2018), reported some vulnerabilities in the system, such as a lack of trust, uncertainty about the benefits, a lack of knowledge of the concept of IS, a lack of information sharing, no facilitation for industrial transformation and a lack of incentives and legal support. Early state-led ISNs were developed on an experimentation basis by continuously monitoring the vulnerability of the system and addressing its issues when it comes to the surface. As early state-led ISNs have successfully manoeuvred their challenges, their frameworks and strategies have become a benchmark for the development of emerging ISNs.

Based on the experiences of current state-led ISNs, the challenges and drivers faced by state-led ISNs are presented in Figure 1. These challenges are the identified vulnerable points based on early state-led ISN experiences that need to be monitored and to be proactively

mitigated from the establishment of the state-led ISN system. Based on this figure, the red-line of these challenges is the lack of funds to promote and develop IS, and deficient regulatory frameworks. A pertinent issue arising from these challenges is the resource-intensive nature of state-led ISNs, which might be difficult to be addressed during the economic recovery from the pandemic. This paper proposes state-led ISNs promote IS as part of a firm's ESG strategy. It is necessary to support firms in shifting their paradigm and raising awareness of the advantages of sustainable industrial transformation.

Figure 1. Drivers and barriers of state-led IS
Source: Neves, et al. (2019).

Proposals for G20

The challenges and driving factors of ISNs, as summarised in Figure 1, indicate the heavy investment needed for the state to stimulate the establishment of an ISN. Considering the importance of efficiency in the recovery stage of the pandemic, a comprehensive policy framework that mitigates the challenges before they come to the surface would need to be in place during the early stages of state-led ISN establishment. Another important factor to note is the nature of an ISN itself as a system in which stakeholders interact and determine the success of the system. These stakeholders are the central/local government, research institutions/universities and firms. The main actors of the system are the firms whereby they decide on whether or not to get involved in an ISN. Chertow's (2000) driving factors of the underlying motivation of the engagement of firms in an ISN, namely input-output matching, stakeholder processes and materials budgeting, would need to be taken into account in the design of the framework. As ESG strategies gain importance in defining a firm's effort towards fulfilling its responsibility for its business's external impacts, promoting the firm's involvement in an ISN as part of its ESG strategy would minimise the investment in stimulating state-led ISNs. On the other hand, the nature of IS, which goes beyond the current state of ESG in tackling environmental issues (i.e., waste management), deserves to be recognised as an advancement in a firm's ESG strategy.

We propose the below policy framework to mitigate the system's challenges and induce private sector engagement to consider IS as part of its ESG strategy.

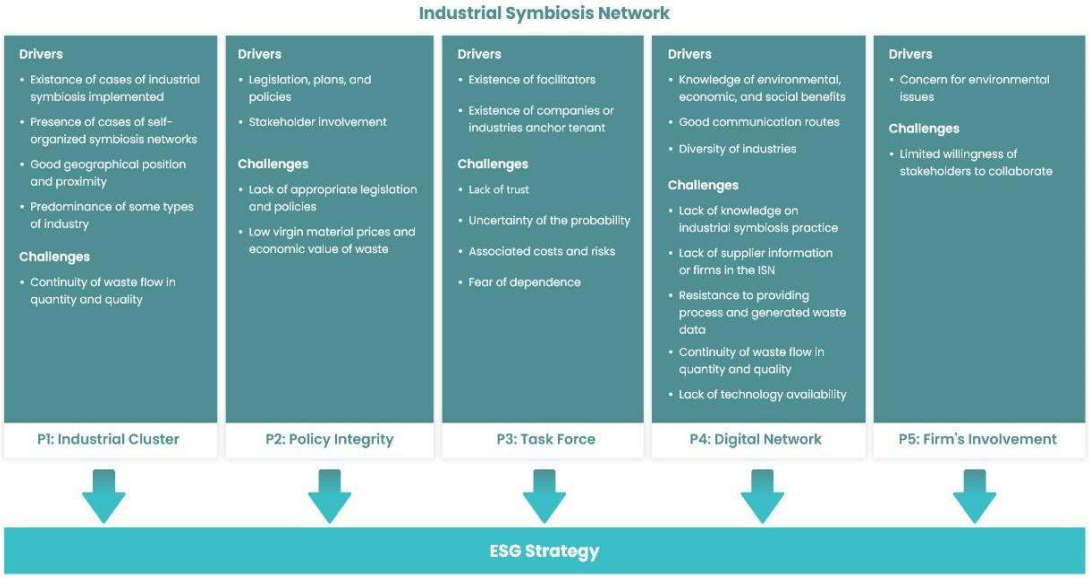

Figure 2. Proposed policy framework

Prioritising industrial clusters

An attempt to develop IS is normally started through an industrial cluster in which all the players are trying to reap a benefit from geographical proximity and also incentives from the central and local government. Basically, the practice of IS is similar to biological processes, in which different organisms associate in a "mutually beneficial relationship" (Schwarz and Steininger ,1997), as it allows entities and firms that operate separately to come together in the physical exchange of materials, by-products, energy and water, with competitive advantages for all stakeholders (Chertow, Ashton and Espinosa,2008). In addition to waste/by-product exchanges, this sharing of resources also encompasses infrastructure sharing and the joint provision of services. Some of these efforts are not only limited to the industrial cluster but also extended to the urban areas because common industrial problems, such as increases in waste, waste treatment costs and high resource consumption will have an impact on the region where the cluster is located (Dong, et al. 2016, Sun et al, 2017). Thus, to successfully implement IS, governments should develop and design industrial clusters with the ISN policy in mind. For example, the Malaysian Investment Development Authority (MIDA) has a specific department on the circular economy. A circular economy is a model of production and consumption that involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. Micro, small and medium enterprises in Malaysia have been encouraged to adopt recycling in production, logistics and waste management. To implement this, there is a need for cooperation between firms and municipalities to achieve both environmental and economic benefits and simultaneously solve several environmental problems. This collaboration has been referred to in several publications as industrial and urban symbiosis (Fang, 2017; Dou, 2018).

To have a successful eco-industrial cluster, there is always a daunting question: Is it better to have a bottom-up approach or top-down approach? In most cases, the top-down approach where the government is actively involved in designing the type of cluster by considering resource availability and material flow analysis is the one that proves to be more successful. Nevertheless, we should not neglect the importance of having a hybrid approach in which the designed and the natural cluster work together because of the symbiosis mutualism to increase the efficiency of their production. This arrangement could be materialised because the waste of one company can be utilised by other companies from totally different industries. This could happen if there is a high level of trust among players, social norms, regulatory programmes, incentives and the right policy in place.

There are ample examples of synergistic networks around the world with a wide variety of the numbers of participants, types of economic activities and how they are organised. In Europe, most IS (Domenech et al., 2019) are spread across different countries, with the UK having the highest number of cases (Neves et al., 2019). This is due to the voluntary programme that the government has launched to help firms find partners to use their waste as raw material, called the National Industrial Symbiosis Programme (De Abreu, Ceglia, 2018). Finland also has several examples of IS, largely arising from the large presence of the pulp and paper industry, which has driven the creation of synergy relations (Pakarinen, 2010). In Asia, a number of IS initiatives have also been reported, with the highest number of cases in China, largely due to constraints on carbon dioxide emissions and the numerous plans and policies that have been implemented to foster circular economy practices (Liu et al., 2018). In Japan, most industrial and urban symbiosis is driven by the Japanese Eco-Town Programme, which encourages the use of industrial, municipal and commercial waste in industrial applications, with the aim of boosting the economy and reducing waste disposal (Fang et al., 2017, Dou et al., 2018).

Ensuring policy integrity and support for IS

IS in some cases has been stimulated by the enforcement of a supporting policy. For example, the stimulation in China was largely due to constraints on CO2 emissions and the numerous plans and policies that have been implemented to foster circular economy practices (Mathews and Tan, 2011). In Japan, IS and industrial-urban symbiosis was driven by the Japanese Eco-Town Programme, which encourages the reuse of industrial, municipal, and commercial waste to achieve economic efficiency and reduce waste disposal (Shi et al., 2010). Environment and circular economy policies are the foundation to drive the establishment of an ISN. An integrated policy framework is essential to also gain sectoral regulators' buy-in to support the ISN.

In addition to developing a supporting environment and circular economy policies, the state also needs to assess its current industrial policies to avoid legislation restricting the development of IS synergies. Restricting policies might be present in policies regulating new waste materials used in productive processes (Husgafvel et al., 2016) and the toxicity of some of these waste materials (Husgafvel et al., 2016). Restricting policies can hinder the flow of waste materials and the development of future synergies. By reviewing current industrial policies and other relevant regulations, the state could ensure that policy integrity is present to drive the establishment of an ISN in its present time and for future synergies. Specifically regulating new waste material usage in a manufacturing process would define the economic value of waste. This policy could also encourage firms to use waste as their manufacturing inputs. As a result, this action would become common in a specific industry. Hence, it would drive firms to sell their waste or by-

product and engage in an ISN. The support of a waste or by-product supply, especially a predictable and regular supply, would make prices more competitive in comparison with virgin raw material prices. A coordinating actor is a key to monitoring the waste or by-product supply. This coordinating actor could be the party that assists supplier-matching in the ISN, similar to the role of the UK NISP (De Abreu et al., 2018).

Establishing a task force with R&D capabilities

A coordinating actor is key to mitigating the challenges of lack of knowledge, supplier information, trust and information on technological availability. Evidence has shown that governments (including local governments) can support IS by coordinating relationships and material exchanges, as well as providing infrastructure and funding (Sodergren and Palm, 2021). To increase trust among stakeholders and minimise the state's budget, a task force consisting of relevant governmental regulators, academics and business associations is proposed to serve in the coordinating role. In addition to mitigating the identified challenges, the task force would also enable the driving factors of building knowledge awareness on the environmental, economic and social benefits, carrying out the role of facilitator, and enabling good communication routes. Considering the task force would also include business associations, it could also establish, maintain and promote the database of existing IS initiatives conducted by businesses. The relevant governmental regulators in the task force would be expected to ensure that integrated policies are enacted to support the establishment of IS. The regulators could also monitor and evaluate the effectiveness of their policies in a coordinated fashion through this task force and check on whether policy amendments are compliant with other relevant policies. The academics within the task force are essential to conduct research on the connectivity between diverse industries based on their waste and by-product relevancy in the materials flow analysis (MFA). Noting that there are material flows that are yet to be discovered, an advanced task force could also facilitate a research and development (R&D) centre for exploring future materials that could form part of an IS connection. An R&D centre facilitated by the task force would substantively reduce the cost of establishing a new IS connection.

Learning from the current cases and understanding the various IS dynamics (Boons et al., 2016), the existence of a task force consisting of government, academics and business associations, would enable the development of eco-cluster IS dynamics. In this type of IS dynamic, multiple stakeholders develop symbiotic linkages through a participatory process as part of the broader eco-innovative strategies. Hence, including an R&D role as part of the task force is essential in enabling innovation within an ISN. To be updated with current IS innovations and existing material flow analysis, the task force should engage in international fora by being a member of

the International Society for Industrial Ecology's (ISIE) IS and Eco-Industrial Development Section. The task force would also need to be open to regional cooperation as there is evidence in which cross-border ISNs could improve efficiency and sustainability, for example between Italy and Switzerland (Borbon-Galvez et al., 2020).

In carrying out its roles, the task force can be assisted by a digital platform to ease its coordination role, reaching out to wider businesses and the maintenance of data transparency. Such a platform would digitalise the ISN and improve the efficiency and effectiveness of the task force's efforts in promoting IS. The digital platform is discussed further in the next section.

Digitalising an ISN

A traditional ISN takes more effort in updating knowledge on IS practice, lacks updated trading information and a material database. Digitalising the ISN would ease the facilitation of the task force in providing updated information on current and emerging IS practices. This would allow open public access to knowledge and provide information on updated MFA, secure information access to waste material trading and global social network information on IS news and activity. The adoption of a secure digital solution by developing an online ISN platform is expected to facilitate the adoption of IS as part of ESG strategies in providing reference to MFA, facilitating supplier matching, disseminating rules and regulations and reducing R&D costs for firms' IS exploration. The platform could function as a collaborative knowledge centre that could also collect data on firms' IS engagement to improve the facilitation of IS and measure its impact. By gathering data on IS synergies, it could attract more firms to engage in an ISN and construct new synergies between industries. This collective intelligence could be obtained from an open platform where multidisciplinary industries can share their needs and demands.

Below are features of a digital platform that would facilitate the stimulation and advancement of an ISN:

1. Database archive of waste and by-products based on the MFA
2. New experiments of MFA
3. Database of firms in the ISN and their synergies
4. Updated waste and by-product trading and processing best practices
5. Industry social network hub to share their material information
6. Relevant policies and regulations

The current ESG metrics predominantly measure the existence of policies or certain activities rather than their impacts (O'Connor and Labowitz, 2020). The next phase of development of the

digital ISN platform can cover the impact of IS considering data on firms in the ISN and their available synergies. By assessing the impact, the government can apply a more dynamic improvement to the advancement of IS. This improvement will create a digital community of corporations that challenge themselves to grow and improve their sustainability. The platform stands to gain stakeholders' trust and to realise the potential economic, environmental and social benefits of adopting IS in line with firms' ESG strategies.

Recognising involvement in an ISN as the highest score in a firm's sustainability report

The United Nations Sustainable Development Goals (SDGs) introduced the urgency of the concept of sustainability for firms and organisations around the world leading to a better future for all people. It is essential to have a collective contribution to an ecosystem where firms can reinforce each other (Bijon et al., 2022). This ecosystem of sustainability can be overlooked with the correlation between involvement in an ISN and sustainability in the firm's ecosystem. This ecosystem includes corporate sustainability reports, corporate sustainability measuring and ESG scoring (Drempetic, et al., 2017). The creation of indicators for proper scoring has been raised in addressing ESG reports (Lopez and Serrate, 2021). Several issues were found earlier, if ESG reporting is not applied regularly the ESG initiative decreases over time.

Therefore, to enhance and emphasise a firm's engagement and involvement in the symbiosis ecosystem, we recommend acknowledging the firm's involvement in an ISN as the highest point in corporate sustainability report. To maximise the benefit of an ISN, sustainability and responsibility in ESG scoring should form part of the SDGs to create more sustainable firms whose claims with regard to their responsibility will be accepted by society (Drempetic, S. et all., 2017). An ISN itself has its own large beneficial community that will share its continuous ethical partnership and broad material exchange not only nationally but also with regard to international resources. This mutual benefit will improve society and improve sustainability in the life cycle of industrial waste. The proposed 5 policies can mitigate state-led IS challenges by positioning IS as an ESG strategy to increase firms' motivation and engagement in the transformation towards a green recovery.

Conclusion

From the above policy proposal, we may conclude that the successful implementation of an ISN depends on collaboration among academics, businesses, communities and governments. The five policy recommendations need to be synchronised and implemented as a whole to anticipate the challenges of ISNs. Promoting IS as an ESG strategy would advance the environmental effort

of firms in their transition to zero emissions. Furthermore, acknowledging IS in sustainability reporting would scale up the standards of firms' sustainability efforts as it goes beyond waste management. The transition to a circular economy not only results in a greener economic recovery but also raises the efficiency and cost-effectiveness of resources and simultaneously reduces the dependence on natural resources.

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