

Effects of Regulation/ Deregulation on Natural Resource Management for Market Efficiency, with Special Reference to Aggregates Mining

K.R. Gangadhara*

Senior Assistant Secretary to the President

Abstract

Extraction or mining of geo-resources has created a much-complicated situation in terms of environmental, economic and social aspects. Currently, the depletion and the environmental damage done by this extraction have become core issues in Natural Resources Management. Regulation, thus, imposed to address the resource depletion and environmental damage has been widely considered as a main instrument to manage the Natural Resources. However, it (regulation) is frequently criticised stating that it has a little assistance in mitigating the damage done to the environment while distorting the market efficiency, affecting ultimately the overall economic growth. Yet, controversy between regulation and deregulation is highly debated over the decades. Consequently, with the objective of shedding insights on the effects of regulation and deregulation on natural resource management towards market efficiency, with special reference to aggregate (sand, gravel and metal) mining; this article offers a theoretical conceptualisation how effective it is. The article put forwards both the positive and negative aspects of regulation and deregulation, and via detailed discussion, concludes that regulation in mining of geo-resources is in favor of proper management of such, but detrimental to the efficiency of the resource market.

Keywords: geo resources, regulation, deregulation, natural resource management, market efficiency

1. Introduction

Earth resources, such as sand, gravel and rocks, which are aggregates in the construction industry, have been mining since the ancient times. Yet, in the 20th century, the extraction of construction minerals grew by a factor of 34, while that of ores and industrial minerals by a factor of 27. This growth significantly outpaced a quadrupling of world population and a 24-fold increase in GDP (UN Environment, 2018). Globally, between 47 and 59 billion of tonnes of earth material is mined every year of which sand and gravel account for both the largest share; from 68 per cent to 85 per cent (UNEP, 2014). These aggregates are encountered with fastest extraction as well, actually, with the ever-increasing demand, they are on the verge of depletion (Krausmann et al., 2009). Thus, the utilisation of remaining earth resources has created a much-complicated situation in terms of environmental, economic and social aspects, on top of its depletion. Currently, these depletion and environmental damage have become the core issues in Natural Resources Management.

The regulations put in place to address the resource depletion and environmental damage has been publicly considered as an instrument to manage the Natural Resource Management. However, regulatory authorities are frequently blamed for their sedentary style of interventions or poor monitoring saying regulations little helps mitigating the damage done to the environment associated with the exploitation of these resources; criticisms are also there that the stipulated rules and regulations hinder the expansion of mining industry, distorting the market efficiency, affecting ultimately the overall economic growth.

*Correspondence: gangadrr@yahoo.com

Tel: 0718215469

© University of Sri Jayewardenepura

This conundrum between regulation and deregulation in natural resources management has led to two schools of thought. One school view that the regulation is a sound mechanism for the proper management of natural resources including mining, while the other argues that the regulation is detrimental and hence, deregulation is better for the proper management of natural resources. This article sheds some lights on both the schools of thought and supports insights on conceptualising the relationship between the regulation in natural resource management, while analysing how they are affecting to the market efficiency, with special reference to aggregates business.

First, the article looks for the definitions of regulation and deregulation. Secondly, the regulation and deregulation are discussed in terms of natural resources management and then for the market efficiency. Finally, a theoretical conceptualisation in relation to understanding how regulation and deregulation affect with natural resources management is presented.

2. Method and the Postulation

For the present study, it has been postulated that both the regulation and deregulation are based on sound technical principles which are fundamental to the law, but may have different implications when it applying across different sectors which are not in the doctrine of law. In this respect, it has been approached to study and compare regulation and deregulation in terms of natural resources management and then the market efficiency.

2.1 Regulation and deregulation

Simply the regulation is the authoritative rules issued by the state (Drahos, 2017). For some lawyers the meaning of regulation is confined to the rules of delegated legislation. This definition has both theoretical and empirical dimensions. Empirically, regulation had pluralised in important ways, governments are pushing on third parties to deliver. In legal point of view, stipulating regulations demote the penalties for non-compliance, which is intimated as burden for the society. However, a broader view of regulation that included non-legal forms of norm-making, along with the idea that private sovereignty over such norm-making matters to regulatory outcomes. This broader view of regulation is nicely captured in the definition of regulation as ‘influencing the flow of events’ (Parker and Braithwaite, 2003).

2.2 Regulation and natural resources management

The development of international and national environmental regulations arose against a backdrop of states exercising its sovereignty over natural resources within their jurisdictions (Gess, 1964). It was only natural, and also this early environmental protection of the 1970s relied on the national or at the international level, groups of states, acting primarily through treaty based intergovernmental organizations (Abbott and Snidal, 2009). A bundle of issues specific international rules (for example, climate change and trade in endangered species) was developed and overseen by international organizations such as the United Nations Environment Program (Kelemen and Vogel, 2010). Under this approach, Governments believed that they understood environmental problems clearly, that they could be defined in advance and managed through mandatory rules and regulations which has flown to a minor level such as mining and logging (Burca et al., 2013).

When we turn our eye to an application of such regulation; consider the sand mining. Governments all over the world have regulations to ban or to restrict mining sand in specific areas to limit the environmental impacts. Mining operations, not only in middle income countries such as Sri Lanka or India but also in high-income countries such as Canada, Australia, Finland, Sweden, or even Russia require obtaining environmental permits to carry out mining activities (Söderholm et al., 2015). As the reduction of in-stream mining for example can be achieved by state regulation, in-stream mineral mining is strongly regulated in countries such as Portugal, Italy, and New Zealand and is prohibited in countries such as France, the Netherlands England, Germany, and Switzerland (Kondolf, 1997). The exploitation of beach sand deposits is another issue that is solved by imposing strict rules and

regulations. Studies asserts that: “the natural sources of beach sand are decreasing, and the natural causes of sand removal are increasing” (Pilkey, 2000). Nevertheless, countries such as Malaysia, Indonesia, and Vietnam try to limit beach sand exploitation by restricting or banning the export of sand to Singapore, and Grenada limited beach sand exploitation to a small number of beaches (Beiser, 2017). To solve environmental problems related to sand exploitation, it is necessary to establish a complex regulatory system that comprises: environmental regulation, sand exploitation regulation, and land use planning regulation (Rodriguez, 2017).

Studying the impact of sand mining in the Limpopo Province in South Africa, Dacosta and Mathada (2019) emphasise the need of policy guidance and bylaws to protect and conserve the river and river valleys from destruction by sand mining. They are concerned that the legislation and regulatory setting for sand mining is vague and passive, and it makes enforcement difficult and complicated. They concern about the lack of clear and precise guidelines for dealing with sand mining operations coupled with inability of the regulatory authorities and other stakeholders that would be inevitable of uncontrolled sand mining and concomitant environmental degradation. Expected implementation of the regulation limits the negative externalities of sand mining, according to them. They also suggest, even if there are no specific guidelines on sand mining operations currently imposed in countrywide, it is suggested that local municipalities come up with bylaws to help preserve the ecology of areas, and stress the concerned regulatory authorities for more serious consideration of the potential long-term consequences of widespread sand mining (Dacosta and Mathada, 2019).

Moreover, studies reveal that the particular geographic areas have had stringent regulations seem reported less illegal mining activities in comparison to areas where less regulated. Koehnken et al. (2020) show that river systems that have received the most research focus, say the rivers in temperate climates in North America and Europe, typically have strict regulations and are not the areas where media articles describe extensive legal and illegal mining with few controls, areas which include China, India, South-east Asia, Indonesia, Malaysia, and Bangladesh. Going a step further, they further suggest rivers in the emerging economies of Asia and Africa urgently require research to quantify the rapidly accelerating pressures and their impacts associated with urbanisation, hydropower, and other activities, so that science-based regulations can be formulated. Koehnken et al. (2020) further recommend that it must analyse the potential effectiveness of regulations to improve management of sand mining in these contexts in order to achieve a balance between economic, social, and environmental outcome, in concerned geographic areas.

Discussing the ecological-economic implications of deregulation of trade as promoted by the General Agreement on Tariffs and Trade (GATT), Daly and Goodland (1994) argue that many environmental problems cannot be resolved equitably, efficiently, or sustainably by unregulated markets. They also stress that there is no alternative to public intervention in certain situations. The main purpose of Daly and Goodland (1994) work is to pay attention to the environmental risks of deregulating the trade. They outline fifteen (15) overlapping problems with deregulation or “free” trade. This includes both environmental and socio-economic factors such as standards of living and equity. Finally, the authors advocate a position balanced between two extremes: regulated and deregulated “balanced trade”. This implies that prudent environmental accounting and regulation are urgently needed.

Quoting the UNECE Environmental Performance Review (EPR) it is highlighted the adequacy of the legal and regulatory basis for mining. On many occasions, EPR recommendations address matters such as the adequacy of the legal and regulatory basis for the sustainable management of mineral resources (e.g., mineral exploration, exploitation, processing, mine closure, post-closure, maintenance and mineral waste recycling and recovery, the introduction of new technology to improve environmental performance, the mapping of mineral industry hot spots and the drawing up of a program to manage them, the introduction of good environmental management in the mining industry including

through education and training establishments, better monitoring, the creation of a national geological survey and the development of environmental assessment and auditing in the mining sector (OECD, 2018).

However, Gavriletea (2017) contend that, theoretically, illegal mining can be reduced by governments by setting regulation and penalties by increasing patrols in areas favorable for exploration, and by monitoring areas using performant systems. However, in practice, it is difficult to accomplish these because, usually, illegal operations take place in low-income or emerging countries where governments do not have necessary resources such as financial, human, etc. or persistent of corruption is high (Gavriletea, 2017). There are countries that registered a success in their battle with illegal groups but the efforts need to continue: India has reduced its illegal sand exploitation from about 70% to about 30%. It can find solutions for problems related to sand exploitation by regulation but every solution require time and financial, human efforts and demand doesn't take account of any of this.

2.3 Deregulation and natural resources management

Term deregulation has increasingly been referring nowadays among policy makers as a remedy to the concerns of regulations affecting to the market efficiency, in the primary sector economy – including environment sector. Central to deregulation is the ambition of greater primary sector boom with ease of doing business looking for an improved market efficiency. After the 2008 economic crash, many governments selectively removed environmental regulations to boost return on private investment and promote growth and employment, and downgraded protected area designations (Apostolopoulou and Adams, 2015). United States Presidential campaign in 2016; the Republican candidate identified environmental regulations related to mining as a major offender for unemployment. Later 2017, The President of United States signed an executive order revoking US international commitment made by the previous administrations to reduce carbon emissions, and to remove restrictions “stream protection rule” which restricted expansion of coal extraction (Bryenton, 2017). The President of Sri Lanka issued an extraordinary gazette notification to review the existing methodology of licenses issuing for mining purposes and to revisit the rules and regulations in force therein. The central argument for this notification is the difficulties faced in the procurement of earth resources for development priorities and to meet livelihood needs (Extraordinary Gazette, 2020).

In the face of an even greater global recession caused by the Covid 19 pandemic, governments are likely to take any steps necessary to maximise economic growth (Sandbrook et al., 2020). Currently, this could include bailing out polluting industries such as aviation, relaxing environmental standards, and opening up natural resources to exploitation—in effect spending down natural capital reserves. Under this corona pandemic, many governments tend to liberalise markets while deregulating environmental laws to the removal of obstacles (that they think) to economic growth. Sandbrook et al. (2020) reveal that the possible deregulated or liberalised sectors would be fossil fuels, aviation industry and mining & logging. They infer that this may increase funding available for conservation but likely to accelerate biodiversity loss, resource depletion, and increases in carbon emissions. Several countries such as India and Ecuador have already allowed new mining concessions in protected areas since the (Covid 19) crisis began. Brazil and the United States have also been reported on-going or planned disassemble of environmental regulations in high biodiversity spots (Sandbrook et al., 2020).

A piece of deregulation occurred in the forest administration, a different sector other than the mining, in Aemenia indicates a mix of positive and negative impacts of deregulation. Deregulation of the forest sector in Armenia, was influenced by the World Bank by introducing new planning instruments with the formal aim to strengthen the ecological goals in the natural resources management (Burns et al., 2016). By employing a discourse of illegal logging and by framing local actors as the main drivers of deforestation, it has been considerably deregulated the Armenian forest sector. This in turn promoted privatisation of the forest land as well as a reform of the state forest administration. These deregulations formally claimed to enhance the common goods (e.g. through strengthening

ecological goals in natural resources management), but informally, the interventions strongly incentivised the extraction of natural resources. These reforms, however, largely benefited to provide for transnational private companies, while at the same time restricting the access of poor local users to natural resources. By establishing market models and private ownership, the deregulation policy created illegal occupation of small local actors and favoring private sector investment in Armenia (Burns et al., 2016).

In study of smelting and refining industry in Indonesia, ease of deregulation of tax structure is seen as important to the growth of the industry (Shofiana and Aisyah, 2020). The obstacles in the processing and refining of mining materials such as anode sludge which contributes to more taxes, in Indonesia required support from various sectors. Hence, Shofiana and Aisyah (2020) conducted an analyse to check the impact of the elimination of value added tax on mining of anode sludge using research method namely the statutory and the conceptual approach. The results showed that in eliminating the value added tax, the government could use the regular-end function. Nevertheless, the elimination of value added tax provides facilities for the development of the smelter industry on the basis that the tax collection requirements must not interfere with the country's economic development. Thus, it is concluded that the elimination of value added tax related to mining goods promotes the development of the industry (Shofiana and Aisyah, 2020).

2.4 Regulation and market efficiency

The economists believe that regulations distort the market efficiency which determines the welfare gain of the society. Welfare gain is an essential part of the economic growth, and economic prosperity. The concept of market efficiency was first developed by Fama (1970), who defined an efficient market as one in which prices fully reflected all available information. In Fama's words: "The primary role of the market is the allocation of the ownership of the economy's capital stock. In general terms, the ideal is a market in which prices provide accurate signals for resource allocation: that is, a market in which firms can make production and investment decisions, and investors can choose among the securities that represent ownership of the firms' activities under the assumption that prices at any time 'fully reflect' all the available information. A market in which prices always 'fully reflect' available information is efficient."

In such an efficient market mechanism, prices would adjust rapidly and accurately to the arrival of new information, as past information is expired to predict future prices. In a regulated market environment (laws and delegated legislation), public intervention in for of regulation becomes a serious constraint and distort that market efficiency as the rule-bound procedures and the rigidity in the structure do not allow the individual and firms the flexibility to respond promptly to dynamic market conditions. And resulting to hide the proper price reflection of supply side and demand side, this (regulation) stifles competition and distorts the market efficiency and, ultimately the economic growth.

2.5 Deregulation and market efficiency

Deregulations, in particular those that liberalise entry, are very likely to spur investment; tight regulation of product markets restricts investment (Alesina et al., 2003). Tight regulation of the product markets has had a large negative effect on investment. The data for sectors that have experienced significant changes in the regulatory environment suggest that deregulation leads to greater market efficiency in the long-run. While a reduction in public regulation can be seen as a reduction in the shadow cost entry. These results are robust to several sensitivity checks and extensions. Interestingly, the marginal effect of deregulation depends on how deep the change is: more decisive regulatory reforms have a greater marginal impact (Alesina et al., 2003).

Moreover, deregulation improves economic welfare, and the improvement builds over time (Crandall 2016). Since the 1970s, deregulation has succeeded in increasing overall economic welfare and sharply reducing prices. The 25-year deregulation movement that began in the 1970s had a remarkable impact on the United States and many other countries. In the United States, the entire

national transportation sector was substantially deregulated; the energy, financial, and video distribution sectors were heavily deregulated and even telecommunications witnessed considerable deregulation and regulatory reform. About two-thirds of the communications sector (including long distance services, broadband services, telephone terminal equipment, and cable television) has been deregulated, while local telephone service and broadcasting are still regulated. Overall, the amount of regulation has fallen by roughly 74% (Crandall, 2016).

After the first oil shock of 1973, the developed economies experienced a dramatic decline in their economic growth (Nordhaus, Houthakker, and Sachs, 1980; Sachs, 1982) and labour productivity growth (Baily, Gordon, & Solow, 1981). Since mid-1970s, the productivity decline triggered a wide range of policy responses, including economic deregulation. Deregulation initiated in the US (Winston, 1998; Morgan, 2004), soon followed by the UK and other developed economies in the early 1980s (Pera, 1988; Healey, 1990; Matthews, Minford, Nickell, and Helpman, 1987) and were imitated by the new democracies and many developing countries in the 1990s with an extensive set of labour, capital, and product-market reforms. The process continued throughout the early years of the 21st century (Wölfl, Wanner, Kozluk, and Nicoletti, 2009) until the recent (2008) global economic and financial crisis.

The deregulation softens trade and capital borders, and introduces more complexity to the processes of global economic growth (and recession). With the global movements of information and resources while possessing the connectivity with each other, the point shock of the system cannot be concealed within the particular affected system. This is the nature of systemic risk. The impact of these systemic booms and busts is not borne equally by all; marginalised communities bear the burden of these globalised, deregulated systems more. For instance, case studies of the impacts of financial deregulation, environmental deregulation, and labour safety enforcement outsourcing bear the witnesses for this disappointing truth. The movement towards over deregulated economic system has experienced the consequence of exploitation.

2.6 Effects of regulation and deregulation on natural resource management for market efficiency

Initially, governments and their agents managed environmental problems through enforcement of strict rules and standards set out in legislation and treaties (Gunningham, 2009). However, with the rise of neoliberal ideals in the 1980s, governments began to shift their attention away from this Westphalian sovereignty of state power. Instead, environmental degradation was, in many cases, to be curbed via market-based approaches, voluntarism and other ‘light-handed’ policy initiatives such as partnerships and cooperation yet, by the end of the 1990s, continuing ecological degradation and the increasing complexity of social and environmental problems saw a new shift towards environmental governance (Driessen et al., 2012) or what is increasingly being called ‘new environmental governance’ (Holley et al., 2012).

The new environmental governance (NEG) emphasised collaboration, integration, participation, deliberative styles of decision-making, adaptation and learning. NEG may equally be described as polycentric governance, where governments, non-governmental organizations, the private sector and civil society form many centers of decision-making and action that are formally independent of each other, but that can either function independently or constitute an interdependent system of relations (Ostrom, 2010). Although NEG is still an evolving concept, a growing number of scholars and policymakers believe it can substantially improve the effectiveness, efficiency and legitimacy of responses to environmental problems.

The environmental governance landscape has changed significantly over the last 40 years, but it remains multifaceted as it is covered by new and old policy approaches (Dryson et al., 2012). A good example for this change is the present-day response to climate change, which involves not only market-based instruments, but also hierarchy, as well as NEG approaches (Dryzek et al., 2011). In the Anthropocene, the trajectory of governing environmental problems is far from complete, as,

environmental governance remains something of an ongoing experiment, suggesting there is all the more reason to learn now from both successes and failures so we can build a more effective and democratic approach for environmental governance in the future.

3. Conclusion

Regulation or deregulation can only be discussed in a particular doctrine which are identical to each other, and if perform in different platforms results wouldn't be same. Regulation in natural resources management compromises the resources availability (minimise the depletion) and the sustainability of the environment, but distort the growth of the industry-market efficiency. Deregulation in natural resources management improve the market efficiency and also the ease of doing business in primary sector including mining, but affect the nature.

References

- Abbott, K. and Snidal, D., 2009. 'Strengthening international regulation through transmittal new governance: Overcoming the orchestration deficit. *Journal of Vanderbilt Law*, 42:501-78.
- Abbott, K.W. and Snidal, D., 2008. *The governance triangle: Regulatory standards institutions and the shadow of the state*. The Politics of Global Regulation: Princeton University Press.
- Alesina, A., Ardagna, S., Nicoletti, G. and Schiantarelli, F., 2005. Regulation and investment. *Journal of the European Economic Association*, 3:791-825.
- Andbrook, C.S., Omez, E.G., Baggethun and William, A. A., 2020. Biodiversity conservation in a post-COVID-19 economy. In: *Fauna and Flora International*. s.l.: Cambridge University Press, pp. 2-8.
- Apostolopoulou, E. and Adams, W.M., 2015. Neoliberal capitalism and conservation in the post-crisis era: The dialectics of "green" and "un-green" grabbing in Greece and the UK. *Antipode*, 47:15-35.
- Beiser, V., 2017. Sand mining: The global environmental crisis you've probably never heard of. *The Guardian*. <https://www.theguardian.com/cities/2017/feb/27/sand-mining-globalenvironmental-crisis-never-heard>. Accessed 26 April 2020.
- Braithwaite, J., 2000. *Global business regulation*. Cambridge: Cambridge University Press.
- Braithwaite, J., Elgar, E. and Cheltenham, 2008. *Regulatory Capitalism: How it works, ideas for making it work better*. s.l.:s.n.
- Bryenton, R.G., 2017. The impact of environmental regulations on the West Virginia coal economy: assessing the "coal means jobs" mantra and the prospect of deregulation. s.l.: Senior Capstone Projects. 633.
- Burns, S.L., Krott, M., Sayadyan, H. and Giessen, L., 2017. The World Bank improving environmental and natural resource policies: Power, deregulation, and privatization in (post-Soviet) Armenia. *World Development*, 92:215-224.
- Crandall, R.W., 2016. *Extending deregulation make the U.S. economy more efficient*. Washington DC: The Brookings Institution.
- Daly, H. and Goodland, R., 1994. An ecological-economic assessment of deregulation of international commerce under GATT Part I. *Population and Environment*, 15:395-427.
- De Búrca, G., Keohane, R.O. and Sabel, C., 2014. Global experimentalist governance. *British Journal of Political Science*, 477-486.
- Democratic Socialist Republic of Sri Lanka, 2020. Extraordinary of the Gazette of the, No. 2196/28.
- Drahos, P., 2017. *Regulatory theory foundations and applications*. s.l.:ANU Press The Australian National University, pp. 1-8, 741.
- Eggert, R.G., 1994. *Mining and the Environment: International Perspectives on Public Policy, Resources for the Future*. Washington DC: s.n.
- Francis, F.A. and Mathada, H., 2017. Study of sand mining and related environmental problems along the Nzhelele river in limpopo province of South Africa". *Mine Water and Circular Economy*, Lappeenranta, Finland.

- Gavriletea, D.M., 2017. Environmental impacts of sand exploitation. Analysis of Sand Market”, Sustainability (ISSN 2071-1050; CODEN: SUSTDE, MDPI (Basel, Switzerland).
- Gess, K., 1964. ‘Permanent sovereignty over natural resources’, International and Comparative Law Quarterly 13:398-449.
- Gunningham, N. and Holley, C., 2016. Next Generation Environmental Regulation: Law, Regulation, and Governance. Annual Review of Law and Social Science, 12.
- Gunningham, N. and Sinclair, D., 2002. Leaders and Laggards: next generation environmental regulation. Sheffield: Greenleaf Publications.
- Gunningham, N., 2009. Environment law, regulation and governance: Shifting architectures. Journal of Environmental Law, 21:179-212.
- Hawkins, K., 1984. Environment and Enforcement: regulation and the social definition of pollution. Oxford: Clarendon Press.
- Hawkins, K., 2002. Law as last resort: prosecution decision-making in a regulatory agency. New York: Oxford University Press.
- Hodzic, S. and Celebi, H., 2017. ‘Value-Added Tax and Its Efficiency: EU-28 and Turkey. UTMS Journal of Economics, 8:79-90.
- Holley, C., Gunningham, N. and Shearing, C., 2012. The New Environmental Governance. New York: earthscan.
- Kelemen, R.D. and Vogel, D., 2010. Trading places: The role of the United States and the European Union in international environmental politics. Comparative Political Studies, 43:427-456.
- Koehnken, L., Rintoul, M.S., Goichot, M., Tickner, D., Loftus, A.C. and Acreman, M.C., 2020. Impacts of riverine sand mining on freshwater ecosystems: A review of the scientific evidence and guidance for future research. River Research and Applications, 36:362-370.
- Kondolf, G., 1997. Hungry water: Effects of dams and gravel mining on river channels. Environmental Management, 21:533-551.
- Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K.H., Haberl, H. and Fischer-Kowalski, M., 2009. Growth in global materials use, GDP and population during the 20th century. Ecological Economics, 68:2696-2705.
- Ma, D., Fei, R. and Yu, Y., 2019. ‘How government regulation impacts on energy and CO2 emissions performance in China's mining industry, Resources Policy, 62:651-663.
- Malkiel, B.G. and Fama, E.F., 1970. Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25:383-417.
- Morgan, I., 2004. Jimmy Carter, Bill Clinton, and the new democratic economics. Historical Journal, pp. 1015-1039.
- Organisation for Economic Co-operation and Development, 2018. UNECE and responsible mining. André Pascal 75016 Paris: OECD Environment.
- Parker, C. and Braithwaite, J., 2003. ‘Regulation’, In: P Cane and M Tushnet, The Oxford Handbook of Legal Studies. s.l.:Oxford University Press, pp. 119-145.
- Pilkey, O., 2000. What you know can hurt you: Predicting the behaviour of nourished beaches. In: Science and Policy. In: D. P. R. J. B. R. J. Sarewitz, ed. Prediction: Science, Decision Making, and the Future of Nature. Washington, DC, USA: Island Press, p. 159-184
- Rodriguez, R., 2017. Sand and gravel resources of Puerto Rico. <https://pubs.usgs.gov/fs/sandgravel>. Accessed 26 April 2017.
- Sachs, J., 1982. Stabilization policies in the world economy: Scope and skepticism (No. w0862). National Bureau of Economic Research.
- Sandbrook, C., 2020. Covid and conservation on the ground. Thinking Like a Human Blog, 2020 05. [thinkinglikeahuman](http://thinkinglikeahuman.com).
- Shofiana, R. and Aisyah, S.H., 2020. Elimination of value added tax on mining (Anoda Sludge) in Indonesia. Palarch's Journal of Archaeology of Egypt/Egyptology 17:1902-1908.
- Söderholm, K., Söderholm, P., Helenius, H., Pettersson, M., Viklund, R., Masloboev, V., Mingaleva, T. and Petrov, V., 2015. Environmental regulation and competitiveness in the mining industry:

Permitting processes with special focus on Finland, Sweden and Russia. *Resources Policy*, 43:130-142.

UNDP and UN Environment, 2018. *Managing Mining for Sustainable Development: A sourcebook*. Bangkok: United Nations Development Programme.

UNEP, 2014. "Sand, rarer than one thinks". Thematic focus: Ecosystem management, Environmental governance, Resource efficiency, Sioux Falls.

Wölfl, A., Wanner, I., Kozluk, T.J. and Nicoletti, G., 2009. Ten years of product market reform in OECD countries-insights from a revised PMR indicator.

Wolkersdorfer C, C., Sartz, L., Sillanpää, M. and Häkkinen, A., 2017. Finland mine water and circular economy. Lappeenranta: IMWA.