

Executive Summary

Natural Resource Management in Israel

Phosphorous Industry Case Study

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Natural resources are defined as the elements that people extract from nature for their needs rather than producing them (Ministry of Environmental Protection, 2010). This definition includes metals (such as aluminum, copper, and gold), nonmetals (such as sodium, calcium, and phosphorus), and minerals (such as gypsum, calcite, and quartz), as well as oil, natural gas, and water. Since ancient times, human beings have taken advantage of these resources (OECD, 2011b).

Today, natural resources are key to economic activity and human welfare. Evidence can be found in the unprecedented consumption of natural resources in the 20th century, along with the increase in world population (United Nations, 2011). In the past 30 years alone, there has been a rise of 80% in natural resources mining. And by 2050, it is predicted that, in a business-as-usual scenario, there will be a 300% rise in resources consumption worldwide. Such an acceleration, in turn, would increase dramatically the competition for resource extraction (Dittrich et al., 2012). In addition to this compelling forecast, a number of current global trends demand attention:

- 1) Depletion of certain resources, leading to greater environmental damage when resource extraction requires more effort. This phenomenon creates a cycle of increased depletion and environmental damage.
- 2) Rise in world prices affected directly by the depletion of resources. Since 2000, there has been an increase of more than 300% (in terms of real index) in the prices of global resources, and this appears to be part of a continuing trend (World Bank, 2011).
- 3) Increased control over the supply of so-called critical minerals, which are rare and considered vital to various industries. For example, China produces 97% of these resources, and places restrictions on their export to ensure future local supply (Humphries, 2012). Another example is the competition among countries over the control of natural

resource reservoirs (such as oil and natural gas), which promise great economic potential.

These trends can be seen in Israel, from the rise in energy and water prices to the growing demand for minerals for the construction market (Ministry of Interior, 2010), as well as the issue of exporting natural gas while ensuring sufficient supply to the Israeli economy for the foreseeable future. Another interesting trend, global as well as local, is the social and informational revolution related to natural resources. Examples in Israel are the outbreak of social protests in the summer of 2011, and more recently the fierce public opposition to exporting natural gas and the Tzemach Committee recommendations, which were altered due to public pressure.

These trends raise important strategic and diplomatic questions regarding the management of natural resources in Israel. Among them:

- What will the future prices of natural resources be?
- How can the supply of natural resources and raw materials be ensured in order to secure the survival of different industries?
- What annual mining volumes and export volumes should be set, so as to leave enough resources for future generations?
- Should strategic reserves be preserved?
- What is the added value of using these resources?

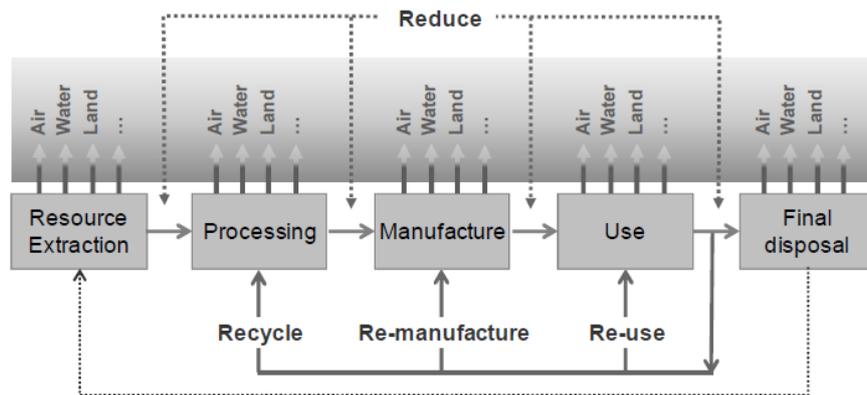
In response to these trends and questions, a new integrative approach to management has emerged in the recent decades. It focuses on the efficient use of natural resources and other materials for economic activity, while separating (or decoupling) natural-resource use and environmental impacts from economic growth.

Natural Resource Management

Many countries have already started to implement operational plans for managing and effectively using natural resources in their territory. Most of these programs grew out of waste-management policies and expanded to address the primary processes of mining and production, and even

consumption and use management. These plans were given different names such as sustainable development strategy; sustainable consumption and production; green growth; sustainable materials management; or securing the supply of raw materials. Despite the differences between these terms, it seems that all are based on the same basic principles. The first principle is the "3Rs"—Reduce, Reuse, and Recycle at every stage of the product's life. The second principle is to reduce pollutant emissions into the environment. The third principle relates to securing the supply of certain resources, giving rise to diplomatic strategies to strengthen trade relations and restrict resource exportation, among others.

3Rs - Reduce, Reuse, and Recycle at every stage of a product's life



Source: OECD, 2011b.

In Europe, the last few decades (and especially the most recent decade) have seen dozens of new programs and initiatives related to natural resource management and efficient use of resources. Recently, in 2010, the EU launched the Europe 2020 program under the title "Smart, Sustainable and Inclusive Growth." One of the seven flagship initiatives of the program is "Resource Efficient Europe." The program sets goals and objectives for an economy that uses resources efficiently, and includes attributes of previous works mentioned above (European Commission, 2010a).

In China, rapid economic growth in recent decades, along with inefficient use of resources and low investment in waste treatment and recycling, led to a

significant depletion of natural resources. Environmental pollution, coupled with an increase in morbidity of the population (World Bank, 2009a), also occurred in this period. As a result, the Chinese Congress approved in 2008 a law promoting a circular economy (China, 2008), following years of research on how to support such an economy. The research included experiments to improve the environmental performance of over 1,325 different industrial companies, and 256 eco-industrial parks were built. At the same time, strategies were developed for the creation of "green" industries, technological conversions were carried out for inefficient polluting industries, and a network of various government agencies was established to collaborate on the issue (Dajian, 2008; OECD, 2012). By 2010, results of the initiative were evident, and the contribution to the Chinese economy yielded over 1 trillion yuan (approximately U.S.\$150 billion). More than 20 million workers were employed and 20% to 30% of raw materials required for the steel, paper and cement industries came from recycled waste (OECD, 2012). In addition, China has promoted another strategy in natural resource management: since the country is responsible for the production of critical minerals, it was decided to impose restrictions on the export of these materials for the benefit of the local industry. Limitations include restrictive limits on export volumes, an export tax, and other measures (European Commission, 2011a; WTO, 2013).

The Status in Israel

In recent years, natural resource management has been of great interest, both among decision-makers and among the general public in Israel. This interest grew when natural gas resources were discovered off the coast of Israel, and with the establishment of the Sheshinski Committee in 2010, designated to examine Israel's fiscal policy regarding oil and natural gas resources in its territory. Public interest grew even stronger with the publication of the Tzemach Committee's conclusions, supporting the export of natural gas (June 2013). The height of the debate came with the establishment of the second Sheshinski Committee, which was mandated "to examine the State's policy allowing private entities to extract national natural resources." To date Israel has no national plan, national strategy, or a written

comprehensive policy on the management of natural resources or efficient use of resources. Different ad-hoc committees (for example, the Tzemach Committee, the Phosphate Market Committee, and the Sheshinski Committees) are routinely established to address complex questions such as the extent of mining of natural resources. Over the years, various attempts have been made to treat specific issues, such as resource extraction from the Dead Sea. A breakthrough occurred in 2011, with the approval of a national strategy for green growth from 2012 to 2020 by the government (Ministry of Environmental Protection, 2011). Nevertheless, it seems that the main focus of the strategy is consumption and waste, and less so issues of mining resources, streamlining their use, and developing a natural resource management plan. Even so, this should be considered a breakthrough and the first milestone on the way of intelligent management of natural resources in the country.

Purpose of the Study

This study was done as part of a work plan on natural resource management in Israel. The study was designed to examine how natural resource management is done worldwide and in Israel, and to illustrate how to examine the economic-environmental efficiency of the industry, as a necessary stage before making decisions regarding the management of natural resources in the country. To examine these issues, the phosphate mining industry in Israel was selected to serve as an example. This industry in Israel has a single player, Rotem Ampert Negev Ltd. The company was used in a case study analysis to examine economic-environmental efficiency. The research question asked: What is the economic-environmental efficiency of value chains based on natural resources in Israel?

Research Methodology

The research methodology is divided into two distinct main parts. The first part reviews the tools for proper management of natural resources, including a literature review of global trends and trade aspects related to the use of

natural resources; review of policies in the world and in Israel; analysis of governance issues and aspects of public policy. The second part is an economic-environmental analysis addressing the research question, and includes a review of the extraction process of phosphate using a value chain analysis tool, in its extended form. This perspective is essential for understanding the different production processes and the possibilities that exist for managing the resource and using it more efficiently. Moreover, when examining the manufacturing processes of the industry, it is incorrect to separate the environmental effects and the flow of materials, and the economic value added to the industry. This is true even more in an industry based on the use of virgin natural resources, which are highly valued, such as the phosphate industry. Often, direct contribution to the economy, in terms of GDP and employment, reflects the importance of the resource for the individual, the industry and society at whole, and balances the equation against the environmental damage caused by the exploitation of the resource. Additionally, an examination of the value added generated from the use of natural resources is intended to serve both the public sector (in determining the right regulatory and financial tools to implement) and the private sector (in streamlining and improving aspects of competitiveness).

Major Policy Gaps in Israel

In the first phase of the study, three major types of gaps in natural resource management policy in Israel, were mapped. These gaps have been discussed over the years in State Comptroller reports, government committees, and policy documents of government agencies and in press reports. The gaps are presented in the following diagram grouped under the three types:

- A. Regulatory gaps, which include legislative affairs and division of authority.
- B. Information gaps, which include collecting information about natural resources and their flow in the market.
- C. Institutional gaps, which include aspects of planning and rehabilitation.

Gaps in Natural Resource Management Policy in Israel

Regulatory Gaps

Legislative arrangements and out-of-date proceeds mechanisms. The legislation that regulates mining in Israel is based on a mandatory order from 1925. This legislation is not up-to-date, despite having been amended several times over the years; it appears to be insufficient for current and future needs in Israel. For example, the level of proceeds in the order is low; it is the same for all resources; and lacks appropriate mechanisms, such as advanced proceeds mechanisms, which support efficient use of resources, a fund to rehabilitate the mines, and internalizing external costs.

Many stakeholders and no comprehensive view. The responsibility for natural resource management is divided among different government agencies. For example, the Ministry of Energy and Water is responsible for regulating oil and natural gas, and issuing licenses to the various mining industries; the Israel Land Authority is responsible for issuing permits for designated mining lands; the Water Authority is responsible for the water market; the planning institute in the Ministry for Internal Affairs is responsible for the planning and regulation of the mining areas; and the Ministry of Economy is responsible for the Dead Sea area. The existence of multiple players is not necessarily problematic, but when there is no coordinating office to provide a comprehensive viewpoint and guiding hand to produce a coherent and uniformed policy, the situation is one of uncertainty, where responsibility is passed from one office to another, and there is no public transparency or consistency in dealing with industry.

Centralization. In Israel, most of the profits from mining natural resources are in the hands of a small group of private companies that often enjoy the benefits of the whole supply chain. For example, in the construction market there are about 19 gravel quarries, and three companies have holdings on 64% of the production and 40% of the reserves. These companies are part of the five main companies that control the cement market, with 75% share of the market (Pundak, 2013). Recently, the regulator has begun to address this issue. The inter-ministerial committee responsible for increasing competition in the cement industry has found that "the existence of a monopoly in the transportation of cement in bulk is creating a barrier in two fields (transportation and marketing) and it is proposed to impose reporting requirements on the transportation monopoly." The Committee also found that the cement market should be opened to other players (The inter-ministerial committee responsible for increasing competition in the cement industry, 2013). As the Committee found, in this form of centralization there are information gaps.

Informational Gaps

No updated database. Today, for most of the natural resources, there is no unified, organized, and updated database regarding the quantities and quality of existing natural resources in Israel. There is no information about the mining volumes, decrease in open spaces, level of export, production costs, and more. Often, the country receives information regarding the scope of resources, quality of resources, annual production amounts, and economic exploitation data from the mining companies. Some of the information is dispersed among different government agencies and different mining companies, but there is no unified reporting mechanisms. In addition, many times there is a problem of information transparency.

Institutional Gaps

Difficulty in getting programs approved and incomplete future planning. Given the current extraction rate, many natural resources will be depleted within the next 20 to 40 years. If national master plans are based on the current rates, it is unclear what resources will be left for future generations. What is the vision beyond 2045? What are the expected market outcomes due to job loss? In parallel, the national planning committees are facing many challenges and fierce public opposition to mining and quarrying plans, many times due to the "Not in My Back Yard" (NIMBY) effect.

Rehabilitation of past, present and future hazards. The mining and quarrying industries have significant effects on the unique landscapes of the country. Many times mining means a detrimental damage to an open space, to the country's landscape, to heritage, to nature, and to the ecological systems that define these spaces (Lautman, Laster & Karni, 2013). The expected demand in 2045 will require hundreds of thousands of acres of land for mining and quarrying. How will the country look after this massive mining and what will be left of the open spaces? For example, in the Negev desert alone there are more than 30,000 acres of mines that have not been rehabilitated (Amir et al, 2011). There is a fund to rehabilitate quarries (in the construction industry), but the State Comptroller has warned in the past (State Comptroller, 2000), that it is not being used, and today there are hundreds of deserted quarries (Moriya & Skaly, 2009). The money from the fund continues to accumulate to hundreds of millions of Israeli shekels, yet different obstacles prevent it from operating efficiently (Lautman, Laster & Karni, 2013). For mines, there is no such fund. The State Comptroller has summarized well the government's incompetence in rehabilitating the Dead Sea and addressing this challenge over years: "Throughout the years, there was no one organization that managed the issue of the Dead Sea. The issue was dispersed among different offices and different levels of management—statewide, provincial, and local. There was no coordination, and there was no common database for all bodies dealing with the Dead Sea, which made it very difficult to manage the Dead Sea as a natural resource, to preserve its level, and to address the problems that rise from its decreasing levels... The government offices have been slow to act, and have not yet prepared the infrastructure that will allow the government to decide on a sustainable policy to continue the development of the area." (State Comptroller 2009)

Main Findings and Recommendations

The economic-environmental analysis of the phosphate mining industry suggests that there are a number of trends in the manufacturing supply chain, and points to potential conflicts between private companies and the market. On the other hand, there are reservations regarding the assumptions and assessments done for research purposes, mainly regarding the quantification of external prices of different pollutants. From the analysis, it cannot be clearly determined in what phase the economic-environmental efficiency is the highest, nor that the sub-phase of phosphate mining is best for the market, and therefore phosphate should be mined as much as possible. It seems that the biggest gap to make such determinations is the complete quantification of external costs. The conclusions and recommendations from the case study are exemplified in an individual case, and then presumed for the whole market, reflected back to the first part of the study and the research question of natural resource management. Some of the main conclusions are:

- There is great potential in reducing external costs through energy efficiency and reduction measures of the Israel Electric Corporation (IEC). It is important to note that Rotem Ampert Negev Ltd. is not responsible for the emissions from national electricity production, but only for the emissions from its own production, and therefore the company is limited in its ability to become more efficient, without a change in the electricity energy mix in Israel.
- Emissions of carbon dioxide (CO₂) constitute more than 95% of gaseous emissions (in terms of weight) and approximately 80% of external costs that can be financially quantified in accordance with the Ministry of Environmental Protection. Therefore, there is great potential to reduce external costs by reducing pollutant emissions. Additionally, for phosphogypsum (a byproduct of the production process, containing gypsum, phosphorus and various pollutants), which is not discussed in detail in this study but is the “largest” pollutant emitted (in terms of weight) in the value chain (and accumulated considerably over the years), there is still no external cost pricing. If external costs for this pollutant will be implemented in the future, however minor, they will still

constitute a significant share due to the large quantities of the pollutant. This should be taken into account by private companies and they should prepare accordingly (similar to the case of salt harvesting by Dead Sea Works LTD.).

- In the sub-phase of processing, where both the company's gains and the value added to the economy are at their highest, the economic-environmental efficiency is at its lowest. This is due to the high inputs (water, electricity, etc.) that go into the processes and the pollutants emitted. Since this sub-step is critical to the company, appropriate tools and incentives (technological, regulatory, financial, etc.) must be established to maximize efficiency by reducing inputs needed and environmental externalities. This is why the value chain analysis is so important. Such data, along with recommendations on limiting the amount of enriched resources exported from Israel (Recommendations of the Inter-Ministerial Committee to Examine the Phosphate Market, 2013), shed light on the importance to supply appropriate tools and incentives to increase efficiency in this sub-stage, alongside this kind of recommendation. Such tools and incentives were not included in the recommendations of the committee.
- While working on this study, the researcher found that the information gap was evident; some data were provided by various ministries, most of the information was taken from many different reports, and often predictions were done because the information was not known or accessible. In order to implement this methodology on other value chains, based on natural resources in Israel, and in order to standardize the regulation (as discussed below), a national database needs to be established. Without a database that includes the movement of materials in the market and helps develop an understanding of manufacturing processes and the relationships between various industries, the flow of materials cannot be managed, clear objectives and policies regarding natural resource management cannot be set, and improving the use of resources cannot be achieved.

- This study is a first step in the analysis of economic-environmental efficiency of the value chains that are based on the natural resources in Israel. But, as indicated above, there are questions beyond this analysis. Therefore, in order to understand the interaction between industry, the economy, and the environment in the natural resource market in Israel, and in order to understand how to maximize the economic-environmental efficiency of these industries, further holistic studies are needed, of all markets, in cooperation with the academy and Israeli experts.
- An analysis of all value chains based on Israel's natural resources is required before a national policy can be formed regarding the management and efficient use of natural resources. This is clearly the case based on the policy issues and principles mentioned in the study. Only with a comprehensive analysis can the interactions between the different chains be understood, and a fuller picture about the costs and benefits to the economy be clarified. As indicated so far, such a policy should meet three main principles (Lester, 2013): 1) Development of a national database; 2) Determining the optimal utilization rate of natural resources; and 3) Development of a complementary set of tools to achieve maximum efficiency of natural resources use and reducing adverse environmental impacts.

In conclusion, for Israel, which has an important resource in phosphate, with its price gradually increasing, reserves running out, and source locations in problematic areas, efficiency objectives of resource usage are essential to secure the future of this industry and the conservation of this precious resource for future generations. Government policy and strategy for natural resource management and efficient use of resources is a global and national necessity, and it seems that the conditions for regulatory action are in place in Israel.

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