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Critical reflections on the Chemical Leasing concept

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ABSTRACT

Chemical Leasing has been developed as a collaborative business model to complement the two main approaches (policy initiatives and scientific/technological) used to foster green chemistry and sustainable chemistry. Chemical Leasing is based on using chemicals more efficiently, reducing waste, and closing the feedback loop more effectively. This is done by shifting the focus away from profit generation, through increased sales, towards a value-added approach by providing a service. Most of the available Chemical Leasing studies have been empirical and descriptive, and generally identify only short-term benefits from process change. This paper provides critical reflections on the Chemical Leasing model based on types of chemicals, green and sustainable chemistry, business models, collaboration, and the chemical leasing cases available. Chemical Leasing offers a more efficient business model alternative to traditional industry practice, bringing economic and environmental benefits to both suppliers and users; however, its use is restricted to some specific types of chemicals (such as solvents and catalysts). The paper proposes a clearer and more precise definition of chemical leasing and argues that chemical leasing needs to be part of a holistic approach, so that the economic, environmental, social, and time dimensions of sustainability are fully addressed.

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1. A brief overview of the chemical industry

> "to an amount not usually recognised, chemicals are part of our everyday life" (Perthen-Palmisano and Jakl, 2005, p. 49)

In 1998, the global chemical industry was worth around US$1.5 trillion in sales and employed around 10 million people globally (OECD, 2001). By 2010, the global chemical industry–excluding pharmaceuticals–had increased its worth in global chemical sales to US$3.2 trillion, with the top 100 companies generating an estimated $1.23 trillion of those sales (Hartnell, 2011). It is estimated that by 2015 the global chemical market will be worth US$4.16 trillion (Meyer, 2011). This has resulted in a complex network of chemical industries, which involves several stakeholders, and has been mainly based on the economic return of marketing and selling chemicals.

The chemical industry has been highly innovative. The centennial anniversary of the American Institute of Chemical Engineers lists 100 market innovations related to chemicals mainly by USA companies (CEP, 2008), and celebrated the innovation and importance that is representative of the profession.

Chemicals are used to make almost all man-made products, including many which can be used to protect crops and increase yield, prevent or cure disease, and provide many benefits to improve people's daily lives. According to Miller (2002), every year, 1000 new synthetic chemicals enter the market, adding to the approximately 75,000 chemicals already commercially available. The health and environmental risks from the use of chemicals have long been recognized, for example carcinogenic effects (see Hayes, 1998, Tomatis et al., 1978, and Tolbert et al., 1992) and negative impacts on agriculture and forestry (see the seminal work of Rachel Carson (1962)).

The OECD (2001) identified the main chemical types as basic (or commodity) chemicals, specialist chemicals that are derived from those basic chemicals, products derived from life sciences (including pharmaceuticals and pesticides), and consumer care products (including soaps and detergents). The general structure of the chemical industry, including the types of chemicals and consumers of those chemicals, is outlined in Fig. 1.

Another way of classifying chemicals is by their type, which includes: inorganic industrial, organic industrial, ceramic products,

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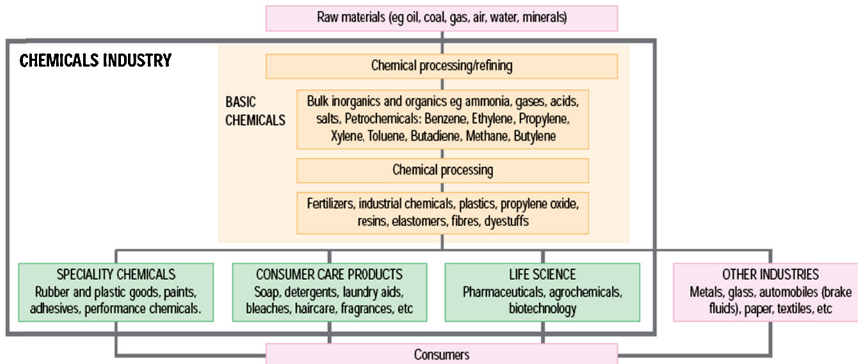

Fig. 1. General structure of the chemical industry.

petrochemicals, agrochemicals, polymers, elastomers, oleochemical, explosives, and fragrances and flavours. Chemicals can also be classified into: reactants (e.g. acids and bases) and non-reactants (e.g. solvents and catalysts).

This paper is aimed at providing clarity through critical reflections to some of the challenges to Chemical Leasing (ChL) raised by Plas (2008) and Lozano et al. (2013), as well as its potential limitations of the concept and its application. The remainder of the paper is structured in the following way: Section 2 offers an overview of green and sustainable chemistry; Section 3 provides an explanation of the ChL concept; Section 4 discusses business models for sustainability and how they relate to ChL; Section 5 presents the principle of collaboration and its importance to ChL; Section 6 provides a comparison of a traditional chemical selling model illustrative example against a ChL one; Section 7 discusses the ChL in order to help elucidate the concept, its challenges, and its limitations; and Section 8 concludes by providing a more robust and clearer definition of the ChL concept.

2. Green and sustainable chemistry

Green chemistry has developed as an alternative to reduce or eliminate the use, or generation, of feed-stocks, products, by-products, solvents, reagents, or other hazardous chemicals that are, or might be, dangerous to human health or the environment (Anastas and Breen, 1997). It is aimed at preventing waste before it is ever formed by considering the environmental impact, or potential impact, of a product or process (Anastas and Breen, 1997). Sustainable chemistry is a concept which links preventative protection of the environment and health with an innovative economic strategy which will result in more jobs, and which is of concern to stakeholders across the scientific community, the economy, public authorities, and also environmental and consumer organisations (German Federal Environment Agency, 2013).

Often, the terms green chemistry and sustainable chemistry are used interchangeably (Tundo et al., 2000). However, they are inherently different. Some authors have highlighted that green chemistry under-emphasises the social dimension of sustainability (e.g. Böschen et al., 2003; Lozano, 2012), and the time dimension (Lozano, 2012).

It should be noted that both green chemistry and sustainable chemistry are mainly directed at improving operations and production in a company and they need to be linked to the other elements of the company system (strategy and management, organisational systems, procurement and marketing, and assessment and communication) (see Lozano, 2012), as well as to the company's business models, strategies, and practice.

In the past decade, a number of international initiatives have been adopted to more safely manage chemicals and promote green and sustainable chemistry. Some of these include the UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)[1] adopted in 2006, the EU Regulation on Registration, Evaluation and Authorisation of Chemicals (European Commission–Environment, 2012), and other REACH-like regulations in China (see China Chemical Inspection and Regulation Service, 2011), together with actions in a number of countries to strengthen the regulation of chemicals (see Lozano et al., 2013). Additionally, a Strategic Approach for International Chemicals Management (SAICM) policy framework was adopted at the International Conference on Chemicals Management held in Dubai in 2006 (UNEP, 2006), where the concept of ChL(ChL) was discussed for the first time. Within this context and to assist businesses globally, UNIDO launched its Global Chemical Leasing Programme in 2005, with support from Austria and Germany (UNIDO, 2011).

3. The concept of Chemical Leasing

The United Nations Industrial Development Organization (UNIDO, 2011, p. 2) defined ChL as "a service-oriented business model that shifts the focus from increasing sales volume of chemicals, toward a value-added approach". The ChL concept is aimed at achieving this by including: more efficient use of, and reduced risk from, those chemicals; protection of human health; improved economic and environmental performance of participating companies; and enhanced access for those companies into new markets (UNIDO, 2011).

Under the value-added approach used in the ChL concept, rather than generating profit by high volume of sales to companies using its chemicals, the chemical producer/supplier, who remains the owner of the chemicals, is paid for the service provided by them (for example, instead of volume or weight of chemicals, they might use square meters of painted surface). Breaking the link between sales and profit can result in both increased efficiency in the application of chemicals within a specific production process and also lead to optimisation of that process as a way of reducing the volumes of chemicals needed to carry it out, minimizing any chemical waste or discharges generated by the process (see for example Geldermann et al., 2009; Gilbert and Downs, 2010; Ohl and Moser, 2007). Gilbert and Downs (2010) highlighted that a basic assumption with ChL is that the user pays for services rendered by the chemical rather than purchasing it.

Schwager and Moser (2005) postulated that different ChL approaches may be necessary depending on who owns the substance (chemical) to be used, who owns and operates the plant

[1] The third revised edition of the GHS (2009 version) is available online at: http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html.

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