

Sustainably Sourced Luxuries: a Road for the Mining and Metals Industry.

Differentiating Metal Commodities through Sustainability

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Abstract

Metals play a key role as a cornerstone of our modern society; they are part of the most basic elements of our daily life and have been part of our lifestyles for millennia. Current trends of metal production point out that developing countries in order to attain a developed-countries consumption level will require 3-9 times the present metal stock per capita, yet their mining practices are far from desirable (UNEP, 2010) This project is driven by necessity to address those environmental and social challenges that the mining and metals industry currently faces through the market-based policy tool of private regulation and under the sustainability product differentiation framework. Through this work, both ends of the product chain were analysed, as well as current sectorial initiatives. In conclusion, sustainable product differentiation is possible for metal commodities; in addition, this research points out that those private regulation schemes that relate to luxury products are promising for creating momentum for change in the industry.

Keywords: Mining, Metals, Product Differentiation, Environment, Sustainable Development, and Luxury Products.

Executive Summary

Metals play a key role as a cornerstone of our modern society; they are part of the most basic elements of our daily life and have been part of our lifestyles for millennia due to their characteristics that include strength, durability, conductivity and aesthetic appealing (GHGm, 2008). Current trends of metal production point out that developing countries in order to attain a developed-countries consumption level will require 3-9 times the present metal stock per capita (UNEP, 2010). Much of this resource extraction will take place in the developing world where China, Chile, South Africa, Indonesia and Peru are already leading the way (UNEP, 2010); unfortunately many of these places lack mining manners that reflect best practice, thus having large negative environmental and social impacts for different reasons that include among others bad governance and bad conduct (UNEP, 2010).

Recent incidents in 2010 in extractive industries such as BP oil spill in the Gulf of Mexico and the red sludge spill in Hungary have raised concerns on how these commodities' prices do not reflect the real costs to society and the environment of their production. This market failure can be partly attributed to the anonymity of the commodities' trading scheme and the natural properties of metals making virtually impossible to determine their precedence (GHGm, 2008).

Labelling and certification schemes have proven to be effective means to change industrial practices (The Economist, 2010; GHGm, 2008) by providing information on how products are manufactured and by appealing to consumer's choice for *good* products. A recent study for UNEP (UNEP, 2011) that analysed thoroughly the mining sector's various initiatives showed that many of these lag in some key areas of sustainability, the important optimisation of the relationship between resource extraction development and the economic, social and environmental systems has not yet come to fulfilment.

This thesis project is driven by necessity to address those environmental and social challenges that the mining and metals industry currently faces through the market-based policy tool of private regulation and under the sustainability product differentiation framework. Therefore, the following main research question was posed:

- *How can improved sustainability performance provide product differentiation for the products coming from resource extraction industries –especially in mining and metals industry-?*

The main method for data collection for this work was an extensive literature review of commodity market work and initiatives that relate to the mining and metals sector. This literature review also sought to integrate stakeholders' views and opinions. Additionally, this work incorporates the thoughts and comments of different experts in economics, finances, environmental sciences, marketing, corporate social responsibility, sociology and psychology that contributed to the development of this project through informal semi-structured interviews.

In order to analyse the data collected, an environmental product differentiation framework developed by Forest Reinhardt of Harvard University, was adapted for sustainability. The analysis process is therefore a comparison between the conditions for differentiation for a commodity and the current situation of the mining and metals sector; some institutional theory was introduced further in order to provide some understanding on private regulation schemes. In addition, some interviews were performed and notes made from them to provide the distinctive points of view that shaped this analysis.

Through this work, both ends of the product chain were analysed, first what firms in the mining and metals sector have among their activities and what is defined as best practice was reviewed; without going deep into supply chains we also examined a number of issues related to differentiation in final products – in this analysis by looking into luxury product framework, additionally we stepped outside the supply chain on the private regulation field and examined how it can be a reliable and legitimate source of information for consumers and what practicalities and conditions are needed for it to be functional in the context of product differentiation.

Sustainability product differentiation in the mining and metals sector is possible, and is already happening. Through this analysis we provided evidence that there are important drivers for the industry to move towards best practice and differentiate themselves and their products. The success of these and future initiatives relies on what we explained as luxury products due to their intrinsic characteristics and what consumers seek in them. Additionally, this work's results demonstrate that there is a high potential for this product category to drive change towards better practices throughout the industry, improve environmental conditions and the livelihoods of millions that depend and are affected by the resource exploitation. Furthermore, other supply chains that are not necessarily related to the mining and metal industry, but that derive from luxury products can improve their sustainability performance, however this is to be study in future research.

In conclusion, sustainable product differentiation is possible for metal commodities; those private regulation schemes that relate to luxury products are promising to create momentum in the industry. Yet, there is much room for improvement in both the initiatives and the industry when it comes to sustainability and product differentiation. The former has to look for synergies and complementarities and provide stewardship for the product through the whole supply chain with a Life Cycle Assessment (LCA) mindset; the latter has to overcome the sustainability challenges that are jeopardising their current and future operations. Not only it is in the stakeholders' best interest that firms improve their performance but in firms' best interest, yet barriers inside firms and poor governance keep firms from the rapid change that is needed.

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Abbreviations

UNEP – United Nations Environmental Program

NGO – Non-Governmental Organisation

DRC – Democratic Republic of Congo

UN – United Nations

FDLR - *Forces Démocratiques pour la Libération du Rwanda*

EITI – Extractive Industry Transparency Initiative

IIIIEE – International Institute for Industrial and Environmental Economics

OTC – Over The Counter

ARM – Alliance for Responsible Mining

LBMA – London Bullion Market Association

iTSCi - ITRI Tin Supply Chain Initiative

ICMM – International Council on Mining and Metals

RJC – Responsible Jewellery Council

KP – Kimberley Process

BGR - Bundesanstalt für Geowissenschaften

IRMA - Initiative for Responsible Mining Assurance

GeSI - Global e-Sustainability Initiative

EICC - Electronic Industry Citizenship Coalition

CASM - Communities and Small-scale Mining Initiative

ASM – Artisanal and Small-scale Mining

GRI – Global Reporting Initiative

GMI – Green Mining Initiative

FSC – Forestry Stewardship Council

MSC – Marine Stewardship Council

RA – Rainforest Alliance

LCD – Liquid Crystal Display

LPSD - Leading Practice Sustainable Development Program

NSMD – Non-state Market Driven

GATT – General Agreement on Tariffs and Trade

LCA – Life Cycle Assessment

EU – European Union

USD – United State’s Dollars

1 Introduction

Metals play a key role as a cornerstone of our modern society; they are part of the most basic elements of our daily life and have been part of our lifestyles for millennia due to their characteristics that include strength, durability, conductivity and aesthetic appealing (GHGm, 2008). Metals are used in a variety of alloys in order to obtain properties that pure metals do not have, and their applications are as diverse as the products we have available in the markets.

Metals come from a variety of ores and their quantities are limited and fixed on earth, however their profitable extraction limits their availability. In order to extract the metals from the earth, layers of soil and rocks have to be removed to have access to the ores. After this process is done, refining has to take place, where through a variety of chemical and physical processes metals are concentrated and separated from the rock matrix leaving behind great quantities of tailings and obtaining ~98% purity of the metal, later processes of refining take place in order to obtain concentrations of ~99.9% (GHGm, 2008).

Recent incidents in extractive industries such as BP oil spill in the Gulf of Mexico and the red sludge spill in Hungary have raised concerns on how these commodity's prices do not reflect the real costs to society and the environment of their production. This market failure can be partly attributed to the anonymity of the commodities' trading scheme and the natural properties of metals making virtually impossible to determine their source (GHGm, 2008).

Labelling and certification schemes have proven to be effective means to change industrial practices (The Economist, 2010; GHGm, 2008) by providing information on how products are manufactured and by appealing to consumer's choice for *good* products. Through this document I will use the word consumer indiscriminately whether it is business-to-business or business-to-consumer cases. Product differentiation in metal-commodities has been challenging as metals' supply chains are long, metals are global and interchangeable, brokers do not share good practice values, and purchase confidentiality make the traceability of metals difficult (GHGm, 2008). Current trends of metal production point out that developing countries in order to attain a developed-countries consumption level will require 3-9 times the present metal stock per capita (UNEP, 2010). Much of this resource extraction will take place in the developing world where China, Chile, South Africa, Indonesia and Peru are already leading the way (UNEP, 2010); unfortunately many of these places do not mine in manners reflecting best practice, thus having large negative environmental and social impacts for different reasons that include among others bad governance and bad conduct (UNEP, 2010). Product differentiation schemes are an interesting alternative to reward better environmentally performing products, and have been an active field of research and work in recent years through many initiatives, yet there is room for further development (GHGm, 2008, The Economist, 2010, Jaffry et al., 2010, Ponte, 2002)

1.1 Justification

In recent years, the mining industry, a range of stakeholders and some governments, have been developing a series of initiatives as a response to the different challenges that the sector faces in sustainability – a core issue for their business continuity. This upwelling of initiatives has included new regions as well as new metals. It is clear that effort is being made to change not only the perception of the industry but to improve the manner in which it can continue supplying metals to society. While progress has been made, there remains a long way to go.

A recent study for UNEP (2011) that analysed thoroughly the mining sector's various initiatives showed that many initiatives lag in some key areas of sustainability, the important optimisation of the relationship between resource extraction development and the economic, social and environmental systems has not yet come to fulfilment. Furthermore, the common effort of the different initiatives still lacks coordination and limits itself to some specific aspects of sustainability without a truly Life Cycle approach; according to the same study the absence of a clear broad coverage is clear in environmental and social aspects – moreover, many opportunities for complementarity and synergy between initiatives have not been leveraged. This perhaps explains why some of these institutions have been abandoned through time while new ones are created. Nevertheless, the opportunity for private regulating institutions that permit a holistic approach to mining and sustainability is still on the table.

Moreover, the prevision in the initiatives for the future growth of the industry is still incipient (UNEP, 2011), even though it is of great importance, as mining will continue spreading through new sites in the developing world and with companies that are not yet meeting what is thought to be best practice in line with the principles of Sustainable Development (UNEP 2011). Also, important issues in social aspects such gender, revenues distribution, minorities and so on, are starting to become more important on the agenda of the mining initiatives.

Furthermore, the UNEP (2011) study identifies five key areas for improvement where the different initiatives toned to advance if better social, economic and environmental performance are to be achieved: achieving integration and synergy; facilitating information availability for decision-making; enhancing sustainable development; addressing mining legacies and greening supply chains. For this study, only the last topic is directly relevant as it involves all the initiatives that go beyond the production phase and include the metal life cycle and the downstream supply chains and products. These initiatives encompass all different sorts of policies, principles and technologies that contribute to cleaner production, resource efficiency, reduced toxicity and products designed for the environment. What is key is that there is no institution, according to the study, which covers all the sustainable development issues; however, there are many that address a few and others that address only a single issue. Finally, the study emphasizes on the need to pursue a better information flow through the supply chain and improvement of the data sets, thus allowing increased transparency and traceability of the metals.

In addition to the mining industry, initiatives coming from downstream industries -i.e. electronics- have started to incorporate the general public's interests on supply chain responsibility. Consequently, companies have started mapping their supply chains further down unveiling the anonymity that prevails in commodity markets and ensuring that environmental and social aspects are better highlighted and understood. All this under the increasing scrutiny of watchdog NGOs and media that contest firms' precious reputation by campaigning and lobbying against bad social and environmental practices that merge with the rising concern of final consumers on how their goods are produced and where they come from.

1.2 Risk to reputation

Recent events in resource extractions industries such as the oil spill in the Gulf of Mexico; the trapped miners in Chile, New Zealand and China; and the red sludge in Hungary have

drawn attention to the industry. Such events keep raising questions on the general public on whether the products we daily use are causing severe problems where their parts are being sourced from. The following are a few examples on how companies' reputation may be affected by their practices and how different stakeholders such as the civil society, NGOs, states, minorities, shareholders, investors and so on can or do affect the firm. What is important to consider is how the pressure has come from many different actors in many different parts of the organisations:

- **State:** Recently the case of Chevron in Ecuador (BBC, 2011) where a court fined the company to pay \$8.3bn for polluting a large part of the Ecuadorian Amazon by dumping gallons of toxic materials into pits and rivers, and where activists claim that crops were damaged, farm animals were killed and local population's cancer rates increased. Additionally the company will have to pay a 10% compensation fee bringing the fine to \$9.5bn.
- **State:** The coal American company Drummond paid paramilitary militias in Colombia for security and laying off union members as revealed in wikileaks documents. Additionally the company is in trail at the Federal Court of Alabama for the murder of union leaders in the hands of paramilitary groups paid by Drummond. (Elespectador, 2011).
- **State:** The British-Dutch company Royal Dutch Shell settled a thirteen-year battle in an agreement with the families of an executed Nigerian community leader paying compensation of \$15.5m for the complicity in human rights violations committed against the Ogoni people in the 1990s, additionally the settlement included a \$5m trust to benefit the local community (Milieudéfense, 2009).
- **Multilateral Organisation and private companies:** In the Democratic Republic of Congo (DRC) mineral resource extraction of copper, gold, diamonds and coltan played a significant role in perpetuating the civil war that took place by financing rebel groups, polluting water sources and creating erosion (UNEP, 2009) and all types of human rights violations such as forced recruitment of children and adults (Hayes and Burger 2003), forced displacement and over 3 million dead people (Oxfam, 2001); this concerns have led to initiatives from industry that ban sourcing of the mineral from DRC for electronics for instance the case of Nokia that requests certification of coltan produced in DRC.
- **Multilateral organisation:** In 2008, the UN Group of Experts of the Security Council committee published a report providing evidence that the Thailand Smelting and Refining Company (Thaisarco), the fifth largest tin producer in the world owned by the British Amalgamated Metal Corporation Group, made purchases of ore from a company supplied by mines controlled by the *Forces Démocratiques pour la Libération du Rwanda* (FDLR) (UN, 2008). The FDLR militia is claimed to be responsible for the 1994 genocide in Rwanda and continuous violation of human rights of the Congolese people (Global Witness, 2009).
- **State:** Since last June, a new US law requires companies to certify that their products do not contain metals sourced from rebel controlled mines in DRC and nearby countries, in a move to cut down the rebels' source of income. On the downside, the

prohibition of sourcing from these mines may place at risk the livelihood of people that have no other alternative and live in the conflict areas (Yahoo! Finance, 2010).

- **Investors:** Rio Tinto Group in year 2008 was explicitly excluded from the Norwegian Pension Fund investment portfolio claiming that the Fund did not want to contribute to the environmental deterioration that is taking place in the Grasberg mine site in Indonesia and as current practices are not planned to be changed in the near future. The mine is joint venture between Rio Tinto Group and Freeport McMoRan Copper & Gold that had also been excluded from the portfolio in the 2006 for the same reason. (Norway Ministry of Finance, 2008), According to press reports on the mine, an environmental assessment from 1994 was made public by a lawsuit of freedom of information, in the report The Austin Chronicle claims that the mine has acid mine drainage, dumping of the tailings to the river that today have reached the sea and accuses the company of devastating the river system and causing an important impact on the West Papuan environment (Bryce, 2005).
- **Shareholders:** In another case in year 2006, the shareholders of the Barrick Gold Corporation requested explicitly the board of directors to implement Extractive Industry Transparency Initiative (EITI) to minimise the risk of corruption in states where governance is weak and can jeopardise the company's license to operate. From the shareholders point of view, the EITI permits companies to disclose their payments and expenditures with the adequate stakeholders; they legitimise this initiative by outlining the involvement of governments, multilateral organisations and peer companies (Sinclair, 2006).
- **NGOs:** New developments of mining sites have encountered fierce opposition from NGOs and local communities; this is the case of the Crucitas gold mine in Costa Rica where the NGO Friends of the Earth with other NGOs and the local community of Las Crucitas campaigned against the licensing of a mining site in the northern border near the Nicaraguan border for 17 years, this site has been claimed to be rich in biodiversity and home of endangered species (Phil, 2010)
- **NGOs:** In 2008 South Africa, Anglo Gold Platinum has been reported for human rights violations and forced displacement by ActionAid. Also, it has brought to attention that the Swedish companies Volvo Cars, Volvo Trucks, Scania and Saab sourced parts of their catalytic converters from Anglo Gold Platinum mines going against their ethics and corporate responsibility commitments (Actionaid, 2010).
- **Multilateral Organisation:** In year 2000 a tailings dam of the Aurul Mine—a joint venture between the Australian Esmeralda Exploration and the Romanian Government- in Baia Mare overflowed and released 100 000 cubic meters of cyanide into the Tisza River, the spill reached the Danube and caused more than 1,000 tonnes of dead fish, affected the livelihood of fishermen, drinking water supplies and the local tourism industry in seven countries. As a result the Cyanide Code initiative for gold mining was created and it helped strengthening the regulation inside the EU (Fritz, N.D.).

Finally, the risk to reputation is a real threat to organisations; it can compromise future operations, as it works as a coercive mechanism to force firms to follow the values of what

stakeholders considered best practice. The cases presented here show the multidimensional pressure to firms to embrace sustainable development and highlights that the industry has still a long way to go before general public's perception changes about it.

1.3 Research questions

This thesis project is driven by necessity to address those environmental and social challenges that the mining and metals industry currently faces through the market-based policy tool of private regulation and under the sustainability product differentiation framework.

In order to do this, the relevant mining and metals initiatives were included and analysed through the lens of sustainability product differentiation. Subsequently, the product-end of the supply chain was analysed. Therefore, a main research question was posed with two subordinate questions, as follows:

- *How can improved sustainability performance provide product differentiation for the products coming from resource extraction industries –especially in mining and metals industry-?*
 - *Where, if anywhere, does product differentiation with sustainability fit with the mining and metals sector?*
 - *Where, if anywhere might it spread?*

2 Research Methods

2.1 Data Collection

The main method for data collection for this work has been an extensive literature review of commodity market work and initiatives that relate to the mining and metals sector. This literature review has also sought to integrate stakeholders' views and opinions. Additionally, this work incorporates the thoughts and comments of different experts in economics, finances, environmental sciences, marketing, corporate social responsibility, sociology and psychology that contributed to the development of this project through informal semi-structured interviews. The interviews served as means to understand the personal perceptions and opinions of the challenges of product differentiation on sustainability grounds for a commodity. The access to the interviewees was mainly achieved via the academic and research staff of the IIIIEE as well as my own personal networks. This information has been taken into the work as expert knowledge from the different fields where the interviewees have expertise and in the universe of topics that were addressed during this project.

Furthermore, newspapers and magazines were monitored for articles and opinions regarding resource extraction industries in order to attain a broader and updated information source the veracity of the information from the articles was evaluated by finding more reports on the same news from different news agencies. The effort for collecting this information was not extensive and a brief summary based on relevance can be found in the justification.

2.2 Methods of Analysis

In order to analyse the data collected, an environmental product differentiation framework developed by Forest Reinhardt of Harvard University, was adapted for sustainability and subsequently used looking essentially for two conditions: first that the conditions of the framework were fully met and second by assessing whether the product differentiation can spread into common practice in the mining and metals sector. The different initiatives have been analysed with the sustainability product differentiation framework, those initiatives that are currently happening in the sector and that are related to product differentiation, additionally other commodities that have had some sort of differentiation have been included in this work. The analysis process is therefore a comparison between the conditions for differentiation for a commodity and the current situation of the mining and metals sector; some institutional theory will be introduced further in order to provide some understanding on private regulation schemes. In addition, some interviews were performed and notes made from them that shaped this analysis.

2.3 Scope and limitations

The scope of this project is limited to the analysis of product differentiation for the mining and metals industry under the sustainability product differentiation framework. Indeed, the author recognises the many challenges that industry faces and that each part of it should have a separate thorough in depth analysis, however the broader approach of this research pretends to draw attention to those areas that are key for improvement. Therefore, some discussions have been intentionally excluded from the present study, not that they are not relevant and would not enrich this research, but for time, information availability and resource constrains have been left out.

The author considers that mapping supply chains, basic information about the metals, detailed impacts, technology assessment, deep theoretical background of labels and certificates, analysing local legislation in line or against private regulation and the discussions on social-welfare and desirability of: labels, certification, private regulation schemes, product differentiation and luxury are important topics to consider yet they will not be addressed. Additionally, country and regional based initiatives were excluded, as the author did not intend to review all initiatives in the sector. Finally, this study will focus on the core topics that permit an understanding and analysis of product differentiation in the context of sustainability for the mining and metals industry.

3 Behind the scenes: Product Differentiation

3.1 Economics background

Products are available in numerous forms, styles and brands. Product differentiation is about those variations inside a product class that consumers *may perceive* as imperfect substitutes (Anderson, 2005). The market power of product differentiation creates the opportunity for firms to overcome the Bertrand Paradox of pricing of homogenous products, where consumers view products of two firms as perfect substitutes, thus either firm cannot ask for a price premium over their products without cutting profitability (Hingley and Sodano, 2010).

Product differentiation concept comes from the work of Michael Porter (1985) where in his book he introduced the concept of competitive advantage. In his framework, firms can create additional value by two pathways: offering lower prices than their competitors for similar benefits or by providing unique benefits that allow a higher price. Thus, there are two types of competitive advantage: differentiation and cost leadership (Porter 1985). For this paper I will only take under consideration product differentiation.

In the neoclassical economical framework, firms look to maximise their profits by finding the optimal arrangement of inputs and to produce the optimal outputs (Holcombe 2009). Under this framework, a firm's production function is given as $Q=f(K,L)$ (Q: quantity, K: capital and L: labour), thus being the firm's task to find the optimal combination of K and L (Holcombe 2009). The cornerstone of the model is perfect competition where the free entry of firms will drive economic profit to zero in time (Besanko and Breutigam 2005). In order to avoid this, a firm differentiates its products to achieve a monopoly that permits it to maintain economic profit in the long-term instead of the zero-profit long run equilibrium (Holcombe 2009). The burden of having monopolies is greatly compensated by the diversity of products available to consumers by monopolistic competition (Pindyck and Rubinfeld 2005). In this competition, the more successful a firm is in differentiating its products from similar firms, the more monopoly power it has (Perloff 2004). However, this power is not necessarily related to the production process or the product itself, it can be based on the perception of a difference by the consumers, for instance the preference for a certain brand. This may happen even though competitors have the same technological level to produce perfect substitutes by having access to the same production technology (Browning and Zupan 2003).

Within the product differentiation realm, a key aspect often mentioned in the literature is the distinction between horizontal and vertical differentiation (Hingley and Sodano 2010). The former refers to when perfect substitute products are offered at the same price, but consumers prefer to purchase the same one. The latter concept refers to when perfect substitutes are offered at the same price, and consumers when asked to do so, rank them according to their individual preferences and rank them in the same way, the outcomes of these two concepts vary greatly (Hingley and Sodano 2010).

Horizontal differentiation starts with the assumption of monopolistic competition and can be analysed with two different models: symmetric consumer preferences and asymmetric preferences. In the former case, one brand is perfect substitute for another and consumer's choice depends on its preferences. On the other hand, on the asymmetric model brands are not equally the same. The economic analysis implications of this, results in the models

employed for analysis: asymmetric preferences are assumed in location models such as Hotelling (1929) and symmetric preferences are assumed in models related to the Chamberlin paradigm (Hingley and Sodano 2010).

The simplest model for location is Hotelling (1929) where the location of a certain firm may grant it a monopolistic position in the market due to the relative distance of consumers to other firms. Under this model, with or without the zero conjectural variation assumption, firms will reach one or more Nash-equilibria (Hingley and Sodano 2010). From the metal sector stand point this means for instance that transport simplicity –short supply lines and less transfers- may give a firm monopolistic control of the market.

In the Chamberlin (1933) based models, firms may behave as monopolies in the short term gaining market power in order to increase their profits, the interactions of many firms having the same behaviour creates a perfect competition market, that the long term, turns the profits to zero. These models raise questions about the social optimum on the number of firms or products (Spence 1976). The result of these models is usually (Hingley and Sodano 2010) a suboptimal number of firms or products. The idea behind it is that firms differentiate their products to gain market power, however competing firms also differentiate their products through time, taking the market power of other firms. This type of differentiation, in the case of the metal sector, can be found by looking at labelling and certification schemes where firms try to gain market power by differentiating their products, for instance by providing quality certificates.

Reaching equilibrium in vertical differentiation is more straightforward than in horizontal; as shown in Shaked and Sutton's (1983) model, consumers agree to rank products according to a measurable feature, such as quality, that is reflected in the variable costs of the product; the consumers' choices depend on tastes and income. As a result, prices reach Nash equilibrium, as there is a limit of firms or products that can coexist with prices over unit variable cost (Shaked and Sutton 1983). The costs associated with higher quality may rise at a slower pace than consumers' willingness to pay for it, thus they fall on fixed costs rather than variable costs as product innovation comes together with process innovation (Hingley and Sodano 2010, Shaked and Sutton 1983). For the mining sector, we can see this in diamonds; diamond specialists can rate diamonds according to cut, carat, colour and clarity and define diamond price accordingly, yet this commodity is a special case as we will see further on.

Finally, product differentiation is a consistent example of imperfect competition. Its main concern is to curve the demand to the will of supply by using the firm's market power (36). Thus, differentiation is a market imperfection and creates welfare loss (Hingley and Sodano 2010) that may be more than recompensed by the product diversity (Holcombe 2009).

3.2 Environmental and Sustainability Product Differentiation

Product differentiation presents an opportunity for environmental and sustainable differentiation. Market power and price premiums make the idea very attractive for firms. The differentiation can be vertical through changes in the processes, thus delivering products with a less environmental burden than its competitors, these changes count as fixed costs with the risk of making the products less competitive if the consumers are not willing to pay for a premium. Horizontal differentiation may happen if the product's price remains unaltered by the changes in the process, yet it reflects on the product's information making it a preferable choice for consumers. Both schemes lead to better environmental quality, however as it falls in the public good category, firms are not so open to provide them as they

may find it difficult to recover the investments; for this reason, consumers' awareness plays a key role in changing firm's behaviour (Reinhardt, 1999).

In industrial markets, such as mining, the willingness to pay for products relies almost completely on product's total costs (Reinhardt, 1999). Branding for industrial companies has an increasing role in social license to operate – acceptance and approval to a firm's operations in a certain location by the general public– and consumers' preference or aversion to a product or firm will have an impact on sales, this is clear for the mining and metals industry with the risk to reputation. According to Reinhardt (1999) there are three necessary requirements in order to make a successful environmental product differentiation; I have broadened the scope in order to make them suitable for the sustainability case; that is including social, environmental and economical aspects:

1. It must find, or create, a willingness among consumers to pay for sustainability.
2. It must establish credible information about the sustainability and other attributes of the product.
3. Its innovation must be defensible against imitation by competitors.

Reinhardt's last requirement is perhaps the most important for the industrial realm. Firms have to come up with products and processes that are unique and have embedded higher sustainability performance, or at least consumers have to be able to perceive – some differentiation. Firms at the same time have to avoid competitors from imitating their processes and products. Nevertheless, in the industrial context usually processes and technology applied are adapted to local conditions making it site-specific, thus giving an opportunity for differentiation. For instance, the challenges that a mine site experiences are different from the challenges that other firm faces in another mine site in spite of producing the same metal, from the same ore. Furthermore, socio-political circumstances vary from place to place as well as ecosystems and resource availability; and if we follow the sustainable development concept it is clear that the sustainability of a mine-site will also vary through time.

There has been some work in the environmental product differentiation by assessing consumers that care for sustainability choice of products. It is assumed that consumers that care for sustainability or environment will have their enjoyment of a good diminished if there is a sustainable or environmentally friendly substitute. Therefore, if a consumer buys a product that lacks the characteristics that she values – environmental or sustainability quality – she ought to have a “bad conscious” (Conrad, 2005) as the correct choice is expected from her. Her choice and attitude towards the product is a result of her social networks – friends, family, colleagues and partners- and the media. In a work that differs from others by Arora and Gagopadhyay (1995) all consumers value environmental quality and have the same preferences, however they have different income levels and capacity to afford green goods. In this model, firms differentiate their products by competing in environmental quality, consequently segmenting the market according to income levels. As a result of consumer's preferences and firm competition, some firms end-up over complying with the environmental standards. In Moraga-Gonzalez and Padron-Fumero (2002) work, they assess in duopoly model with vertical differentiation the consequences or a series of environmental policy instruments on total emissions and social welfare. They assume their consumers are green, and they are willing to pay for environmental friendly goods. As a result, they prove

that a maximum emission standard reduces emissions, however it can markedly increase firms' sales increasing their total aggregate emissions. Greaker (2003) provides us with a model with two firms, a domestic and a foreign, where products are vertically and horizontal differentiated by environmental quality and taste/eco-label respectively. For his model regarding horizontal differentiation, he assumes that the taste variable is more important than the environmental quality for the consumer. Then he compares the use of eco-labels with national legislation and notes that it is optimal for the government to introduce a voluntary eco-labeling scheme, not on the grounds of protectionism, but as it provides domestic and global welfare. In Eriksson (2004) he places two firms at different levels on environmental quality. He then looks, through a horizontal product differentiation model, how much voluntary or partially voluntary internalization of externalities by consumer's choice can replace governmental intervention. Conrad (2005) uses a duopoly model to establish how consumers' environmental concerns affect product characteristics, prices and market shares of firms. Finally, Clemenz (2009) analyses the effect of eco-labels for emission abatement comparing end-of the pipe and cleaner production methods. Concluding that in the former there is a chance for underinvestment, assuming consumers' willingness to pay for abatement is equal to the social marginal benefit.

Environmental or sustainable performance is highly related to the previous literature review. It is understandable how consumers receive a direct benefit from products with a higher quality that is quantifiable and can be easily related to a product's price. In the same fashion, a firm can reduce its variable costs through the use of a new technology that has less resource use, thus it would be able to ask for a lower price for its products, this is cost leadership.

Now, let us assume that environmental quality is part consumer's utility function and that consumers pursue maximisation of their utility function, we can make this assumption by considering the sensitisation and awareness campaigns that we saw in the justification and how companies are not willing to risk their reputations limiting their growth. As the firm with this new technology is providing a public good, environmental quality, it can ask for a premium over the market price by differentiating its products, the premium in this case is linked directly to the firm's market power. The differentiation may be horizontal, vertical or both, depending on Reinhardt's second condition, which is how the information is presented to consumers. This is where the role of advertisements and publicity for firms take place as it is a way to keep their products differentiated. If the product's environmental quality can be rated (i.e. emission abatement) by consumers then vertical differentiation may happen, if the products environmental quality cannot be rated yet the firm promotes its product in a way that it appeals to consumer's preferences then it will be horizontally differentiated. Finally, both situations can happen at the same time, for instance a highly recognised brand of products that can rated by consumers then there would be vertical and horizontal product differentiation.

Summarising, the drivers for sustainability product differentiation come from the firms' pursuit of market power to ensure profits in the long term and consumers willingness to pay for the improved sustainability in the product or in the product performance. However, how consumers' behave depends directly on the information provided by the firms and the perception of higher environmental or social quality of the products.

3.3 Metal Commodities and Product Differentiation

In order to start linking the product differentiation with the metal sector and its products, I will first proceed to describe what commodities are and how they are traded, then I will

briefly explain how metals fit in the market and finally I will start analysing how metal commodities can be dealt through product differentiation framework based on economic theory.

Commodities are basically raw materials that are traded in large quantities in specialist markets (Nissanke and Mavrotas, 2010) exclusively on the basis of price (GHGm, 2008). The physical materials are bought and sold in standardised contracts traded on 'over the counter' (OTC) markets and exchange where operations of spot trading, physical forwards and derivatives take place.

Physical trading commodities can be divided into: metals, grains and soy, livestock, food and fibre and exotic commodities (IFRL, 2008). There are two generalised categories of commodities traded: soft and hard. Soft commodities correspond to food and perishables while hard commodities are metals (Loader, 2005). A large proportion of the trading is done between businesses and is based on delivery. The trade operations are typically done by brokers and intermediaries (GHGm, 2008, IFRL, 2008).

Derivatives are agreements between two parties that are based on the expected future price of the commodity; they work as an instrument to reduce the risk of a transaction and include many financial operations such as futures, swaps and options (Loader, 2005).

Metal are sold within these markets accordingly to their specifications and quantities, with different prices above the exchange price accordingly to the metal characteristics (GHGm, 2008). Theoretically, the properties of metal commodities allow them to be traded regardless of origin, as physically atoms from one metal are virtually the same, yet there has been ongoing research on fingerprinting of metals i.e. *Bundesanstalt für Geowissenschaften und Rohstoffe's* research on the topic. In this market process, buyers can look to have private contracts with one or many sellers in order to insure quantities, qualities and price (GHGm, 2008).

Different types of markets deal with the different metals, where a clearinghouse acts as guarantor for the commitments to be honoured by the parts (Loader 2005). Consequently, a large proportion of the metal stock is in warehouses around the world that are monitored by traders as indicators of metal supply. Metals are traded in the following exchanges (GHGm, 2008):

- Aluminium: London Metal Exchange, Shanghai Futures Exchange and Osaka Mercantile Exchange
- Copper: London Metal Exchange, Shanghai Futures Exchange, New York Mercantile Exchange (COMEX)
- Gold: Tokyo Commodity Exchange and COMEX
- Palladium and other Platinum Group Metals: London Platinum, Palladium Market and Tokyo Commodity Exchange
- Tin: besides to the London Metal Exchange, the market operates largely in Asia, with the Kuala Lumpur Tin Exchange having the largest pricing system for the metal.

- Cobalt is the exception, as it is not traded through market exchanges, instead it is traded directly through commercial contracts where the prices are published online. Other minor metals, as well as cobalt, are in the process of developing new exchanges to facilitate trading operations.

- Gold trade is a special case as it is treated as a commodity and at the same time as a valuable asset with three quarters of its total stock used a value store by investment funds, governments and jewellery. The London Bullion Market Association fixes gold price twice per day.

Finally, metals are hard commodities traded in centralised locations through mechanisms that provide security to the investors and consumers, according to minimise the risks that the transaction involves. Understanding the characteristics of the metals and their trading systems is part of understanding how firms take steps towards sustainability product differentiation.

Going back to Reinhardt's (1999) revised conditions that we outlined before, the question posed is how can the metal industry use their sustainability performance to differentiate their products? We have reviewed the economic theory of how firms seek to differentiate their products to obtain market power seeking long term profits, let us now start applying this economical theory to the metal case in a qualitative fashion.

Perhaps the biggest challenge in metal differentiation is related to Reinhardt's (1999) third condition, where defending innovation against competitors in the sustainability field is not so clear. Product sustainability differentiation in the metal industry can be done through changing production processes and general practices only and by communicating credible and reliable information, therefore posing barriers for copying by competitors. As the metal industry's product is a raw material for other industries there is no much room for product innovation, yet companies could declare what their practices are about and differentiate by the use of certain technologies in their processes. Currently, some product differentiation can be found in the many initiatives aimed to improve the over all industry's sustainability performance through certification schemes such as (GHGm. 2008): The Council for Responsible Jewellery Practices that deals with precious metals and gemstones promoting good practice through the supply chain; the Mining Certification Evaluation Project that gave rise to the Initiative for Responsible Mining Assurance at seeks to be a certification body through a multidisciplinary approach; part of the Eden Project is a chain of custody certification project in the UK for construction copper; the Kimberley Process Certification Scheme is a certification process to avoid the 'conflict diamonds' coming from Africa; the Green Lead Project is an initiative coming from the private sector that deals with the production and use of lead accordingly to sustainable development principles; finally, the Coltan Traceability initiative where the electronic industry has unilaterally decided not to source Coltan from the Democratic Republic of Congo and so on.

Nonetheless, these initiatives face the same problem of metal physical properties in commodity markets that make them virtually impossible to distinguish from where they come from, and as outlined before there is ongoing research on this topic. Initiatives have been focused mostly on horizontal differentiation, appealing directly to consumer's preferences for commodities produced under certain conditions. Additionally, the biggest issue for a certain certification or labelling programs for metals that only deal with a few aspects of sustainability is that there are only two categories: the firms that are certified and the ones that are not, for instant conflict metals, they either are conflict free or they are not

as the stringency bar cannot be moved further. This difference does not truly follow Reinhardt's third condition; therefore there is no drive for firms to seek for a higher price on their products. Also, in order for a certification system to work it has to be credible and part of its credibility is in the number of interested firms that are willing to follow its standards (Ponte, 2002).

Vertical differentiation schemes have not yet been implemented for sustainability; the Global Reporting Initiative is perhaps the closest to a ranking system, yet as it is a reporting system it does not truly reflect the conditions on how the commodity is produced in the price. Vertical differentiation, contrary to horizontal, poses an alternative that does not necessarily have to come from a multidisciplinary approach. Let us take, as an example a firm that is producing copper worldwide, for this purpose the firm will have five mining sites in different countries, the environmental conditions for each site are different as expected, all but in one aspect: water availability. It is expectable that a ranking system where water conditions are more favourable and it is managed properly would allow the company to ask for a premium for the copper produced at that site. Nevertheless, it is necessary that the firm is transparent to consumers, as he cannot truly see the difference between coppers that have been produced in different ways and under different conditions. Thus, it would be in the firm's best interest to be transparent and provide the necessary information for its products even if it means to have it certified by an independent body.

Furthermore, an important aspect of a site-specific rating system is the power relationships between the firm and the consumer, as described by Benedictow (2000) in the Norwegian case of metal exports, the power relationship varies according to capacity output of the mines. Mines have a limited output capacity where in order to increase it, they require large capital investments and construction that take some time, mines sites depend on their consumers when demand is low and the prices are low, when the demand is high and the prices are high the power relationship shifts and mines gain market power over the consumers, thus product differentiation can help as catalyser for mines sites to increase their market power. This provides an opportunity for firms, as a price premium could provide not only better conditions for the firms when prices are low, but depending on how the premium is set, it could also mean a price floor.

In conclusion, sustainability product differentiation is applicable to the metal industry –with distinct limitations-, and as we will see further on, commodities can be differentiated always relying on the three conditions that we have set. Additionally, the current initiatives that seek to create product differentiation may or may not be in line with these conditions and explain why the limited results of some of them.

3.4 Product differentiation Initiatives

3.4.1 Mining and Metals Product Differentiation Initiatives

The following information has been retrieved from documents and websites of the different initiatives here presented and that I considered relevant for this research project as they have a product or a lifecycle approach that therefore goes in line with our product differentiation focus. The information presented is a summary of each of the initiatives through this author's perspective and includes initiatives that are mainly focused on metals with the exception of the initiatives in diamonds that are here included as they provide a shared view and solutions for the industry's challenges.

3.4.1.1 Fair Trade Gold

The Fair Trade Gold is a joint program between the Fairtrade Labelling Organisation International and the Alliance for Responsible Mining (ARM). This Initiative is a third independent party certification scheme for gold, with the purpose of opening market opportunities for artisanal small-scale miners. This target group was selected considering that there are over 100 million people that depend directly or indirectly on small-scale gold mining and commonly struggle with poverty and with an unfair supply chain scheme that does not allow them to get a good price for their gold. Furthermore, they produce 15% of the global gold and account for 90% of labour in the industry. (<http://www.fairtrade.org.uk/gold/>)

Additionally, the project expects that the added price premium and enhanced market access will permit a better resource extractions conditions, community development in key areas of health, education, environmental management and alternative incomes, thus improving the resilience of the communities in line with sustainable development.

With these standards it is expected that:

1. Producers get a higher price for the gold setting a minimum price of 95% of the London Bullion Market Association's (LBMA) Free on Board for unrefined pure gold.
2. Miners receive social premium of 10% LBMA. Additionally, for ecological gold, the one that is extracted without chemicals and through strict environmental restoration, an ecological premium of 5% on top of the Fairtrade premium is to be paid.
3. Miners organise themselves in groups to gain better bargain power with traders, whose utilities are often in detriment to producers', and after the middle-men and exporters take their shares, they leave as little as 70% of the LBMA. Moreover, with this initiative it is expected that miners gain some control over the jewellery supply chain and promote competition in local markets providing improved trading relations for the miners.
4. Miners that are certified have responsible practices to manage the chemicals required for gold recovery –mercury and cyanide- as well as reduce their use and if possible eliminate them through time. On top of that, they may get an extra premium for recovering gold through gravity methods exclusively.
5. The Fairtrade and Fairmined miners must not contribute to conflict or violence. The idea is that where the certified party is, increased income provides stability, transparency and helps with peace building processes.

3.4.1.2 Green Lead Project

This initiative starts by recognising and identifying the different impacts that the use of lead may have, hence establishes a set of standards and tools to minimise the impacts and certifies the organisations that comply with the standards. This initiative claims to be the world's most ambitious stewardship program. (<http://www.greenlead.com/>)

The program has its focus on lead batteries that represent the 75% of the world's lead in the human-biosphere. The idea is to strengthen the weak parts of the battery life cycle through four strategies:

1. Compelling lead mining companies, smelters and battery manufacturers to only sell their products to Green Lead Certified customers. This means that there only Green Lead companies trade between them.
2. Battery manufactures can only sell their batteries to retailers that are certified and that work together with local or national agencies that ensure that the batteries are returned to the retailers after the use phase, and therefore they can be sent to a Green Lead Certified smelter.
3. Persuading major customers –i.e. motor manufacturers- to only buy Green Lead certified batteries.
4. Improve the labeling of the lead acid batteries, promote education programs that raise awareness among consumers about the Green Lead label, what the advantages of using it are and ensuring that batteries get recycled under the appropriate practices.

3.4.1.3 ITRI Initiative for Tin

This is an industry initiative that is supported and sponsored by its mining and smelting companies. Its aim is to encourage and promote the use of tin by representing industry's best interests and sharing information on market, technology and legislation developments. (<http://www.itri.co.uk/>)

In addition, they have started the ITRI Tin Supply Chain Initiative (iTSCi) for the tin minerals exported from the Democratic Republic of Congo. The purpose of this initiative is to trace the minerals together with providing credible and verifiable information from the different mine sites in eastern DRC. This initiative is a joint work between the ITRI, Malaysia Smelting Corporation Berhad (MSC), Thailand Smelting & Refining Co Ltd (Thaisarco-AMC) and Traxys Europe SA. Currently the initiative is under trail and has required funding of around USD\$600k to move forward, according to their website.

3.4.1.4 The Cyanide Code

The International Cyanide Management Code is a voluntary initiative for the gold industry's miners and the producers and transporters of cyanide. It intends to provide further operational information for best practice and provide compliance of its members with local laws and regulations where the operations are taking place. Moreover, the code was created as a response to the Baia Mare incident in year 2000, where UNEP organised stake-holders with cooperation's of the ICMM and it claims to be the first code created with partners outside the organisation. (Balkau N.D.)

However, the code does not guarantee that its application will prevent accidents, injuries or hazards. In addition, the code states that it is not legally binding for its members and is not legally enforceable for its signatories.

The Cyanide Code's focus is on cyanide's safe management during production, transportation, decommissioning of facilities and use for gold recovery. Also, it includes financial aspects, emergency response, accident prevention and in general transparency procedures. The code is subdivided in parts applicable to the different stockholders that manipulate cyanide and are under verification of the corresponding protocols. It is also clear that the code does not address all aspects of environmental and safety management or how

to design, construct and maintain tailings ponds. As production operations usually do not have control over the supply chains that provide cyanide, they are also required to undergo verification audits in order to be certified as complying with the Code's principles and practices. (<http://www.cyanidecode.org/>)

The cyanide code includes the following principles:

1. Production: promoting responsible cyanide manufacturing practices and purchasing from responsible manufacturers.
2. Transportation: Avoid hazardous activities that may compromise people or the environment during cyanide transportation
3. Handling and Storage: Protect the environment and workers during cyanide managing and storage activities.
4. Operations: Have adequate practices for cyanide solutions and waste streams in order to keep the environment and people's health.
5. Decommissioning: develop and implement plans for decommissioning cyanide-related facilities to protect communities and the environment.
6. Worker Safety: Make sure that workers health and safety are attended in order to protect them from cyanide exposure.
7. Emergency Response: Develop strategies to protect the people and the environment in case of emergency.
8. Training: Train the involved personnel –workers and emergency- in practices that provide safety and environmental responsible practices.
9. Dialogue: Provide disclosure and participate in stakeholder consultation.

3.4.1.5 Responsible Jewellery

This initiative –Responsible Jewellery Council (RJC)- is an international industrial cooperation between over 290 companies along the jewellery supply chain that have agreed and committed to promote and have environmental, ethical, human rights, social practices from the mine to the final market product. As a main goal, it seeks to strengthen consumers' confidence in jewellery. (<http://www.responsiblejewellery.com/>)

To achieve this goal, a certification system was created for to its members through the supply chain that deal with gold and diamonds. All members are required to be audited by a third party accordingly to the initiative's code of practices.

According to the RJC's website, there are four pillars for the certification system:

1. The Code of Practices
2. Auditor Accreditation
3. Independent Verification

4. RJC Certification

Finally, this scheme provides information about the good practices that in return can be communicated to the different stakeholders and parts of the supply chain. Additionally, the status of each member can be found on the initiative's website.

3.4.1.6 Diamond Development Initiative

This initiative is a multi-stakeholder endeavour that aims to ensure that the revenues from diamonds work as an 'engine' for development. This development diamonds are those that are produced under responsible environmental, safety, human rights, conflict free areas and that benefit communities and provide a fair price for miners. The initiative comes as a response for the conflict or blood diamonds from DRC. This initiative works as a compliment to the Kimberley Process and its main target are alluvial producer countries. Additionally, it intends to support through education, policy advice and projects for artisanal miners and their communities, using diamonds as a vehicle for national growth and reduce poverty. (<http://www.ddiglobal.org/>)

The diamonds for development objectives are:

1. Gathering and providing information for artisanal diamond mining
2. Promoting possible solutions and understanding of regulation, distribution and marketing, organisational aspects, legitimate and transparent channels, open markets for development diamonds.

3.4.1.7 Kimberley Process

This initiative started when the diamond producer countries from southern Africa gathered in Kimberley, South Africa in year 2000, as a response to halt the trade of conflict diamonds, therefore putting an end to the funding of violent groups. Later that year the United Nations General Assembly adopted a resolution creating a certification scheme for rough diamonds that came into force three years later when member countries started its implementation. (<http://www.kimberleyprocess.com/>)

Currently the Kimberley Process (KP) has more than 49 members and 75 countries –with the EU counting as one member- and is open to new countries that want to adhere to it and comply with its requirements. The current members account for 99.8% of global rough diamond production.

The KP scheme ensures that diamonds are conflict free by setting a group of requirements on the member parties and certifying the shipment of rough diamonds, thus avoiding that the conflict diamonds enter the market. To achieve this, states must set a group of policies, institutions and controls that permit transparency. Moreover, member parties can only trade between them.

The website claims that KP Certification is an effective system for restricting the trade of conflict diamonds and promote peace and security. As part of their achievements, the KP states that it has been successful on reducing the trade of conflict diamonds in a short period of time. Furthermore, the KP has aided stabilising fragile African countries, promoted the

revenues of poor countries and therefore helped them improve the livelihood of their populations.

3.4.1.8 Eden Project - Metals and minerals stewardship

The Eden Project's initiative on metals and minerals stewardship was a showcase on copper product stewardship in their building in Cornwall UK in 2005. During the construction of their centre, they were tracing the metal since it was mined, up to the installation process ensuring best practices during the process. This was the first time a metal was traced from the production site to the final product. (<http://www.edenproject.com/>)

Currently the Eden Project is working with companies from mining to the retail and assessing responsible sourcing schemes. Their strategy encompasses the following:

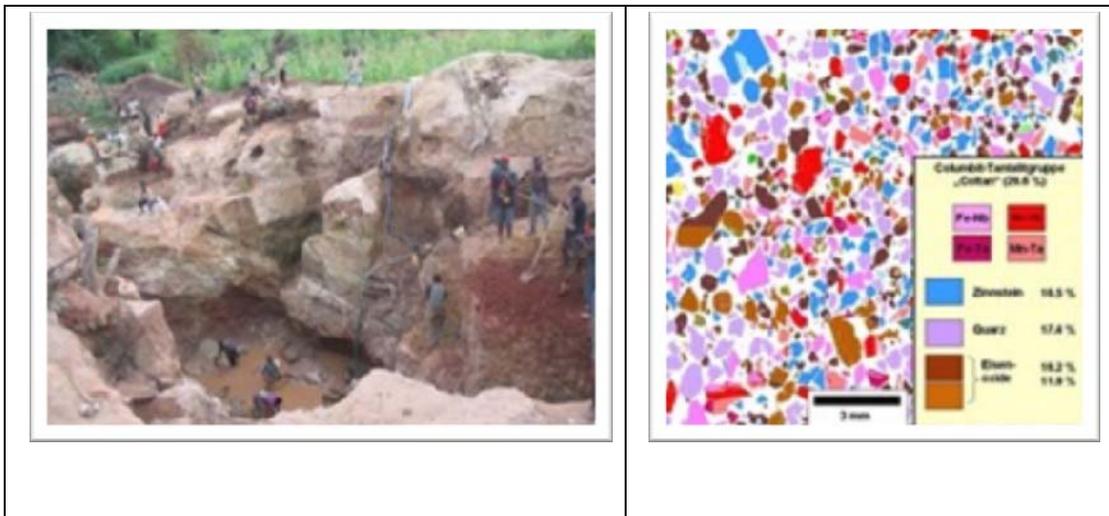
- Working to influence policy in the UK's Building Research Establishment and British Standards Institute.
- Linking members of the supply chain and promoting dialogue for responsible Convening unlikely players within metals and minerals supply chains. They are currently working with Aluminium's supply chain with Nespresso and TetraPak end producers and the mining companies Rio Tinto Alcan and Alcoa.
- Encouraging others to ask the right questions about the sourcing of materials.

3.4.1.9 Bundesanstalt für Geowissenschaften und Rohstoffe "Coltan fingerprint"

This initiative comes as a response to the Coltan production in eastern DRC that is financing the on-going war. As industry has been in constant need for the resource, the need to purchase conflict free metals has increased. The UN, aiming to stop the illegal trade of the mineral has proposed a new certification system, yet most important from it is to be able to track the metal. The BGR has recently developed a way to fingerprint the place of origin of the tantalum in the ore that is produced. (<http://www.bgr.bund.de>)

The BGR scientists carried out research for three years on behalf of the German Ministry for Economic Cooperation and Development (BMZ) on how to confirm the origin of tantalum ores from Central African deposits where "Coltan" is primarily exploited by artisanal mining. The pilot project focussed on the Congo and its neighbouring countries, which now account for around 50 % of the global tantalum production.

Figure 3-1 'On the left, artisanal coltan mining in Mozambique. Almost all of the mining is carried out manually. On the right Electron-microphotograph of a tantalum ore concentrate from Rwanda consisting of around 30 % coltan minerals and show a distinctive fingerprint'.



Source: BGR

The results of the research: the BGR scientists developed a forensic test which can unequivocally localise the original deposits of traded tantalum ore concentrates based on the measured chemical and mineralogical parameters. This will enable illegal supplies from potential conflict regions to be identified.

The aim of the project is to register producing and processing companies in Africa and Europe enforcing transparency, fairness and sustainable mining activities, those that include social and environmental aspects. The project is a reproduction of the certification schemes in the forestry industry with the FSC and in the food industry with Fair Trade.

Currently the BMZ is working on projects on tin and tungsten fingerprinting and is serving as an advisory player in the UN.

3.4.1.10 IRMA

The Initiative for Responsible Mining Assurance (IRMA) is a multi-stake holder process that started in Canada as a voluntary compliance verification scheme for environmental, human rights and social aspects in mining operations. Among the participants are mining and jewellery companies, NGOs and trade associations. The aim of the project is to work towards mining operations that have good environmental practices, leave positive legacies and maintain healthy communities. (<http://www.responsiblemining.net/>)

IRMA project attempts to create a third party and independent quality system that guarantees that mining operations are in environmental and social responsible activities. The system has the next principles according to its website:

- Independent verification.
- Fair and equitable distribution of benefits to communities (including tribes/first Nations and indigenous peoples) while respecting and protecting their rights.

- Effective responsiveness to potentially negative impacts to the environment, health, safety, and culture.
- Enhancement of shareholder value.

In addition, this initiative plans on using the existing knowledge and support from the ICMM's framework on Sustainable Development, the Mining and Minerals Sustainable Development project and the Mining Certification Evaluation Project.

3.4.1.11 Global e-Sustainability Initiative Supply chain

Since 2004, Global e-Sustainability Initiative (GeSI) together with the Electronic Industry Citizenship Coalition (EICC) has developed tools in order to help their members persuade their suppliers to improve their environmental and labour performance. The idea is that the initiative's tools permit suppliers reduce their costs by not having to duplicate information for their customers. In the same way, the member companies are using their influence on their direct suppliers to induce improvements through raising awareness and understanding of the social and environmental challenges. This initiative works with a top-down approach with the idea that each of the suppliers through their supply chain requires improvements to the level under them and so on. (<http://www.gesi.org/>)

Addressing the issues raised by NGO and media campaigns on DRC's issues, the initiative praises to the unacceptability of minerals as a source for conflict. Therefore they are currently supporting and focusing on two strategies on the supply chain:

1. Supporting the iTSCI's initiative on 'bag and tag' region sourced program.
2. Through the Smelter conflict free program identify and validate conflict-free smelts where their members can source from.

Initially the initiative was focused on tin and tantalum supply chains and is currently spreading to the tungsten and gold industries. Further work is planned on tungsten smelters and gold refinery.

GeSI will continue to promote the use of E-TASC within industry and among suppliers. Additional training courses to improve supplier understanding on specific topics (including health and safety, and worker communications) will be developed and launched in 2011.

3.4.1.12 Walmart Love Earth

Walmart, the largest jewellery retailer in the world, through this initiative promotes sustainable practices in the jewellery supply chain. The purpose of Walmart's initiative is to provide Sam's Club and their own customers with products that have less impact on the environment and communities. Inside Walmart, according to their website, their sustainable group tries to include sustainability by:

- Setting targets to reduce the waste generated
- In packaging, increase the quantity of recyclable materials
- Optimizing transport of goods to the stores
- Launching the Love, Earth jewellery brand, as a responsible metal sourcing segment.

The Walmart Love, Earth® brand is a demonstration project of how the different parts of the supply chain can work together to produce goods that are affordable yet responsible. The current project covers gold and silver that is traced from the mine to the retail and that meets Walmart's criteria on environment and social aspects. The project plans to include diamonds in the near future. Additionally, customers have the opportunity to learn on-line where their jewellery comes from and trace it back to the mine. (<http://www.walmart.com/cp/Love-Earth/1008379>)

3.4.1.13 CASM

The Communities and Small-scale Mining Initiative (CASM) started in 2001 as coordination and networking effort focusing on the challenges that Artisanal and Small Scale miners face regarding environmental and social issues. The World Bank a funding member –together with the UK, Japan, Canada, France and the US- has provided great assistance to this initiative as it looks to provide capacity building on the target groups. CASM currently priorities include developing countries in Asia and Africa. The initiative's main tasks are:

- Seek for ASM mitigation strategies for environmental impacts
- Provide guidance materials for artisanal miners in environment, health and safety topics.
- Raise awareness
- Augment implementation of policies and practices in line with its values by its member states and agencies.

(<http://www.artisanalmining.org/casm/>)

3.4.1.14 Global Reporting Initiative (GRI)

The GRI is an organisation based on networks that has become world's largest used sustainability reporting framework. The organisation praisers to continuous improvement of its framework. Among its core goals is the disclosure of its members' environmental, social and governance performance. (<http://www.globalreporting.org/Home>)

The framework development process is done through a multi-stakeholder process by consensus seeking. The Initiative includes principles and performance indicators that members use for their reports on their economic, social and environmental performance of their operations. The framework itself relies in a group of guidelines that are used to demonstrate institutional commitment to the principles of sustainable development by providing a unified and standardised approach for organisational reporting. In addition, the GRI works in conjunction with UNEP and over 500 organisational stakeholders from 55 countries.

This Mining and Metals Sector initiative supplement was developed in 2010 by including over 94 stockholders and actors that represent the broad spectrum of interests in the industry. The guidelines include the following aspects, which we also explore in the Best Practice Chapter:

- Biodiversity

- Emissions, effluents and waste
- Labour
- Indigenous rights
- Community
- Artisanal and small-scale mining
- Resettlement
- Closure planning
- Materials stewardship

3.4.1.15 Green Mining Initiative – Canada

This initiative started in 2009 with the aim to improve the mining sector's environmental performance and create green-business opportunities for Canadian companies by incorporating a life-cycle approach. The initiative aims to remediate and protect the environment, promote the use of best available technologies for resource extraction, processing and environmental reclamation. The GMI lies on four research pillars:

- Reduction of the footprint
- Innovative waste management
- Risk management for ecosystems
- Mine closure and rehabilitation

Also, the initiative pretends to cover issues for tailings, mining in northern areas and climate change. The sector considers that through innovative technical solutions a sustainable mining development can be reached, reduce production costs, improve the added value of their processes and protect people's health, safety and the environment.

(<http://www.nrcan.gc.ca/com/>)

3.4.2 Initiatives in other commodities

The following is a brief review on other commodities that have been differentiated, I will consider the green energy markets, the sustainable forest certification scheme, coffee – ecolabels and specialty coffees-. What is in common in these labels and certification schemes is how Reinhardt's three conditions apply to them and therefore is the reason of their success. Additionally I have decided to include the case of the brewing industry in the US as an example of product differentiation by the use of advertising.

3.4.2.1 Green Energy labels

In energy markets there have been three kinds of differentiated products designated (Clean-e, 2006):

- Consumption based products: In this category customers agreed with the suppliers to be provided with electricity that was generated in facilities with good environmental practices. As it is impossible for the supplier to actually transport green electrons to the consumer, what is done is that the producer is certified on the amount of green

electricity produced and that is supplied to the green consumer. Thus, the system relies on a clear legal framework for consumers, producers and retailers.

- Investment based products: in this scheme, the consumers gain property rights over an environmentally sound project, a fundamental requisite of the certification. As new investors, they share both the profits and the risks of the project.
- Contribution based products: this product works as a donation from the customer to the producer in order to support new developments on environmentally sound projects. Additionally, the consumer has neither guarantee that the electricity he is consuming is green nor property rights over the electricity.

These schemes have been used in Europe through many labels, and have been fairly successful in the Netherlands where more green electricity is consumed than the one nationally produced and in Sweden (Clean-e, 2006) leaving room for further improvement in the other countries. Nevertheless, the labels face some scepticism as consumers fail to recognise the difference between labelled and not labelled energy.

3.4.2.2 Forestry

The certification scheme for the forestry industry emerged as a response to the public controversy over deforestation around the world. The new institutions that came out claimed to reduce exploitation and reward responsible firms through voluntary schemes, monitoring of production sites, certification of participants and providing transparency to consumers (Bartley 2003).

In 1993, the Forestry Stewardship Council (FSC) emerged amid of tropical deforestation and started labelling well-managed forests according to fulfilment a group of standards and rules. This market-based tool provides traceability of the forest products that are harvested through sustainable and responsible practices, meeting the FSC principles on social, economic, cultural, ecological and spiritual needs of the communities.

The FSC has three main activities:

- Setting standards for the industry.
- Managing the Accreditation program.
- Maintaining the Trademark

Additionally, the FSC's vision is to provide added value to the industry rewarding sustainable sound practices by providing a system based on consensus between the North and the South. (<http://www.fsc.org/>)

3.4.2.3 Fisheries

The Marine Stewardship Council (MSC) is the leading institution for labelling and certification of best practices in the fishing industry according to the sustainability principles. The organisation's aim is to use its ecolabel and certification programmes to contribute to a healthier and better ocean environment by providing a market incentive for the industry.

The organisation works in conjunction with seafood companies, scientists, fisheries, NGOs and the general public to promote a better choice on seafood. Currently 7% of global catch is certified by the MSC. The scheme as its name indicates is a stewardship project that provides traceability along the supply chain for seafood. In addition, the organisation works with large retailers and seafood producers to help them move towards a sustainable management of the resource. (<http://www.msc.org/>)

3.4.2.4 Coffee

In the case of coffee, I have decided to include the following four labels that differentiate coffee addressing sustainability issues. The purpose is to illustrate that competition, complementarity and competition exists outside the mining and metals industry. In addition, coffee is the second most traded commodity after oil.

3.4.2.4.1 Fair Trade Certified

The FairTrade organisation promotes better conditions for producers in developing countries by providing better prices, market access and assistance to meet better environmental performance all this with a stewardship product approach. Additionally, they provide a price floor-shielding producers from the unpredictability of the market, thus securing a price for producers that covers their production costs. The price premium is as follows:

- Producers are paid a floor price of USD\$1,25 per pound for Fairtrade certified washed Arabica and USD\$1,20 for unwashed Arabica, or the market price, if higher.
- For organic coffee there is an extra premium of USD\$0,20 per pound.
- A US\$10 cents per pound premium is added to the final price and used for economic and social investments.
- There is a line of credit that finances up to 60% of the purchase price.

(<http://www.fairtradecoffee.org/>)

3.4.2.4.2 Rainforest Alliance

The Rainforest Alliance (RA) label has the mandate to join together community development, biodiversity conservation, human rights and sustainable farming practices. The RA praises to be traceable from roaster to producer and works with the farmers to help them reducing costs, improve crops, manage natural resources and protect the environment, and capacity building so farmers learn how to negotiate and cope with the globalisation demands. Currently, 1.3% of world's coffee is certified under this scheme with over \$1 billion sales. Moreover, the RA scheme promotes native leafy canopy shaded coffee that in turn provides a good wildlife habitat, limit soil erosion and water pollution.

(<http://www.rainforest-alliance.org/>)

3.4.2.4.3 Smithsonian Bird-Friendly (Shade-Grown)

In year 2000, the Smithsonian Migratory Bird Centre created a new certification scheme: Shade-Grown coffee. Just as the RA label, the Shade-Grown coffee initiative promotes sustainable practices and recognises the advantages of growing coffee through the traditional practices that provide habitat for a great number of species. Additionally the coffee has to

meet organic standards, certain conditions of the canopy and foliage and a required number of bird species. Furthermore, the Shade-Grown coffee provides a price premium of USD\$0.05-0.10 per pound. Additionally, the initiative claims that the taste of Shade-Grown coffee has a richer flavour and provides a better and healthier environment for workers and communities.

(<http://nationalzoo.si.edu/scbi/migratorybirds/coffee/default.cfm>)

3.4.2.4.4 Utz Certified

This label was created to award responsible coffee producers and roasters and to meet the demand for responsible practices along the supply chain. The name of the organisation comes from the words *utzkapel'in* Quichú –Mayan language- that mean good coffee, later the organisation started to certify other products, hence keeping only the first part of the phrase.

The price premium for Utz is agreed upon the market price of the commodity and is determined by a negotiation process between the seller and the buyer where Utz does not interfere. The price premium is around USD\$0.05 per pound for Arabica and USD\$50 per metric ton for Robusta.

(<http://www.utzcertified.org/>)

3.4.2.4.5 Specialty coffees

Most of the literature that I have reviewed focuses on fresh produce and food-related commodities where through market segmentation and horizontal product differentiation by product innovation, location and ecolabels (Jaffry et al. 2010, Manuszak 2010, Olesen et al., 2010, Hingley and Sodano, 2010); therefore I have selected the interesting case of coffee vertical product differentiation that I will describe below.

Coffee is widely recognised as a differentiated commodity like cheese and wine (Beaver, 2006). The variability of coffee is related to the different altitude and rainfall circumstances where it is grown and the cultivation and processing methods (Donnet et al., 2010). The concept of ‘coffee specialty’ was first developed by the Norwegian coffee connoisseur Erna Knutsen in 1978 (Holly, 2010) where the different microclimates produce coffee beans with unique flavour qualities. The industry started differentiating its products when small roasters started to capture the demand of consumers that appreciated the ‘specialty’ of coffee. The quality of the coffee is graded through an evaluation of sensory attributes and is compiled in quality rating. How these attributes pose value is completely empirical and depends on consumers’ preferences (Ponte, 2002). Therefore, measuring differentiation is a key aspect in the case of products that show many attributes.

In the specialty coffee supply chain roasters are the chain leaders, as they define the quality and link both ends of the chain. They match specialty beans with roasts, where the quality rating works as a tool of product differentiation. The rating system works as a common language that allows comparison between different products. Coffee is assessed through a

sensory quality process done by expert tasters creating a vertical differentiation system (Ponte, 2002).

The success of the system relies on a few key pillars. Traceability of product information through the supply chain, reliability of the rating system for quality and how information is presented to consumers (Ponte, 2002) are key aspects of the coffee rating system, in the same fashion a rating scheme for metals would require the same pillars. Interestingly enough, consumers in the coffee market do not necessarily need to know the difference between two types of specialty coffee; simply they follow what the panel has decided, this experience may be interesting for the metal commodity market.

3.4.2.5 Brewing industry

The case of beer that I outline here is also not a case of sustainability or environmental differentiation, rather it is an example of differentiation from the point of view of advertisement, that is, how information is presented to consumers and how consumers start perceiving differences between two perfect substitutes and prefer one over the other.

Douglas F. Greer (1971) tries to explain how a few firms started to concentrate market power in a period of thirty years, starting from a competitive market to an oligopoly. He finds that through advertising and the rapid growth of television as new means of entertainment and campaigning scenario, companies took advantage and started investing heavily in advertising campaigns. Moreover, he finds a curvilinear correlation of advertisement expenditures and market concentration. Additionally, the market concentration also led to economies of scale in production, allowing firms to reduce their production costs and increase their competitiveness by creating smaller and more locally focused production and distribution centres.

Finally, what is important from this case is how a commodity can be not only differentiated but how the perception of consumers can be changed on a certain product in order for them to prefer it, for our case on sustainability this means that awareness campaigns can also have the same effect on consumers and raise their expectations for sustainably sound products.

4 Reflections on Luxury Products

The following analysis on luxury products has taken shape thanks to the Idea of Luxury: A Conceptual and Historical Investigation (Berry, 1994) that provides us with a theoretical framework on luxury goods, thus in the following paragraphs I intend to describe, summarise and analyse this work looking at it from a sustainability perspective.

I have chosen to use this categories for two reasons, first to have an understanding on why consumers 'care' more for certain goods than for others, and secondly because the dynamism -constant change through time- of this category allows me to link it to the interesting concept of disruptive innovation. Additionally, this category of goods poses a promising answer to when can sustainability differentiated products ask for a price premium and improve the sustainability performance of the supply chains that derive from them.

From the consumer behaviour perspective, what I here call 'care' corresponds to the motivations towards luxury described by Vigneron and Johnson (1999) that without going further into it, include: materialism, uniqueness, hedonism, and perfectionism, as the reasons why consumers seek to have luxury goods. Therefore, this is why this category gives us the opportunity to explore into a category that has not been widely addressed from the sustainability product differentiation point of view yet helps us understand the success or failure of differentiation for the commodities, specifically for the metal and mining's sectors.

It is important that we first proceed to define what luxury goods are. There are certain qualities that define whether a good is a luxury or not and are related to how we *feel* with certain products. The first condition is that there has to be a collective desire for the good and a positive pleasure derived from the good, taking into account that there is an important cultural aspect embedded into what a group people desire, this means that a large part of the consumer world would experience some pleasant sensation by having or using the product, hence consumer *desire* the product. This *desire* for the good has to be understood in terms of wants and not needs, as wants are intentional of individuals while needs are part of the human condition per se. For instance the need and want for food are different in essence as one refers to the basic general constants of human life, the latter implies a pursuit of a particular desire, a particularisation or personalisation of the need.

The second condition is that luxury goods are highly refined goods in their product category. The refinement is culturally-subjective and qualitative, and itself is a never-ending process; there can be as many variables as one wishes to use and how our sense interact with it, a better way to understand this is by imagining the infinite combinations of a certain object interacts with our senses and our preferences providing us, in the case of luxury goods, a pleasing sensation. To exemplify refinement think of a mobile phone, it has to have a set of characteristics in order to be luxurious, think of all the applications, capabilities, functions and design that the latest high-end mobile phone has.

The perception of luxury is dynamic through time and evolves accordingly to cultural change; this dynamism is what makes refrigerators turn from luxuries to common kitchen appliances and that sustainable wood furniture is the norm in Scandinavia from being a luxury at some point. Products start turning from wants to needs when they are socially and culturally perceived as needs, even though globalisation is making needs more homogenous

as more people look-up to the American middle class, we can still find many differences and even talk about the relativity of poverty, this relativity is relevant in the sense that we can understand how through socio-cultural changes *wants* turn into *needs*. If we compare low-income families from rich and poor nations we will find that the *needs* and *wants* are completely different, and from what one family, or society, is a *want* for another can be a *need*, this is the case of gas for cooking and heating, a refrigerator, a car and so on making poverty relative in terms of deprivation (Berry, 1994). Finally, we can say that *needs* are a dynamic-social process of transforming what us as individuals *want* and what collectively we see as needed to pursue a successful and acceptable life. A simpler way to see it, is that everyone has needs, and everyone has desires, however through time changes in many socio-economical, scientific, cultural and industrial aspects that make luxuries affordable for the majority of people they are no longer luxuries but part of everyone's daily lives.

The next reflection that I want to take into consideration is that luxury is about *pleasure*. The concept of luxury as we explained above is product of a mass desire for a product derived from the general *pleasure* that is felt when owning or using the product. This pleasure is nothing else than related to our sensory system together with the emotional link we create with our surroundings (Berry, 1994), it is how we perceive that certain products have added value if they are man crafts, are bought at a special place, with someone or for someone. The case of engagement jewellery is a clear example where the added value comes from the promise of lifetime commitment and creates an emotional bond with the product. In some products the emotional link comes from the idea of luxury itself, the brand and what it represents, as we will see below it is about prestige and uniqueness.

For certain products, what we understand as luxury corresponds to what the product represents, not what it is, and it is related to how the information is presented to consumers. Some products of what today we consider luxury brands do not strictly follow the definition of luxury described above and therefore they are not luxury products, yet we associate them with luxury. A way to understand this is by going back to two of the four –materialism and uniqueness- motivations on consumer behaviour outlined before that led to the creation of luxury brands. This is referring to those product brands that are not the most refined of their product category, yet consumers perceive them as luxury. Those physical products are the means of selling the idea of a luxurious life, a life that is full with luxury products and that only a *few* can enjoy. This is achieved by some brands that have differentiated their products through time by quality and have gained market power and today consumers associate them with luxury (Thomas, 2007). These brands segment their markets having lower-priced and higher-priced goods; the lower-priced are expensive but still affordable for the majority of people who wish they could have a life full of luxury. Having an affordable version of luxury is these luxury brands' market strategy. It is also important to remark that highly priced products do not necessarily mean they are a luxury, high priced could be related to many things however one has to keep in mind the desirability and refinement concepts.

Going back to Berry's work, he proposes a framework with four categories where we can classify products that can be called luxury: shelter, sustenance, clothing and leisure. These four categories are very broad and most of the products fit in them, as they are what he claims to be the basic humans needs, he also leaves out other types of needs that are not physical and calls them 'mental needs', as well as health products, for the purpose of this work I will continue with Berry's scoping.

The first category of shelter exemplifies the link between luxury and comfort; this category goes way beyond from protecting us from weather conditions to the extensive universe of

refined products. The easiest way to see this category in reality is if we have a look inside each of the rooms of a house, the existence of certain appliances such as: lamps, microwave, dishwasher, satellite dish; furniture pieces as beds, tables, sofas and so on; ornaments such as paintings, vases, wallpapers; and sanitary equipment that were at some point luxury products and that today provide us with a level of basic comfort. Going further, each of these items can be further refined and be the best in their own category for example certain type of drapes, sound systems, and so on.

The second category of sustenance encompasses food and drinks, but goes beyond what our basic needs are to what we want and desire and as outlined before. It is easy to imagine the vast number of products that we can find in this category and that today we consider luxury for instance one can choose between having Dom Pérignon or beer.

The next category corresponds to clothing; this category unlike the previous ones it has a different approach as there is a strong sense of cultural heterogeneity in it and clear way to see this is how local fashion varies through the world and the presence of fashion subcultures and styles. One can clearly see that not everywhere the products of luxury brands and *haute couture* share the same desirability, there are many factors that influence it such as genetic variability among the different human populations, cultural, political and economical variables that make hard to create a one size fits all or commoditisation of luxury clothes. Yet in the case of jewellery the desirability is more widespread across the globe.

The fourth and final category is leisure, here Berry distinguishes them from residual activities, which are not included in the previous ones, by remarking that these activities are as important to people as all the other ones and that leisure is an important part of human needs. Leisure is a historical trait of human life; we can find it in rituals, celebrations and games shared in many different cultures and in itself there is an universe of products available for people to enjoy their spare time. Today, we can find luxury in leisure in activities as simple as checking e-mails from an iPhone, watching a TV show on an LCD screen, play Nintendo Wii and so on.

These four categories and the concept of luxury is relevant for this study in two ways, first in the sense that most of today's luxury products have metallic parts and second in the sense that the products where we find successful labels and certification schemes are those that are or were, recently, luxury products. The idea behind this reasoning is that consumers create an emotional link –fetish- with these products therefore they are the products that matter to consumers, as they provide pleasure and satisfaction. The strong-wide desire for them makes them interesting targets to change the behaviour of consumers and practices of producers, as these are the products that 'matter'. These products are the ones that provide not only pleasure from having them; they are the representation of our consumer desires as a consumer society; they are the maximum (and current) expression of our needs, wants and desires and this is exactly why they are important from the point of view of sustainability and rapid change in practices throughout the industry. The rapid improvement is conditioned to how much these luxury products with improved sustainability manage to take a large share of the market and this is where I believe we need to introduce the work of Christiansen on disruptive innovation.

Finally, what is remarkable of these products both the disruptive and the ones that are not, is the inelasticity of their demand and the opportunity to use them as vehicles to improve sustainability in the industries that provide parts for them. For instance high-end luxury

mobile phones have many metallic parts, if those were sourced from sustainable supply chains there would be a drive to change practice in the industry. In the same way, products with a rapid market growth as in the case with tablets, those that are disruptive, if sourced from sustainable supply chains provide further incentive for firms to improve their practices with the assurance of rapid growth.

5 Mining Sustainability and Best Practice

5.1 Sustainability

The next section is a small discussion on how sustainability can be interpreted in the mining and metals context and that is of great importance to the development of this research as the recurrent reference to sustainable performance and improved sustainability. With this section we give an explanation on how resource extraction can be reconciled with conservation, environmental management, social and economic development, capacity building and infrastructure.

According to Christy and Potter (1961) the concept of sustainability comes from forestry, based on not harvesting more than what the forest yields. Throughout history, many communities worried about maintaining soil fertility and preys, these beliefs were in line with resource stewardship (Fukuyama, 2008); later these concerns were expressed by economist such as Malthus by expressing how mass starvation could happen as agriculture would be unable to cope with population growth. A few decades ago, a group of economist named the club of Rome (Meadows et al., 1972) expressed also their concerns on natural resource depletion that led to the Bruntland Commission's definition of sustainability: "development that meets the needs of the present without compromising the abilities of future generations to meet their own needs" (WCED, 1987)

Thus, sustainability is a matter of what resources between natural, environmental quality and capital are left for the future generations. The backbone of the concept is the interchangeability between capital and natural resource (Solow, 1992). However, there are authors that believe that capital cannot replace natural resources and conservation is essential for our survival (Daly, 1997). These two views of what sustainability is are clearly outlined by Pearce et al. (1989):

- That the next generation should inherit a stock of wealth, comprising man-made assets and environmental assets, no less than the stock inherited by the previous generation.
- That the next generation should inherit a stock of environmental assets no less than the stock inherited by the previous generation.

These two perspectives of what sustainability is, or should be, are called weak and strong sustainability, and have been centre of debate (Kuhlman and Farrington, 2010). Perhaps the most conciliatory way of addressing the issue is by understanding that certain resources fall into the former and others into the latter categories. For instance, a dam project that means flooding a valley area, where usually the lands are very productive, can be analysed from a weak sustainability point of view, as it will generate capital income from the energy produced and will provide electricity services to people. However, a project where deforesting a tropical forest to plant commercial trees cannot be analysed through weak sustainability's optics if there is biodiversity loss that due to its definitive nature, it cannot be recovered, therefore it has to be analysed with strong sustainability.

What we have to analyze then is how to set a boundary between what weak and strong sustainability. Strong sustainability sets the borders that must not be crossed, those that deal with our own life support, with ecosystems' functioning and with other variables that

threaten our survival as a species or other species. Perhaps the most adequate characteristic that has to be assessed of an ecosystem where the activity would take place is 'resilience' as it expresses how the behaviour of a system may be affected and what would take to restore it to its original state.

In this document I will use the following framework of weak sustainability taken from the Five Capitals Model (Peck, 2007), in order to be able to compare the different aspects of sustainability and how mining can be viewed as 'sustainable' from a point of view of weak sustainability. By saying this, I intentionally exclude those areas that are problematic for exploitation of resources and only include those that can be analysed through weak sustainability. Five types of capital constitute the framework:

- Financial capital: which includes all different types of financial assets such as currency, bonds, stocks and any other liquid medium or exchange operation that represents wealth.
- Manufactured capital: relates to all basic structures, facilities and products both public and private that are needed for other human activities to take place in a functional society.
- Human capital: encompasses all the skills, knowledge, competences, capabilities and aptitudes that are incorporated by people through education, training, self-learning, teaching and experience that allows people to produce goods.
- Social Capital: is the shared sympathy, individual or collective, for other people that may provide preferential treatment and benefits beyond the expect behaviour. It depends on the networks that individuals create and it allows lower transactions costs. (Robinson et al. 2002)
- Natural Capital: corresponds to all the environmental assets that produce goods or services in the present and in the future (Pearce and Turner 1990). It includes all the resources renewable, non-renewable and ecosystem's functions.

Therefore, what is expected from any mining project is that while the natural capital is depleted through the lifetime of the project, the manmade capitals grow providing financial capital in the form revenues and taxes for the country, salaries for the employees and show macro-economical stability reflected in lower costs of borrowing money; Manufactured capital in the form of infrastructure built by the government for transportation, education, utilities -energy, water, gas, heating-, health care and communications and industries associated with the extraction of the resource that provide higher added value to the metal; Human capital by having people with better education, skills and that are capable of performing economical activities related and unrelated to the mining project that will permit continuous growth when the mining project has come to an end; and finally, Social capital that is represented on people having shared values, having stronger social networks, sense of community, higher level of trust and being able to be a functional society through time.

5.2 Best practice

Throughout this document we have mentioned many times improving the metal industry's sustainability performance, the question then is what is the desired due care level. To answer this question we will take into consideration what best practice currently is in the industry by

looking into three initiatives that have been created through extensive research and dialogue with the different stakeholders. We will take into consideration documents from the Australian Leading Practice Sustainable Development Program for the Mining Industry (LPSD), the Global Reporting Initiative (GRI) for mining and metals, and the Canadian Towards Sustainable Mining guiding principles. I have selected this document based on UNEP (2011) report, with its subsequent analysis, on all the current initiatives in the sector. (<http://www.globalreporting.org/Home>)

What is key to this best practice section is that these are the aspects that we would expect to be included in current and future initiatives that deal with the broader concept of weak sustainability for mining and metals. In addition, not only these are the most complete in comparison with other initiatives, but leading companies in mining and sustainability also support them.

5.2.1 Global Reporting Initiative

The GRI is an organisation that provides guidance to other organisations on disclosing their environmental, social and governance performance on sustainability reports. This initiative includes a series of general and specific key performance indicators for the metal and mining industry. The GRI has split sustainability performance into environment, economic, labour practices and decent work, human rights, society performance, and product responsibility categories, in each of them the GRI defines a series of indicators on what should be measured and reported in the sustainability report. The GRI is not a best practice initiative, what is interesting from it, is how it incorporates aspects of sustainability that are neglected by the other best practice initiatives –such as economic aspects- and through its indicators it is possible to assess whether a firm’s activities are having a positive or a negative social and environmental impact. The table below is a summary of the different aspects included in the five categories of Environment, Economic, Labour Practices and Decent Work, Human Rights, Society and Products Responsibility. I have decided to use these categories to classify the Australian Leading Practice Sustainable Development Program and the Canadian Towards Sustainable Mining initiatives’ aspects.

Table 5-1 ‘GRI Sustainability Aspects Summary’

Environment	Economic	Labour Practices and Decent work	Human Rights	Society	Product Responsibility
Materials	Economic performance	Employment	Investment and Procurement Practices	Community	Materials Stewardship
Energy	Market presence	Labour/Management Relations	Non-discrimination	Artisanal and small-scale mining	Customer Health and Safety
Water		Occupational Health and Safety	Freedom of Association and Collective	Resettlement	Product and Service Labelling
Biodiversity		Diversity and Equal Opportunity	Child Labour	Closure Planning	Marketing Communications
Emissions, effluents and waste			Forced and Compulsory Labour	Corruption	Compliance

Products and services			Security Practices	Public Policy	
Compliance			Indigenous Rights	Anti-competitive behaviour	
Transport				Compliance	
Overall expenditures					

5.2.2 Australian Leading Practice Sustainable Development Program for the Mining Industry

This governmental initiative was launched in 2006 as a support for the Australian minerals industry. This program is in line with the objectives of Australia’s mining industry framework for sustainable development.

The program promotes industry’s self-regulation and has three main objectives:

- Inform: provide reliable information on leading practices in sustainable development to build capacity in the industry and support for those interested in it.
- Influence: promote commitment to leading practices from key organisations such as mining companies, governmental agencies, industrial associations, and contractors.
- Implement: seek implementation of leading practices at the operational level by the local management teams and those related to the mining operation.

(<http://www.ret.gov.au/resources/Pages/Resources.aspx>)

Table 5-2 ‘Australian LPSD aspects summary’

Environment	Labour Practices and Decent work	Human Rights	Society	Product Responsibility
Mine Rehabilitation	Hazardous Materials	Working with Indigenous Communities	Community Engagement and Development	Stewardship
Mine Closure and Completion	Risk Assessment and Management			
Biodiversity Management				
Managing Acid and Metalliferous Drainage				

Tailings Management				
Water Management				
Cyanide Management				
Airborne Contaminants				
Monitoring and auditing				

5.2.3 Canadian Towards Sustainable Mining

The Canadian Towards Sustainable Mining guiding principles are set of indicators that backed by a series of protocols in each of the aspect areas listed below. The indicators provide transparency to the general public and interest groups of the current practices of Canadian mining companies and how they can improve. Currently there are performance indicators for tailings management, energy management, external outreach and crisis communications management with their respective protocols. The additional performance indicators regarding issues such as mine closure, water and mining are under development.

Table 5-3 'Canadian Towards Sustainable Mining aspects summary'

Environment	Labour Practices and Decent work	Human Rights
Crisis Management	Safety and health	Aboriginal and Community Outreach
Energy and Greenhouse Gas Emissions Management		
Tailings Management		
Biodiversity Conservation Management		
Mine Closure (Under Development)		
Water and Mining (Under Development)		

Without going deep into of these three initiatives, it is clear that *good* sustainability performance must address all three realms of environment, economic and social performance. Thus, it must minimise the environmental burden and the resource use, it must provide revenues in the form of salaries and spending on the local economy, it must provide a decent work place and good labour practices, it must address human rights of the people involved and affected by the operations, it must help strengthen local, regional and national society and have responsibility over the supply chains that derive from it. All these guidelines and principles go in line with our previous discussion on weak sustainability and its five capitals. Also, it is important to note that best practice solutions are locally bound and should fit into the context where the operations take place.

http://www.mining.ca/www/Towards_Sustaining_Mining/index.php

6 Institutional Theory for Product Differentiation

Looking at all the different initiatives that have been created in the past years, it becomes clear that they include all sorts of associations and non-governmental organisations (UNEP 2011), and that wide ranges of areas are addressed. Within such developments, one can see the emergence and rapid growth of new organisations creating labels and certification programmes, encouraging adherence to standards and codes, and promoting reporting and transparency in the metal sector. This organisational boom reflects the activities of institutional entrepreneurs whose interests for better environmental and social performance by firms are beginning to collude and use their resources to create new institutions in the forms of new regimes, certification bodies, labels and stewardship programmes; or attempt to reform current ones, such as mining companies, mining associations and governmental policies (Maguire, Hardy & Lawrence, 2004). These concepts of institutional change can be viewed through a lens provided by DiMaggio (1988) work on institutional theory where he argued that new institutions are created when “organised actors with sufficient resources see in them an opportunity to realise interests that they value highly” this can be seen within the case of rising of the private regulation of mining initiatives worldwide.

From the institutional point of view, Oliver (1998) gives us an explanation as well on why firms may pursue decisions that do not immediately seem to meet the economical rationality of profit maximisation. Such may include making green investments and changing practices towards sustainability where some actors hold that they provide returns and have economical rationality (Oliver, 1998), yet firms do not necessarily implement them. The reasons for this behaviour varies from firms being captive of their own history, sunk cognitive costs, cultural support for certain type of investments, unwillingness to imitate other firms behaviour to social influences (Oliver, 1998). Sunk cognitive costs pose a great challenge within organisations as they are the costs associated with the habits and customs that prevent firms from achieving profit maximisation strategies, for instance decisions that involve leaving routines, anticipate change that leads to insecurity and when change violates institutional norms (Amit and Schoemaker 1993). Thus, the role of non-economical decisions within mining companies to address -or not- sustainability issues are of great importance. The high specialisation level of the industry demands for highly skilled, specialised and experienced work force, hence giving ground for firms to not necessarily go for profit-maximising strategies; this could provide some explanation on why some firms do not adhere to -or pursue- leading practices or voluntary initiatives and schemes. As we shall see next, self-regulation institutions have risen as a way to move firms towards sustainability.

Self-regulation

In recent decades, two important developments have changed the national and international policy-making process, first is the use of policy tools where the authority is shared or given to private organizations or interest groups (Clapp, 1998; Coleman and Perl, 1999) and second the increasing use of market based instruments to change behaviour of actors (Bernstein, 2001) Effective solution of environmental problems may require a “middle way between government relations and laissez-faire prescriptions” (Rees, 1997) Institutions that are self-regulating, self enforcing, self governed are of great interest from a policy point of view. Private and soft regulation schemes and initiatives are part of a new approach of environmental policymaking (Bernstein, 2001) and have risen as a new group of institutions to help improving industrial practices. Such new schemes come not from governments but from interest groups that look to target firm-level decisions, thus bypassing governmental

regulation (Cashore, 2002). Also, they pose an opportunity to overcome the challenge of global governance and global trade barriers, where one country's regulatory standards cannot be applied to another country and where environmental regulation has been seen as a barrier to globalisation (Vogel, 1997); and they provide a voluntary regulatory framework enhancing the governmental policymaking process (Cashore, 2002; Haufler, 2001). These new systems go beyond scope of industrial self-regulation towards international self-regulation schemes, in which groups of non-state actors "codify, monitor, and in some cases certify firms" (Bartley 2007) in compliance with environmental, social and governance practices. Due to the globalisation of supply chains and the lack of regulatory capacity in the international arena new governance systems are arising (Fligstein 2005; Kahler and Lake 2003; Sassen 1996).

In the mining industry, a clear example of transnational private regulation is the Cyanide Code for gold mining where firms voluntarily adhere to have a responsible management of cyanide enhancing protection of human health and minimizing the potential for environmental impacts. Firms that become part of the scheme, agree to be audited by an independent body to demonstrate their compliance with the Code's practices. Additionally, the results from the audits are made public to inform stakeholders about the cyanide management practices of the firms. Another relevant example is the Green Lead project, which is based on the idea of responsible life cycle management. The programme works as a stewardship programme for the companies that adhere to its procedures, in return they get certified together with the products they produce or handle. In general terms, any private regulatory scheme that firms adopt in a voluntary basis is eligible for this classification as long as it incorporates the idea of supranational compliance.

Private regulator institutions, as other institutions, have three basic pillars (Scott 1995): Regulative, Normative and Cognitive and certification and labelling are not exempted. As Scott (1995) argued, the regulative aspects take the form of regulations, they provide guidance and coercion or threat of sanctions, in the case of private regulation it means that firms may lose the certification, label or be left out of the organisation. Usually this happens after repeated non-compliances with the regulatory body's principles. Normative aspects are the manuals, principles, standards and procedures that are created as backbone of the regulatory body and are intended to be followed by the firms that subscribe to the regulatory system. The Cognitive aspects correspond to those cultural aspects of the organisation, of how the regulatory body communicates and how societal values influence it.

The following analysis on private regulation institutions is based on Cashore's (2002) work based on the experience of the private regulation mechanisms for sustainable wood. In this work, Cashore (2002) outlines a set of characteristics for private regulation schemes from sustainable wood perspective, this is relevant to our study in the sense that both metals and wood are commodities, and wood is also a successful case of sustainability product differentiation for a commodity.

Private regulation characteristics of non-state market driven (NSMD):

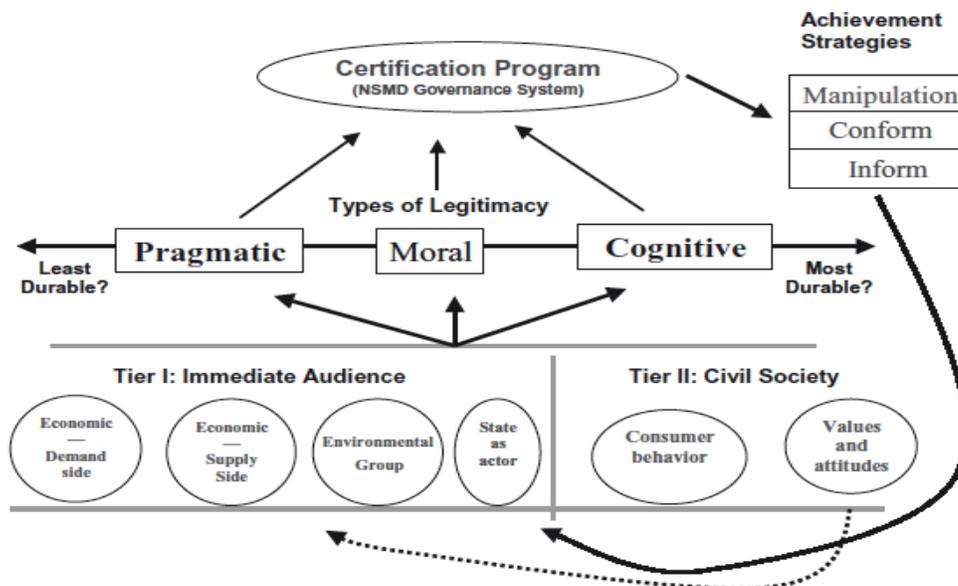
- Role of the market: there has to be a demand for the products that are being differentiated through the supply chain.
- Role of the state: the state has no authority to enforce the rules.
- Role of stockholders and society: they grant the authority to the private regulation body (by mechanisms we will explore further on).

- Enforcement: compliance has to be verified, there has to be some form of coercion and the government has no authority whatsoever to intervene.

Role of the government in private regulation

Governments can act in two ways, it can be consistent with the regulatory scheme or it can go against it, consistency means that the government provides a backbone regulation that permits a functional society with laws and regulations that protect and grant the basic rights and liberties. The government can work as an interest-group and pursue market creation or playing field leveling strategies – for example by the creation of procurement policies to source materials that are under the private regulatory schemes. According to this model, if the government forces compliance or adherence to the scheme then it is said that it is going against the private regulation dynamics as the concept behind it is that it is opposite to command and control policy tools.

FIGURE 1
Legitimacy-Granting Model for NSMD Governance Systems



Source: Adapted from Suchman.

Figure 6-1 Legitimacy Granting Model for Non-State Market Driven Governance Systems. Taken from Cashore's (2002) adaptation from Suchman.

Coercion and Legitimacy

Authority to the private regulation scheme is granted by external audiences by economic benefits, moral persuasion or because it has become the standard norm across the industry. In Cashore's model, he divides the "external audiences" (DiMaggio and Powell, 1991) into four groups of stakeholders: the state, social interests (NGOs, media, labour groups), supply-

side (firms that are under the scheme's regulations) and demand-side interests (markets, people, businesses along the supply chain that pressure firms to adopt the scheme). Then he divides audiences into Tier I and II, the former has direct interest on the organization's policies and practices that they legitimate, while the latter is the civil society that has a more indirect effect yet important in the light of legitimacy. Tier I for our case could include mining industry associations, companies, environmental and human right groups, the banking sector and downstream businesses that purchase metals. Tier II audiences are characterized by the values and behaviour of the society (Frizzell, 1997) and their choices as consumers.

Finally for the scheme to be legitimate and ensure that praises the values it stands for, there has to be a verification procedure that allows reviewing the practices in the firms involved in the scheme (Cashore, 2002). The stringency of the verification scheme creates a negotiation process between the different stakeholders that demand for different levels of astringency. Verification is of great importance for product differentiation, on it relies the credibility of the private regulation scheme and provides the basis for legitimacy. Moreover, legitimacy can be split into three categories: it can be pragmatic in the sense that it comes from self interest, can be moral if it follows society's objectives or it can be cognitive which means that values that approve certain practices and behaviours are widely established (Suchman, 1995).

Furthermore, Cashore proposes three types of strategies that are used to actively achieve legitimacy: (1) through conforming the external audience, that for our case represents those institutions that approach and interact directly with the audience to understand their needs, principles and ideas –i.e. NGOs, community boards, etc.-; (2) manipulating by managing the wants and desires, in the sense of promoting standards and change in the targeted institutions –i.e. advertisement and marketing-; (3) informing by expressing the ideas and facts to other Tier I audiences and explaining how that follows societal values and concerns – i.e. awareness and education campaigns-.

In industry, self-regulation mechanisms happen when firms join together to avoid a common threat or to provide a common good, perhaps engage in these ventures is a reaction of external pressure from various stakeholders. As well as industries interest to avoid tougher standards as a consequence from a few poor performers. Thus, firms join together to solve common issue. (King, 1999). This is the case in the mining industry with the ICMM that seeks to boost trust in the general public for resource extraction industries and be able to 'acquire' a social license to operate.

The effectiveness of self-regulation does not rely strictly in its coercive power; as penalties and sanctions are usually not explicit. However one can still control the shape the behaviour of organizations (Gunningham, 1995). Coercion can be achieved through informal mechanisms as shaming and public exposure (Braithwaite, 1989). This is the case of the many NGOs exposing bad behaviour as we reviewed in the justification chapter. Furthermore, self-regulation can support new values and practices leading to transfer of best practices and allow better overall performance (Kraatz, 1998). In this context, mimicry plays an important role in getting other firms to attain the same behaviour as a consequence of the social networks created through the self-regulating institutions by giving ground for horizontal transfer of information, values, norms and practices between companies.

Moreover, private regulation mechanisms are dependent on the adherence of many stockholders to gain legitimacy (Ponte, 2002). In order to meet the standards companies must implement different policies, training and technological changes. However, from the

institutional perspective differences arise as the 'institutional isolating' mechanisms are present and pose barriers to meet the regulation schemes. This institutional isolation refers to barriers to imitation that exist within organisations and that help them maintain their competitive advantage, for instance skills, knowledge and capabilities (Reed and DeFillippi, 1990). Also, these mechanisms can be involuntary or exogenous, for example when stakeholders exert pressure on a firm thus pushing the firms to make decisions, for instance we saw previously on the justification where different stakeholder groups influence on whether mining firms may or not operate and under what circumstances they could.

The previous analysis on firms' behaviour provides us with a basic understanding of the mining industry's decisions. The question then is what happens on the firm level, institutional theorists argue that organisations in the same industry tend towards similar forms through time as they are exposed to the same influences and marked by common relationships of knowledge and understandings, thus giving rise to homogeneity in structures and strategies (DiMaggio and Powell, 1991). This can be seen in associations as the International Council for Mining and Metals where the largest firms and associations in the mining business got together to create a common organisation for performance improvement, improved reputation and subsequently reduce reputational risk (<http://www.icmm.com/>).

Therefore, we could expect to have some homogeneity among firms in and out of the associations and initiatives, yet in the same sense as we discussed previously the different institutional barriers within firms make some firms more proactive in adopting new practices than others. It is important to keep in mind that mining firms usually do not interact with final consumers, and their products are raw materials for other industries. Therefore, for the bulk of the mining industry, the need for product innovation is not an important driver, in contrast with process innovation as there is a need to achieve product differentiation through cost leadership and obtain higher profit margins, for instance they have continuously dropped in grade of ore body metal concentration. Contrary to the larger miners, in smaller mining companies and artisanal mining the cost of production is higher as they have not necessarily reached economies of scale and run on lower profit margins. Thus, these companies are in a weak power relationship with the buyer, which is likely to make the companies be bold and innovative with their products in order to increment their profit margins.

Finally, what is important from the institutional theory to keep in mind for our case of sustainability product differentiation is that (1) there are barriers within firms that make them fall behind what is expected from the industry in terms of sustainable performance hindering the reputation of the industry as a whole, (2) private regulation schemes are an extraordinary policy instrument that elicits firms to comply with tougher standards and present an opportunity to move towards the sustainable mining goal, (3) the supranational regulatory capacity of these institutional frameworks make them an exceptional instrument to achieve compliance in places of weak governance or loose regulation, (4) the coercion of the private regulation mechanisms work supranationally and the risk to reputation for companies has increased with the communication systems that make information available for everyone to access, and finally, (5) the success or failure of the scheme relies on the legitimacy of the scheme and how it maintains its status quo.

7 Analysis

The primary goal of the paper was to examine the issue of how sustainability performance may provide opportunities for product differentiation for metal commodities. This analysis addressed both current circumstances and directions for the future. In the next pages we shall analyse how this work finds that sustainability performance can be used to differentiate metal commodities through the lens of product differentiation.

This work has analysed both ends of the product chain, first we looked at what firms in the mining and metals sector have among their activities and what is defined as best practice; without going deeply into supply chains dynamics we have also examined a number of issues related to differentiation in final products. In particular, this part of the analysis looked into luxury product framework, additionally we have stepped outside the supply chain into the private regulation field and examined how it can be a reliable and legitimate source of information for consumers and what practicalities and conditions are needed for it to be functional in the context of product differentiation.

The lens of product differentiation

Product differentiation is a value making strategy, where by the distinction of one product among of a group of -often- perfect substitutes firms seek to ask for a price premium. If successful, the elasticity of the demand changes and consumers prefer the differentiated good, providing the firm with market power. This provides the ability to set prices, and as a result gives firms profits in the longer-term. This economic rationale is what pushes firms to be innovative both in the creation of new products and in the way they sell them to consumers or to business consumers. The theory behind the differentiation of products tells us that we can have products that are vertically or horizontally differentiated, -the relevant strategy depends on the characteristics of the product and on the information that is presented to the consumer.

The analysis framework for this research - selected sustainability differentiation for products as a strategy for firms to differentiate their products- was derived by adaptation of Reinhardt's environmental product differentiation conditions. The following were applied in this analysis:

4. The product must find, or create, a willingness among consumers to pay x sustainability.
5. The firm must establish credible information and evidence of demonstrable performance about functions and other attributes of the product.
6. The innovation embedded in the product, or in the performance of the firm, or both, must be defensible against imitation by competitors.

This framework applies to any consumer products making the words of sustainability –or environment- interchangeable for any characteristic that the firm wants to differentiate the products on. Additionally, each of the conditions must be fulfilled in order to attain product differentiation.

Information

The first observation that should be made is on the *information* in product differentiation. The use of information is key to hold a successful strategy and in the case of mining and metals it goes beyond pricing, it is the data that let us know how a certain product is produced and which aspects can be highlighted in order to make consumers prefer it. Also, this is one of the reasons why firms invest heavily on advertising campaigns, as we saw in the case of breweries the success on differentiating the product and the growth relied on the investment in advertisement. The display of information incites consumers to buy products by making them realise what needs have not yet been satisfied, let them know why certain product is better and challenges them into questions of morality of the goods that they consume. On the consumer side, they need to clearly understand the reliability, legitimacy and credibility of the information presented in any case. Furthermore, the readiness of information that consumers have today allows them to challenge the credibility of the institutions turning transparency and credibility key aspects.

Differentiation in metals

As was established in the review of literature enfolding, activities within selected sectors, commodities can be differentiated. In the case of metals the uniqueness of the production processes at each mine site with its own particular socio-economical, political and environmental conditions –all aspects of sustainability- indicates that there is room for sustainable product differentiation utilising both horizontal strategies, as we already see in the many initiatives, and via vertical strategies. However, vertical differentiation in the sector is still incipient with only a couple of initiatives having started to rate sustainability or some of its aspects. From the two projects reviewed -GRI and the EU Thematic Strategy on the Sustainable Use of Natural Resources- the former is a reporting initiative that has no effect on differentiating products and the latter is still on development.

A vertical differentiation system on sustainability would permit a better internalization of externalities by the economic actors; consumers would have a range of possible products differentiated accordingly to the sustainability of their processes of production, and assuming sustainably aware consumers, all firms could be rewarded with price premiums proportional to their performance in sustainability. Additionally, it would allow benchmarking between companies forcing them to continuously improve their processes, innovate in products and technologies and bad performers would have a market incentive to improve their operations. Moreover, the challenge on setting the stringency of the system becomes trivial as any firm could adopt the scheme. Such a system would require a global private regulatory institution that coordinates the stakeholders, gathers the information, evaluates and rates firms, and maintains the running of the system. Moreover, such a voluntary scheme that allows internalisation of externalities would permit better trade in our globalised economy¹. Finally, the voluntary nature would not have repercussions with the current trade agreements that in the case of the General Agreement on Tariffs and Trade (GATT) have no provision for sustainable development's principles.

¹ In the sense that prices would provide more accurate information as firm's output would be intrinsically linked to their production conditions. Hence unsustainable production would not be possible for member firms and in general terms production would be limited by the social and environmental conditions of the production site.

Horizontal product differentiation is what we observe so far in most initiatives, however as well stated in UNEP's (2011) research; the clear overlapping and apparently lack of cooperation and synergies make the work of many institutions redundant. It is not clear yet if the 'initiative market' is starting to have competition between the different initiatives in the sector, not that it was the purpose of this research to clarify this. Yet, evidence from other commodities –i.e. coffee and forests- indicates that competition can be expected in the near future if the lack of coordination and cooperation continues. Moreover new initiatives with regional and country based scopes keep arising, that I have not included in this document, these initiatives will start competing with the international ones, in the same way as the local forestry management initiatives compete with the FSC. The possible outcomes from competing institutions can only be good for sustainability, as they constitute a dynamic response to the requests of the different stakeholders that participate in their institutional processes of legitimacy prevailing those initiatives that manage to successfully integrate and reconcile their stakeholders' needs, expectations and values. From the consumer perspective, this institutional pluralism may in turn be confusing; consumers would get bombarded with labels and certificates that address different aspects of sustainability, or that compete with broader sustainability scope making their choices more complex as we explored in the case of coffee.

For simplification and reassurance of addressing the true negative consequences of the activities it is indeed needed that the initiatives and private governance mechanisms in the mining and metals sector have a LCA thinking approach; and this the case of the 'Green Lead' initiative or the 'GeSI', where the initiatives include what happens to the metals at the end of the user phase. Nevertheless, not many initiatives have contemplated these important conditions and have focused on parts of the product chain. From a product differentiation perspective the most prominent advantage of LCA thinking is that the information that final consumers receive is more transparent as they know that the fate of the metal-components is being taken care of, in addition one could expect that given the choice between two labels the rational choice would be the one that provides more and better information.

What could drive firms to pursue sustainability differentiation?

- **Business Continuity and Better Market Access by Reduced Risk:** First we can talk about reduced risk to reputation; differentiated products along the supply chain avoid scrutiny and pass under the radar easier. Additionally, consumers see their products as a better choice than the ones that are on the market as they are having practices that are desirable and that should spread throughout the industry. Furthermore, the general public perceives firms that have good environmental and social practices as good players and the opposition to new developments that they may encounter loses authority if they provide third party assurance that their practices are in line with the values and principles they claim to have and adjust to what is considered best practice. Additionally, consumers would recognise a strong credible connection between the differentiated product and the firm and in return consumers would therefore prefer both the product and the firm.
- **Bad Reputational Risk Associated with Poor Performers:** Firms that underperform pose a risk to the industry as a whole, overall perception of the industry around the world is far from great, thus an opportunity for firms to differentiate and point-out that companies that are not certified/labelled are the ones that underperform would allow them to take some distance, this of course accompanied with a careful record of good practices that allows them to be noticeable in the international arena as being

the companies with good performance. For such a select group, license to operate should not be a problem then, yet for now, it remains unclear for the general audience who performs well and who does not, this is also linked to some corporations having good practices in some countries and bad practices in another and these should not qualify for certification/labels. At this point I believe it is important to outline that in the five capitals model, assuring that the revenues that come from the exploitation of the resource gets invested adequately is a challenge as companies are not directly responsible for where the money goes in the case of corruption and bad governance.

- **Non-Market Strategies Against Rival Firms:** Early on, we discussed market power that firms can gain with differentiated products. Beyond that, firms can use their differentiation to apply non-market strategies to maintain their status quo; they could use their differentiation to raise entry barriers for new players and new products, they can influence local and foreign governments to maintain other players out by showing their good record certified by a third party and force them to scrutinize other firms that are not differentiated. Moreover, they can strategically add costs to the production of their rival companies by disclosing bad practices through their supply chain or by lobbying for regulation, thus reducing rival firms' competitiveness.
- **New Market Opportunities:** Now, if we consider the increasing willingness to pay by consumers for environmental and social good practices is increasing through the media by the constant exposure of bad behaviour by stakeholders, thus many consumers are aware that they have to reward good firm behaviour if they want to create change in the industry. This responsible consumerism drives firms to seek ways to fill this new market niches and increase their profits, and to do so, they have to strive further down on the supply chains for responsible practices and offer incentives to suppliers.

The luxury products opportunity

Part of the discussion through this research has been centred on the goods that make consumers care, we outlined that the motivation for this is the materialism, uniqueness, hedonism, and perfectionism (Vigneron and Johnson 1999) that consumers seek to satisfy in luxury goods. Then we discussed how the concept of luxury changes through time; and in some goods what were once regarded as a luxury, they became the norm of what is socially considered necessary in order to attain an acceptable standard of living. The idea of targeting these goods is because of the inelasticity of their demand, for instance a few more Euros on a diamond will not curve the demand while it could make a difference on rewarding good corporate behaviour. Moreover, the goods that are sold by many luxury brands are already overpriced and including the use of sustainable metallic parts would not hinder their profits significantly, still these firms could pass the increment of their costs of having sustainable metals to the final consumers without, again, compromising profits. In addition, the fact that some of the products that we use daily were once considered luxury makes them a good target for the initiatives, take for instance status-related market leading high-end mobile phones, if at the beginning of such revolutionary technology, initiatives had forced the avant-garde companies to take steps towards the sustainable and responsible use of metals, it is possible that the coltan exploitation would be different and that the end-of-life of these products would not end up polluting soils and water sources. On top of that, initiatives

focusing on the metal chains of luxury products can create momentum in the industry for change.

What the author proposes then is that the initiatives, if we want them to be successful and provide a rapid change in practices in the metal industry, should initially focus exactly on the consumer products that we consider luxury. This 'sustainable luxury' labelling niche has not yet been explored by current initiatives as a whole category, only some products that are luxury have been addressed; in addition creating a label for sustainable luxury products would further differentiate them and constitute an *exclusive* label that only some luxury products can have, those that are responsibly produced with LCA thinking. From the consumer perspective the drivers of materialism, uniqueness, hedonism, and perfectionism (Vigneron and Johnson 1999) provides us some insight that consumers in this specific niche would go for these goods as they praise for uniqueness and perfection in the products they purchase.

For luxury products, it is possible that, at least for now, the market share in the metal commodity market of their component is not great, however some of these products could be the next disruptive innovation (Christiansen and Raynor, 2003) and start changing the paradigms of our current patterns of consumption. By this I do not mean that initiatives should assess every single product that comes into the market but those that are rapidly increasing in market share and that provide consumers with solutions for their necessities through innovation, those products that at the beginning can be considered luxury for their cost yet when business models change they have the potential to take over market. This is how I connect both ends of the supply chain, from the production to the product.

Now, if we pay careful attention to some initiatives, we can see that it is already happening with Fairtrade and Fairmined where a price premium is given to producers and a premium if the miner recovers the gold only through gravity, thus providing further incentives to have good practices. Additionally, the information to consumers is clear on what they are buying and comes from a legitimate organisation: the Fairtrade Foundation that aims for artisanal and small-scale mining. An organisation that has provided differentiation for other consumer products and that praises giving a fair share price to producers by reducing intermediaries. From our product differentiation view, the third condition for differentiation is not so straightforward, the main arguments that I can provide is that: thanks to the many initiatives we know that artisanal mining only represents 15% of the total production, it is already differentiated from the bulk commodity and large corporations simply cannot turn into artisanal miners overnight and that is a great barrier to imitation; second that the Fairtrade gold is refinement in the gold category as its produced under certain conditions and further more in gravity Fairtrade gold, and finally it is a luxury raw material that will turn it into a luxury good like jewellery.

We can also look at the Eden Project and their Copper roofs; copper roofs are a luxury product among the category of roofs, their aesthetic value, durability and cost make them only accessible for a certain type of constructions. The Eden Project managed to track the copper roof of their building from the mine site to the installation at their facilities, an unprecedented project in the metal industry proving that it is possible to source and trace metals through the supply chain as recent as year 2005. From the point of view of product differentiation the third condition lags behind, as this is not product or service that the Eden Project is currently selling.

Furthermore, initiatives may have the potential to provide a floor price for producers and shield them from the continuous swings of commodity markets that of great importance in

the case of smaller companies and artisanal miners that do not necessarily run in economies of scale. Also, companies' power relationship with the buyers shifts according to dynamics demand, if the demand is low companies will not be extracting minerals at full capacity, contrary to high prices when the output capacity is at its peak and to increase it requires investment and constructions that take time. Therefore, for firms in a weak position innovation turns relevant. We can assume that the innovation in the sector process-wise keeps pace on maximising the use of resource, yet innovation in products lags behind, hence the opportunity for sustainable product differentiation.

Finally, sustainability product differentiation in the mining and metals sector is possible, and is already happening. Through this analysis we have provided evidence that there are important drivers for the industry to move towards best practice and differentiate themselves and their products. The success of these and future initiatives relies on what we have explained in this work as luxury products due to their intrinsic characteristics and what consumers seek in them. Additionally, this work's results demonstrate that there is a high potential for this product category to drive change towards better practices throughout the industry, improve environmental conditions and the livelihoods of millions that depend and are affected by the resource exploitation. Furthermore, other supply chains that are not necessarily related to the mining and metal industry, but that derive from luxury products can improve their sustainability performance, however this is to be study in future research.

8 Conclusions

Having done a thorough analysis of the links and relationships between product differentiation, sustainable development, institutional theory and the mining and metals industry, this section now returns to the research questions that initially underpinned this study. Implications for future research in the mining and metals sectors' private regulation area are included as well as relevant remarks on sustainability product differentiation. This research has been driven by the idea of unveiling, -via a voluntary market-based policy instrument- the anonymity that commodity markets provide for producers and that is one of the many reasons why the industry's performance is far behind that which is desirable in terms of social and environmental performance. Additionally the challenge of a questionable reputation puts the viability of a vital industry in jeopardy and demands for bold and innovative solutions that permit business continuity. The objective of this research has been to use the sustainability product differentiation framework on the mining and metals industry and consequently analysis that highlights the opportunities for the sector so it can use its sustainability performance to differentiate firms and their products.

How can improved sustainability performance provide product differentiation for the products coming from resource extraction industries –specifically the mining and metals sector-?

As we have reviewed and discussed, within the mining and metals sector there are good and bad sustainability performers; there is a broad range of firms that have different practices, some in line with the sustainability principles and some being on the media headlines with scandals. Also, we have reviewed the different initiatives in the sector that deal with product differentiation dividing them from the theoretical point of view in horizontal and vertical differentiation initiatives and finding that there is room for differentiation according to the practices that each firm has and the specific conditions and circumstances under which they operate. Furthermore, in this incipient private regulation industry that oversees the mining and metals industry there is room for improvement in the sense that some strategies are too narrowed, others redundant and there is a general lack of cooperation and synergy between them; raising the question on whether they are starting to compete, and if not now, then when?

From the end-product point of view we analysed the category of luxury products as a promising category for initiatives to look into. The drivers that urge consumers to seek these products are key to understanding why the desirability of luxury makes them great candidates for a sustainability-labelling scheme. Additionally, from this end of the supply chain, the condition of willingness to pay for sustainability is fulfilled and creates momentum for change in practices downstream of the supply chain.

Finally, to answer the research question, improved sustainability performance can provide product differentiation if the three conditions of the framework are fulfilled, that is if there is a willingness to pay for it, if there is credible information for consumers and if it defensible from imitation.

For the first condition, in the case of luxury products and their supply chains, which includes all metal components that they are made of; also, the inelasticity of their demand creates an opportunity for sustainability differentiation as a higher price can be asked without risking lowering the demand, and therefore a higher price can be paid to the metal suppliers. In addition, the risk to reputation for firms that source from the metal industry creates a drive

for them to ask for improved sustainability performance and in return they can provide benefits for better practices.

The second condition relies on how the firms provide credible information; this credibility in sustainability aspects is given to firms by a third party and relies on legitimacy through the mechanisms that we explored.

Finally the third condition of our framework is directly dependent on the intrinsic characteristics of the production site, how they solve those unique challenges and how they reconcile the three pillars of sustainability -under the lens of weak sustainability- and provide returns to society that greatly exceed the value of the depleted resource.

Where, if anywhere, does product differentiation with sustainability fit with the mining and metals sector?

For this question, we have looked at differentiation in the mining and metals industry and in other commodities. Outside our target industry, we reviewed initiatives that follow strictly the sustainability product differentiation framework and found that a stewardship approach is needed for the commodity to maintain its differentiated status along the supply chain; meaning that they follow the metal-product from the mine to the final-product and that they can provide credible information to the different consumers along the supply chain. For the mining and metals industry, sustainability product differentiation currently appear to fit with those mining firms that are part of the supply chains of luxury goods and that through stewardship initiatives they are able to trace the metals that they produced to the final products.

Where, if anywhere might it spread?

To answer this question we have performed an analysis thoroughly luxury products, we went through the consumers' drivers and discussed in depth a framework that explains this important category. Also, how the cultural universality of the desire for a certain product together with its refinement dictate what may or may not be a luxury. Additionally, how this concept evolves through time and how, what today is considered a luxury may not be a luxury in the near future; turning in time *wants* into *needs* and therefore creating a relativisation of poverty in terms of deprivation for a group of people in comparison to the social norm. This dynamism of the concept of luxury is why it is interesting for us; some of those products that today are a luxury may become the social norm in the near future, therefore if the supply chains that come from luxury products incorporate sustainability today, then in the near future when these products stop being a luxury and become the social norm, these products will maintain the sustainable supply chains and provide mass consumers with their responsibly sourced products. Additionally, considering that some of today's luxury products may be disruptive this category fits perfectly into this research question; if a product that is responsibly sourced has a rapid growth in market share it will provide momentum to the industry to change practices towards sustainability.

Concluding comments

In conclusion, sustainable product differentiation is possible for metal commodities; already those private regulation schemes that relate to luxury products are promising to create momentum in the industry. Yet, there is much room for improvement in both the initiatives and the industry when it comes to sustainability and product differentiation. The former has

to look for synergies and complementarity, and provide stewardship for the product through the whole supply chain with a LCA mindset; the latter has to overcome the sustainability challenges that are jeopardising their current and future operations. Not only is it in the stakeholders' best interest that firms improve their performance but this analysis finds that increasingly it is in firms' best interest, yet barriers inside them and poor governance where they operate keep them from the rapid change that is needed to instigate large scale uptake.

Further research is needed to understand the applicability of this research's top down conclusions from the luxury goods point of view and see if they can be translated into changes in the supply chain of new products that come to the market. Furthermore, a deep analysis on the role of the commodity exchange markets and how they can include sustainability and responsible principles is of merit.

9 Recommendations

In this part recommendations for different stakeholders will be provided. These recommendations are the areas where, due to the results of this study, further development opportunities have arisen. These opportunities would strengthen the current initiatives, allow a faster spread of the values they praise and improve the industry's overall environmental and social performance

NGOs and activists

If actors in this interest group are keen to continue using labels, certificates and LCA, these are the recommendations for them:

- Target luxury goods' supply chains for scrutiny and campaigning specially those that are having a rapid growth in their market share.
- Maintain legitimacy of their activities by keeping consumers conscious about their purchasing decisions.
- Promote private regulation schemes as a way to enforce supranational law and improve communities' well being where the resource is being extracted.

Companies

For this interest group, the recommendations have the purpose of advising firms to take advantage of the current opportunities that market based tools are giving them. Changing practices as we represent an opportunity for them to:

- Maintain business continuity and market access by reducing the risk to reputation and granting a social license to operate.
- Take distance from poor performers through sustainability product differentiation.
- Use non-market strategies to use their improved sustainability to undermine poor performer competitors' revenues.
- Take advantage of the willingness to pay from consumers that represent new business opportunities.

Policy makers

For policy makers the recommendations from this research are the following:

- Promote responsible sourcing procurements that strengthen the efforts done by the initiatives downstream of the product chain.
- Have strict scrutiny for where the sovereign wealth funds and pension funds invest, negatively screening and investing responsibly in those firms that have good environmental and social performance.

- Promote regulation that is complementary or in line with the private regulation schemes.

Academia

For the academia it has to continue and promote activities that:

- Find innovative approaches that integrate LCA tools in better ways to the initiatives, so that they include all aspects that are important to the sustainability performance of the mining and metals sector.
- Carry on with research on metal fingerprinting as a way to improve traceability of metals through the supply chains.

Finally all stakeholders should work in ways that promote the cooperation, coordination and synergy between the different initiatives in order to take advantage of the complementarity among them. They should also be able to provide simple and reliable information for consumers. Additionally, they should look for ways to reduce redundancies, improve the industry's reputation by ensuring that the capital gains markedly surpass the capital that is depleted through the resource exploitation. Finally, they should take advantage of the opportunities highlighted in this research – those that have a potential to change the practices of the industry.

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