

Indirect and Unintended Consequences of Environmental Legislations on Economy and Business: A Systematic Review¹

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Abstract:

The environmental impact of products and practices has become an important issue of debate and concern over the past few decades. Several studies conducted in the general area of regulatory impact since 1990s show significant direct impact of regulation on business and economy. However legislations have the potential to produce secondary and tertiary impacts on various stakeholders which are either not clearly visible or take time to show their influence and this holds true for environmental legislations as well. This paper is an attempt to look at the secondary and tertiary impacts of environmental regulations on business and economy, through a systematic review of literature. Review evidence revealed impacts at three levels according to the 'scale of impact', namely, economy, industry and organization. The study concludes by proposing possible emergence of a new industry in recycling and waste management and growth of secondary goods market at the level of economy; possible emergence of a circular supply chain model where consumers and competitors play an interactive and collaborative role for firm survival and productivity, at the level of the industry; and increased permeability of boundaries at the level of the organization.

Key words: Environment legislations; indirect consequences; business; economy

1.0. Introduction – interactional complexity between environment and business

The environmental impact of products and practices has become an important issue of debate and concern over the past few decades. Through a combination of public pressure and government intervention like legislations, stakeholders (companies, institutions, consumers and others) are being forced to consider the environmental impact of their actions. The purpose of environment legislations is to prevent and reduce environmental problems caused by production, use, and disposal of goods. Some of the common features of these legislations are phasing out of certain substances; producer responsibilities in production, waste collection and recovery of the product, and obligation to provide information and documentation to the government and consumer; government approval for treatment of certain substances; and end of life clause for certain products. Several studies have been conducted in the general area of regulatory impact since 1990s to show significant direct impact of regulation on business. The direct impact of this legislative control as identified in the literature includes product and process redesign to include environment friendly materials and processes; systems for life cycle management in the form of

waste management, recycling and reuse; and government structures and mechanisms to monitor compliance (Kim, 2002; Hug, 2001; Low and Williams, 1998; Jaffe et al., 1995; Rutledge and Vogan, 1994).

However legislations have the potential to produce secondary and tertiary impacts on various stakeholders which are either not clearly visible or take time to show their influence (ESRC, 2004; Fraser et al., 2003; Griffin et al., 2001; Rosenzweig et al., 2001; Deudney, 1999) and this holds true for these legislations as well. However, few studies have looked at indirect or not-so-direct impacts of environment regulations on economy, productivity, trade or any other economy and business related area. Identifying indirect causality, complex causal chains that bring unpredictable surprises and the reflex nature of the environment requires creative analysis and is a methodological as well as scholarly challenge (Hug, 2001). A simple human management decision may lead to changes in the environment which in turn can impact human population in new and often unforeseen ways. For example, a simple governmental decision of forest fire in Indonesia to clear land for agriculture caused a cloud of smoke to cover much of South Asia (Fraser et al., 2003). Similarly, regulatory facilitation of intense industrial activity of a certain kind in Canada and Australia, which created clouds of aerosols, is linked to droughts in Africa during the 1980s (Nowak, 2002). These examples highlight the various complexities in the interaction between environmental decisions and societal stakeholders, as the nature of response may take years to be felt, the population impacted maybe different from the population which is affected by the environmental decisions and different stakeholders may have different ability to adapt to the impacts (Fraser, 2003). Hence it is required to move beyond simple cause-and-consequence to understand these not-so-direct, secondary or tertiary, impacts of environment related decisions.

This paper is a systematic attempt to review such secondary and tertiary impacts of environmental regulations on business and economy. The objectives of the review are to:

- Explore the legislative factors and its processes that produce secondary and tertiary effects on business and economics,
- Understand the nature, structures and magnitude of these secondary and tertiary effects in order to generate better insights into the linkage between environment and productivity, and
- Establish new directions for research and theory.

Section 2.0 looks at various theoretical frameworks used to explain legislative impacts. It debates three broad perspectives, namely, the economic, the public interest and the ecological

modernization perspectives. Section 3.0 explains the methodology used. It also details the possible definitions for the secondary and tertiary consequences, and the constraints faced during the review process. Section 4.0 provides the evidence base. The review of evidence fell into three main sections according to the level of impact, namely, economy, industry and firm. These are highly interdependent categories with respect to indirect and unintended impacts and categorization of studies has broadly been according to the focus of each study for its analysis and discussion. Section 5.0 discusses the review findings and proposes some future consequences for business and economy that need to be empirically explored.

2.0 Contested frameworks

While some economists hold that high level of environmental spending can lead to decline in productivity (Barbera and McConnell, 1990; Jaffe et al., 1995; Gary, 1987; Gollop and Roberts, 1983), environmentalists and some strategists (Porter and van der Linde, 1995a; Porter and van der Linde, 1995b; Shrivastava, 1995; Porter, 1991) suggest that it leads to alternate more efficient systems and operational processes which in turn increases productivity. This section elaborates these two points of view.

View The conventional economic view believes that the general business and economic practices have for a long time developed through lesser regulation. While environment regulations do give considerable social and economic benefits, their stringency produces direct costs to industry and indirect and often uncertain impacts on economic growth, productivity and international competitiveness (Jaffe et al., 1995; Jorgensen and Wilcoxon, 1990; and Portney, 1981).

Theoretical framework The economic-liberty perspective or economic theory of regulation, sometimes known as the private interest perspective, supports this view. Market is believed to be the best mechanism for maximising social and economic welfare. This perspective treats political and bureaucratic motives with suspect and highlights the role of interest groups in regulation formation (Wilson, 1980; Stigler, 1971). It contends that interaction between economic growth and environment follows the “Kuznets curve”. The curve states that environment and economy share an inverted U shaped relationship where environment conditions are seen to deteriorate in the early stages of industrialization and then improve once the economy touches middle income levels (Grossmand and Krueger, 1993, 1995; Seldon and Song, 1994; Shafil and Bandyopadhyay, 1992). Many developing countries are seen to be living the early part of the Kuznets curve while developed countries are in the later parts of the curve. Thus this perspective believes that the cost-benefit ratio of policy interventions is always negative and fears that

private costs, imposed through stringent environment policy, impair competitiveness and productivity.

Counterview On the other hand environmentalists and some strategists find current environmental efforts to be inefficient for any economic or environmental gains. They say that proper environment control spurs innovation in a number of ways leading to win-win opportunities (Porter and van der Linde, 1995). Integration of environment efficiency in economics and business can contribute to stronger competitiveness (Facheux et al., 1998; Porter and van der Linde, 1995). It questions the current economic system saying that the system is characterized by high complexity and needs large amount of data input which makes it problematic to be more environmentally efficient (Cerin and Staffan, 2003).

Theoretical frameworks Two theories support this view, namely, the normative-positive perspective or public interest theory and ecological modernization theory. The public interest theory looks at regulation as an instrument to overcome or check market failure. Regulations are seen to improve economic efficiency and promote social values by correcting market imperfections like natural monopoly, asymmetric information, misuse of public good, moral hazard, unnatural transaction costs or creation of externalities (Kearney & Merrill, 1998). It believes that government intervention in the economy and regulation of environment is required due to presence of externalities like pollution, waste etc., and this presence constitutes an obstacle in optimum resource allocation. The state has several means for potential intervention including economic instruments like taxes, subsidies and other incentives and regulations with directives and penalties (Tanguay et al., 2004; Buchanan, 2003).

The theory of ecological modernisation also offers a possible explanation from the public interest perspective. The theory is centrally concerned with the relationship between industrial development and environment. Founded by Joseph Huber (1982, 1984, 1985) it suggests that environment problems can be addressed by the industry through 'super-industrialization', i.e., transformation of industrial production through development and application of advanced technologies. Since then, the theory has moved beyond the focus on innovation and highlights the macro-economic restructuring of advanced industrial economies as another essential component of ecological modernization (Janicke et al., 1988, 1989; Simonis, 1989; Janicke, 1985). The theory contends that environment problems can be addressed within the framework of modernity, largely through the action of state and industry, with the result of economic growth (Weale, 1992). The state would need to actively participate in the environment debate, and strategically promote structural change at the macro economic level, particularly emphasizing

less ecologically burdensome ways of generating wealth (Murphy and Gouldson, 2000). Ecological modernisation has been identified as one of the ways in which late modern society is responding to its increased awareness of and anxiety about ecological risks associated with modernism.

These frameworks have been used to study the direct relationship between environment and economy. In this paper, we explore these frameworks to understand the not-so-direct impacts as well as build on the existing theoretical debates. However, one framework may not be able to capture the complexity of a phenomenon. For example, the Kuznets curve does not take into account the fact that environment degradation is not entirely replenish-able. Similarly, the public interest theory undermines individual and group initiative potential and may not be able to totally explain innovations and entrepreneurship behavior of firms. Hence we use all the perspectives to understand and build on the relationship between environment legislations and their secondary and tertiary effect.

3.0 Methodology

Few studies were found to focus on indirect or unintended consequences. We had to cast a net wide enough by defining 'impact' rather broadly and search for indirect as well as direct evidence in order to identify some studies potentially capable of shedding some light on relationship between environment legislation and its indirect consequence on business and economy. Studies looking at indirect impacts were either technical or discussion papers, or followed the case study approach. In empirical studies, indirect or unintended causality was an indirect result of another variable studied. Therefore, most of the indirect consequences or impacts that have got identified through literature for this review are either secondary results of some other primary environment problem studied or technical discussions. This makes it imperative for us to empirically test the propositions developed at the end of the paper. However, there were advantages to following this broad review base. It allowed for all the key themes to emerge and gave us a systemic understanding of the issues and concerns.

3.1 The Review Process

The review steps taken were as follows:

- 1) Identification of keywords on the subject through a brain storming session. The words identified included, for example, environment legislation, environment policies, social impact, unintended, indirect, unforeseen, and theory of regulation, among others.

- 2) The keywords were constructed into strings. For example, [environment policies AND consequence OR impact] and [environment legislation AND impact AND unintended OR indirect] were used as a method for finding citations and studies.
- 3) An initial search of ABI INFORM (ABI Proquest) and Emerald Text (Emeraldinsight) was undertaken using the basic research strings. The results identified additional key words like end of life, trade barriers, recycling, waste management and e-waste. These words were used for second level search.
- 4) The second search included five databases, namely, ABI Inform: Proquest, EBSCO: Business Source Premier, Elsevier Science, Emerald, and Science Direct. They were chosen based on the number of citations relevant to the basic search strings.
- 5) The studies identified were reviewed for relevance to the theme under study. The exclusion/inclusion criteria were borrowed from the paper by Pittaway et al., (2004) in *The International Journal of Management Reviews*. The inclusion criteria were: theoretical papers, which gave us the frameworks to analyse the results; working papers which ensured inclusion of current research; conceptual and technical papers, which gave us broad, holistic insights into possible indirect and unintended consequences; qualitative and quantitative empirical studies, to capture all empirical evidence; and all sectors, to cover multitude of impacts and their industry and economy linkages. The inclusion/exclusion decision was taken in three stages: review of paper title, review of abstract and review of paper. Table 1 gives details of the number of inclusions and exclusions at each stage of review.

4.0 Overview of evidence

The review results have neither been simple nor straight. Rather they reflect complex structures and involve many counter arguments. For example, there are studies that suggest that recycling itself can be environmentally damaging or environmental trade agreements indirectly create environment hazards when they promote certain sectors over another, allowing those sectors to grow to a substantial environment damaging levels. Keeping in mind these complexities, the review has been analysed against the background of considerations of a total environment equation. The studies focused on different industries, used different methodologies and moreover, covered different time periods. Within the evolving environment legislation context, this adds to the review complexity. The studies fell into three levels according to the ‘scale of impact’, namely economy, industry and firm. While the studies have also been categorized according to sector or industry in focus or methodology in focus, the primary review base has been the first category of ‘scale of impact’. However ‘level or scale’ is a broad categorization and there are considerable overlaps at all levels. Within each of these impact levels, studies talk

of diverse themes. Table 2 categorizes the papers according to themes in focus. Table 3 lists all authors covered under each theme.

4.1 Impact on the Economy

The starting point of this review is the set of empirical and conceptual studies which explore or illustrate the indirect or unintended impacts on the overall economy. The research studies fall into four main streams. The first stream gathers evidence on unintended negative effects on the environment itself. These studies explore specific cases where certain mandated processes and technologies are seen to indirectly create more environment damage than benefit. The second stream looks at regional level impacts. These studies focus on two issues, namely, community level economic impact and the more informal and subtle issue of perceptual interpretation. The third stream debates global level impacts where studies highlight how legislations that create a positive impact in one region can lead to unintended negative impact in another region that does not follow similar legislative constraints and controls. The fourth stream looks at the growth and evolution of new commercial structures where studies focus on the emergence of new markets in secondary and used goods at the local and global level and creation of recycling and refurbishment, with its technologies and services, as a separate industry.

Environment damage The literature on indirect or unintended impacts on environment itself provides two main arguments. One, it uses specific cases studies in the electronic and wood industries to show indirect increase in energy use while processing environment friendly material or process, at the current technology level. Second, it highlights that positive environment impact in one region can be at the unintended cost of environment damage in another region.

Environment regulations address the problem of huge volumes of environment hazardous waste and material due to shorter product life cycles and rapidly advancing technological advancements by proscription of the use of environment friendly materials in certain products. These regulations also set targets for recycling and reuse of such materials. This has direct impact on design of a product. Firms and industries have replaced many materials with eco friendly ones and modified parts of their process in order to reuse certain material. However, this is seen to have indirect impact on the environment when inefficient technologies for processing the material has lead to increased use of energy, potentially decreasing the environment gain. Goosey (2004) and Huisman et al.'s (2004) study of the electronic industry, revealed increased use of energy and material in certain redesign of a product or process. For example, while recycling generated overall positive effects for glass dominated products and precious metals,

recycling of metal dominated products did not lead to overall higher environment recoveries where material had to be sent for fuel gas cleaning at the smelter (Huisman et al., 2004). Similar is the example of PCBs and PVC, a replacement for hazardous CFCs and HCFCs (Richards, 1997). In cases where drying of a PCB was necessary, the cost of energy needed to heat the drying air was very high. PVC generated toxins during its production. Similar results have also been highlighted by Knight et al. (2005) in their comparison of potential environment effects of wood and steel doors. While use of steel saved wood, processing steel doors led to significantly increased energy use and environment emissions, including air and water borne emissions, solid waste and green house gas generation in all categories studied. Thus regulatory mandates, designed to save environment degradation, can lead to environment damage, within the current state of technological advancement.

Sustainability assessment of international trade and technical barriers faced by developing country exports is the basis for the second argument on the indirect or unintended consequence of environment legislation on environment. The authors argue that trade related interactions between regions with different environment legislative controls leads to exploitation of regions which do not have strict controls to manufacture export oriented products for use in strict control regions. Studies that highlight these results at the global level are the literature review on international trade in Brazil by Almeida et al. (2004) and the study of the Brazilian manufacturing sector by Seroa da Motta (2003). Comparative advantages for developing country exports in most cases lie in the intensive use of their natural resources and energy which can potentially lead to large scale pollution, reducing the overall environment benefits (Young et al., 2002; Veiga et al., 1995). However, production from transnational corporations for domestic market has shown a positive environment impact due to their use of superior technology for production (Young et al., 2002; Seroa da Motta, 2002) leading to the conclusion that technological barriers between economic boundaries or countries could be a significant reason for this indirect impact. Ease in technological sharing between regions and nations may substantially reduce this indirect and unintended damage.

Regional impact Literature discusses two main thoughts with respect to relationship between region and environment legislation, namely, unintentional economic impact on populations of certain regions and how implementation of these regulations is indirectly influenced by psychological barriers and diverse interpretations of these laws, which influences regulator as well as firm decision making. Meyer's (1995) study posed the macro economic question of whether states with stronger environment policies pay a price in job growth, and, if so, how much? While he concluded that there is no direct systematic relationship between state

economic performance and its environmental policies, he found regional environment costs to a large extent being perceived as a form of externally imposed social tax and not as ordinary business related cost. This perception was seen to indirectly trigger a firm's relocation decision to a new region or overseas. Moreover, regulators also carry this psychological burden leading to varied interpretation and implementation approaches to indirectly influence compliance. Studied by Gouldson (2004) and Angel et al. (2000) revealed that successful environment compliance by firms was an amalgamation of command and control regulation with a flexible enforcement approach and good information availability at the regulator level. Furthermore, comprehensive policies were seen to be preferred even when their regulation was strict. Stafford et al. (2000) examined the relationship between environment regulations and location decision of 1,548 waste management facilities in 48 states in US to find that firms were more attracted to regions with comprehensive policies indicating that firms may prefer states where there is less uncertainty about requirements due to the comprehensiveness of the state's regulations. This concludes that attitude and perceptions of regulators and firms has an indirect influence on policy compliance.

Unintended economic impact of environment regulation was observed by Cardinali (2001) in his paper on waste management. He discussed the problem of hasty and forced efforts at environment compliance by governments which, though successful and well meaning, unintentionally led to unjust consequences. He illustrates by example of the 1993 decision by the British Chancellor of the Exchequer, of controlling global warming through a value added tax on domestic fuel. This unintentionally created a significant discriminatory effect on the poorer members of the society predominantly in the northern parts of UK, who were living in inadequately insulated houses. Taking a similar perspective O' Riordan (1992, 1995) highlights that new environment structures unintentionally opened the governance system to manipulation and exploitation based on power and access to information and knowledge. In such circumstances economically strong groups gain a clean protected environment at the expense of economically weak groups who have to pay a higher percentage of their income to protect their privileges.

Global impact Macro level studies typically reflect on indirect or unintentional impact of these legislations on international trade, where they suggest that trade and environment issues go beyond GATT and WTO related agreements. Environment laws create unintentional discrimination and additional trade barriers as different governments interpret the laws differently. These discriminations can be seen through situations where welfare maximizing governments lower their standards to manufacture export products and in that harm their environments. A second indirect impact of environment regulations is seen through the effects of

logistical complexity of compliance, where, for procurement decisions get taken based on logistical simplicity rather than the more common low cost considerations.

In recent years the focus of trade has been to lower non tariff barriers to trade (Jackson, 1992). However, domestic regulations, including environment regulations, can indirectly lead to trade barriers (Esty, 2001; Esty and Porter, 2000; Sen 1999; Sachs, 1998; Dua and Esty, 1997; Lawrence et al., 1996; Carrero and Siniscalco, 1994). A welfare maximizing government may adjust its own environment standards to meet competition, by either lowering its standards to be able to manufacture goods for exports or put stricter standards on other countries to control imports. Esty (2001), Fernie and Hart (2001), and Veiga et al., (1995), looked at trade-environment relationship and found that environment laws unintentionally promote a 'command and control' situation in many cases where environment laws can get manipulated to create regulatory dynamics where standards are set strategically with an eye towards competing jurisdictions. For example, Young et al. (2002) looked at primary data from manufacturing industry for 1990-1996, in Brazil, a country with lower environment standards. They found Brazilian industrial output for exports to USA, which is a high environment standard region, had a significantly higher pollution potential than output for domestic market. Wheeler, Huq and Martin (1993) and Grether et al. (2006) found pollution levels were lower and adoption of cleaner technologies was higher, than the South. Studies by Seroa da motta (2003), Esty and Geradin (2001), and Klerovic (1996) have also highlighted this race to lower the standards in order to attract FDI for export. An opposite effect is seen when high income countries impose strict standards on low income countries in order to indirectly create trade barriers for controlling imports (Bhagwati, 2000; Candice, 1994). Fernie et al. (2001) reviewed literature on food industry to compare impact of environmental regulations on various food retailers and concluded that each country had its own specific interpretation of these regulations, creating trade barriers. For example, as Denmark had decided to ban cans, unlike other EU countries, export of beer to Denmark had become economically feasible for only those producers who could afford alternative packaging. This study also takes us to the second issue of logistical complexity involved in compliance of the producer pay principle.

Environment regulations make reverse logistics critical for operations. Prendergast's (1995) primary survey of UK marketing executives from consumer goods firms to understand the relationship between packaging, environment and logistics, revealed that other than substantial cost increase as a direct effect of environment directives of producer pay principle, the respondents were concerned that logistical complexity under the environment directive would create trade barriers. Low and William (1998) analysed cost and energy data from UK

commercial freight carriers in the UK electronic industry, to conclude that there would be unintentional barriers created due to environment legislations as purchase decisions will get modified towards lowest procurement cost instead of earlier lowest manufacturing cost. Legislations which have 'take-back' clauses will force purchase decisions based on transport logistics rather than cost.

Emerging markets and industries Majority of literature analysed on recycling and waste management gives evidence of their emergence as a critical business component. However, there are two views on the nature of integration of this critical component to the rest of the business operations. A high percentage of this literature takes the popular view of companies following a life cycle approach to product development where environment issues are handled during product development stage itself (Jaffe et al., 1995). The second view, hints at the emergence of a new industry, the recycling industry, as an indirect consequence of environment policies which raises increased demand for 'clean up' services from various industries and economies. This industry can be seen to provide recycling, refurbishment and clean up services and abatement technologies as part of their operations. Another indirect consequence of this legislative imperative is the growth of the secondary goods market where used goods are refurbished and used for domestic consumption as well as export to other countries.

An OECD report (1996) and Sorsa (1994) are the first literature evidence of the possible emergence of a new industry where the studies suggest increase in national competitiveness through the development of an industry to produce pollution monitoring and control equipment. Jenkins (1998) suggested this in his review of literature on environment and national competitiveness for USA and EU. Similar evidence is found in UK where there has been a substantial increase in independent recycling sites (from 100 in 1994 to 400 in 2000) which are operationally independent from any industry and work on a business model and structure very specific to their needs (Lawson et al., 2001; BRE, 2000). Suggesting emergence of recycling as an industry, Hick et al.'s (2005) study reviewed cases of Japan and EU in their exploration of recycling and disposal of electronic goods in China. The authors find possible emergence of recycling companies which can generate revenue by providing technologies, refurbishing and reselling goods as well as charge fee to producers and consumers. However, countries may differ in the industry structure. For example, in China, a consumer or producer will expect payment for returning goods for waste management as waste is seen as a valuable resource. Adding environment processing cost to this would make the operations economically unviable. Hence the authors suggest a different possible structure for China and similar country contexts, i.e., growth of a secondary goods market which will incorporate the existing extensive informal

goods market. For example, certain computer parts as scrap like diode and switches are exported from Australia to China for reuse (Kellow, 1999). Growth of the secondary goods market was also found by Herold and Kovacs (2005) in their investigation of the furniture retail industry with respect to end of life products and by Brainwaithe (1995) in her study of recycling electronic goods and appliances for export to developing countries at cost effective prices.

4.1.1 Discussion

Review evidence reflects indirect and unintentional impact on economy through three forces. These are technological, societal and perceptual / psychological. Current advancements in technology and technology policies are seen to lack the capacity to effectively respond and harmonize existing and emergent environment problems. Ecological intervention in using certain eco friendly materials and processes in manufacturing, does not promote significant environment protection through reduced pollution or degradation, mostly due to inefficient, costly technologies. This impacts productivity and is a major issue of concern to policy makers (Murphy and Gouldson, 2000). We can view the current state of affairs from two different perspectives. The traditional economic approach argues that there is a trade off between environment and competitiveness and productivity (Jenkins, 1998) and the level and intensity of this interaction should be left to market forces. Under the “Kuznets curve” market forces will optimize this relationship in the long run, ensuring survival of both and one of the ways will be to innovate and develop cleaner technologies and techniques (Sheldon and Song, 1994; Grossman and Krueger, 1993). The ecological modernization perspective advocates the same saying the way to deal with environmentally inefficient industrialization is ‘super industrialization’. Environment protection imperatives can only be met through developing better, superior technologies. From both the perspectives “technique” effects are seen to arise from the need for cleaner environment. This suggests that abatement technologies will emerge as a significant resource in dealing with environment degradation issues.

Proposition 1: Environment legislative compliance may lead to emergence of a new industry in recycling and waste management, with its specific technologies and services.

The ability of new technologies and technique to influence existing structures and systems will vary in its impact (Murphy and Gouldson, 2000). Review evidence shows that this could be social, cultural or economic in nature. At the economic level, costs associated with the environment compliance have the potential to create socio-economic imbalance between populations. Low income groups will pay more percentage of their income to protect their

environment privileges than the higher income groups. At the cultural and social level, another simultaneous pressure will be from interest and environment groups and individuals who will not accept goods which create environment damage (Roarty, 1997; Mintel, 1995). This will create pressure towards price control for goods as well as energy services. From the economic perspective, these two pressures will act as the market force and ensure economic-environment equilibrium. One such equilibrium can be towards higher and wide scale acceptance of recycled and second goods, for use by large sections of societies, and for sale, by organizations. This can also emerge as a trade opportunity. From the ecological and public interest perspectives this would lead to lifestyle modifications to a more ecologically sustainable level.

Proposition 2: Environment legislative compliance may lead to substantial growth of market and trade in recycled and secondary goods.

Evidence on trade and environment shows a material-product chain where economic benefits for one region get traded for environment benefits for another. While economic theory perspective explains this through the K curve where in the early stages of economic development, there will be pollution and environment degradation, ecological modernization theory contents that technology barriers can play a critical role on the intensity of this pollution and degradation. Both perspectives would see gain in removing these barriers. Economic perspective would view removal of technology barriers as an economic opportunity and ecological modernization would view this as leading to better, cleaner industrialization. Hence, abatement technologies can emerge as a significant resource for industries and economic regions/nations, for trading in order to create an environment friendly world. This may have the potential to be used by some nations/regions as a first mover advantage for economic growth. Country or region which actively invest in R&D for efficient abatement technologies and develop comprehensive support policies will be able to exploit this situation at the national/regional and global level.

Proposition 3: Growth of market in recycled and secondary goods may create significant trade opportunities between regions/ nations, with support from additional second level policies.

4.2 Impact on the Industry

The second set of literature evidence covered influences at the level of industry. Studies highlight three main themes as indirect or unintended industry specific consequence of environment regulations. The first theme points to development of additional government intervention through legislation, incentive or subsidy in order to make the environment

regulations more effective. For example, encouragement in use of recycled plastic instead of new material, for better energy management, not only needs specific environment laws targeted at use of recycled material, but also additional government intervention which will discourage manufacture of new material. The second theme looks at the unintentional impact on entrepreneurship and small firm activity. Studies emphasize the discouraging effect on entry of entrepreneurs and small firms due to high cost of environment abatement imperatives, at the current technological scenario. Moreover, increased capital costs as a deterrent for new firm entry can be manipulated by existing firms to promote legislation which increases capital costs. This would lead to an unintended and socially undesirable consequence of reducing competition. The third theme arising from the review highlights two emergent industry level structures, namely, a non linear, multidimensional supply chain model and strategic collaborative inter firm competition. The non linear multidimensional supply chain model emerges as a consequence of active participation of customers as suppliers in the physical and economic flow of material, instead of only “end or final” buyers. A second industry level structure can emerge due to need for strategic collaboration between firms to manage logistical complexity and costs involved for environment compliance.

Supplementary legislative support Additional government support for effective regulatory compliance is talked about at the level of trade, inter-firm, and intra-firm. Discussing the trade-environment divide, Esty’s (2001) gives examples of shared resources like fisheries in open oceans and other biodiversity and contends that not only will lack of these laws and regulations lead to environment degradation but also threaten market failures that will diminish efficiency of international economic exchanges. Need for additional government support at the regional or national levels is discussed by Zhuang and Synodinos (1997), Roarty (1997), Barass and Madhavan (1996), Jacob (1991). Jacob (1991) argues that market forces left on their own can become an “invisible elbow” or adverse force which can bring general environment damage. Economic policies, like taxes, subsidies and incentives to promote certain business activity are needed to balance the environment imperative and growth needs of firms (Zhuang and Synodinos, 1997; Roarty, 1997). Studies by Finnveden et al. (2005) and Zhuang and Synodinos (1997) give examples of this. Finnveden et al. (2005) conducted a life cycle analysis of energy from solid waste. The results suggested that along with a policy promoting recycling of plastics and paper, further policies promoting the use of plastics not made from virgin material will lead to better energy management and reduction of green house gases. Zhuang and Synodinos (1997) conducted a survey of 203 firms to understand the environment-business incongruity within the chemical industry. The authors found that pure environment policies were not effective in curbing pollution related activity for small and medium firms which formed bulk of this industry.

One of the main reasons for this was lack of additional government support, in the form of incentive or subsidy, which was making environment compliance difficult and substantially eroding competitiveness and existence of small and medium firms in the industry.

Need for firm level support policies for environment compliance is suggested by Russo and Harrison (2005), Venables (2005), and Henriques and Sadorsky's (1999). The studies suggest that uniform policies may not work for all and additional support policies have to be created within an organization to support job variations. Each business function head may need to understand the regulation from their perspective and create sub-policies (economic duties or incentives) that would motivate the employees (Venables, 2005). For example, hiring and firing costs weaken productivity performance, including environment performance, thereby inducing sub optimal adjustments of workforce to changes and innovations. Firms may need to adapt their recruitment policies in order to maintain and maximize productivity in a strict environment regulated regime (Scarpetta et al., 2003).

Entry barriers and decreased competition At the current technological advancement level, environment regulatory compliance puts huge economic cost on firms, making economies of scale an essential criterion for survival. This can unintentionally force the industry to have only big players, with exclusion of small and medium manufacturers unless they expand their business to a certain level. Moreover, this can also be manipulated by big players to inhibit entry of new firms in the industry and thus, reduce competition.

Minimum efficiency of scale and plant size was found significant by Huisman et al. (2004) and Scarpetta et al. (2003) in their study to analyse the possible role of institutions and regulations on multifactor productivity. The burden of initial capital cost of abatement equipment added significantly to the unit costs making operations economically unviable for small and medium level firms (Roarty, 1997; Barnes, 1994; Ungson et al., 1985). Moreover, for small and medium firms, costs associated with environmental procedures itself, like paperwork and legal fee of consultants and registration, made their prime activity economically infeasible (Huisman et al., 2004) Entry of new firms increases industrial productivity as they enter with more efficient systems and technologies (Scherer and Ross, 1990). When environment costs create barriers for entry of new firms due to need for high capital investments in abatement technologies, it unintentionally decreases overall industrial productivity (Fare et al., 2001). This impact is not only felt domestically but also in other nations, through international trade (Almeida et al., 2004), where environment regulations indirectly affected productive chains, especially of small and medium size companies. The small and medium companies and

agriculturists were unable to cope with environment compliance constraints posed by the buyer country, forcing them to get out of the export chain.

As stated earlier increased capital requirements can be a deterrent in entry of new firms which can be used by existing firms to inhibit entry of new firms. Large incumbents may find it beneficial to promote legislation that increases fixed costs (Dean and Brown, 1996; Cairncross, 1992; Brock and Evans, 1986). For example, Henkel, a German detergent manufacturer, informed the government that it had developed a detergent that reduced phosphate by 50% and constructed a production capacity for this (Barrett, 1992). The government responded by introducing a legislation to support this (Barrett, 1992). In industries with inelastic demand and industries experiencing overall growth companies would further benefit because they can pass on larger portions of the costs to consumers (Dean and Brown, 1996; Carlton and Perloff, 1990). Thus, this would lead to an unintended and socially undesirable consequence of reducing competition.

Emergent business models Several studies have found the emergence of new structures in the system based on complexities associated with reverse logistics and supply chain management. The first category of structures is centered round the new role of customers as suppliers and the second category is centered round cooperative inter firm behavior for recycling and other environment compliance activities. Studies in the first category highlight the emerging role of the consumer which involves an active participation in the physical flow of material, i.e., as a supplier who gets paid for facilitating recycling of goods. This questions the existing concept of “final” buyer or end consumer, constructed around the idea of a ‘unidirectional chain’ of actors. The introduction of recycling challenges this linear conceptual thinking, and the models and concepts based on the liner model. Moreover, consumer behavior towards environment becomes additionally important to understand. Studies in the second category talk of logistical complexity and economic costs involved in reverse logistics and waste management, and suggest necessity of new structures to promote cooperation among competitors for managing these issues.

Regulations on end of life make it producer’s responsibility to ensure environmentally safe disposal of discarded goods. Additionally consumer has to actively participate in effective execution of this regulation, by returning the waste as well as by reusing refurbished goods. Producers and retailers will have to encourage consumers to bring back bottles, can and other glass material in order to meet their regulatory obligations. Anderson et al. (2005) discussed this changing role, responsibilities and positions of consumers in the process of material flow for recycling, through a review of literature in the manufacturing sector. The authors found creation

of new actors in the system for fulfilling recycling tasks, namely, suppliers of material for recycling and emergence of a new, active and involved role of the end consumer, as one of the suppliers for recycling of goods. This also highlights the dependence of recycling on this supplier's behavior (Roarty, 1997). Consumer behavior becomes additionally important in these circumstances (Scott, 1999; Gamba and OSkamp, 1994; Vining and Ebreo, 1990, 1992; Oskamp et al., 1991). The evidence on emerging new role of customers, questions the larger assumptions on customers' role in our business models, specially the linear unidirectional supply chain models. With increasing recycling activity, where consumers become active suppliers of raw material, may herald evolution of newer models and business preconditions.

The second category of change in business related structures relates to inter-firm dynamics. Dept of Trade and Industry, UK (2003) found indirect effects in the nature of change in competition among firms, in their study to understand and identify concerns on how existing regulations are affecting competition in the passenger car segment. The obvious direct effects of environment regulations like need for reevaluation of processes and designs and increased cost to operate environmentally safe processes, create indirect and unintended economic pressures for firms which seems to initiate collaborative management practices among competitors for better life cycle management (Richards, 1997), creating a new dimension to inter firm competition. For example, the growth of bottled wine consumption in UK has already exceeded the national recycling capacity and the collection charges have gone up by 400% for producers (The Times, 1999). Kim (2002)'s technical paper on end-of-life policy and Venables' (2005) review of WEEE, the waste related directive in Europe, found indirect factors like cooperation among various actors, namely, dismantlers, producers and monitoring authorities as significant for effectiveness of this regulation as well as smooth flow of products and information. On similar lines, Sherlock et al.'s (2004) study found partnership work being embraced by regulators for regulatory effectiveness. The authors analysed the regulations of Scottish Environment Protection Agency using an ethnographic framework to find that inclusive governance required the regulators to extend the definition of partners to include people beyond technical experts. There is complexity associated with collaboration. First partners must believe that partnership outweighs the cost of this partnership in the long run (Downie, 2001). Second, they require intra-organizational and inter-organizational trust to allow for sharing of resources and systems (Carolan and Bell, 2003; Pierre, 2000; Collins, 1998). Third, effective organizational structures are required to facilitate the partnership process (Smith, 2001; O'Neil, 1997). However, environment regulations indirectly stress on stakeholder partnerships for effectiveness and in that stress for evolution of modified industry level structures and systems.

4.2.1 Discussion

Industrial structures and systems are seen to get impacted indirectly and unintendedly from the environment legislations. Review highlights these such long term indirect impacts, namely, modifications in the supply chain structures and in the competitive structures, and an unintended impact of barrier to establishment of new operations in certain industries. The economic perspective promotes economic theories on cooperation which analyse the basis of cooperation between different actors. This approach argues that actors are drawn into different forms of networks through interdependencies relating to resources like political legitimacy, finance, information and organization assets (Smith 1997; Rhodes and Marsh, 1992). It emphasizes that distribution of resources can establish incentive for cooperation between independent actors (Gouldson, 2004). This becomes relevant in the macro level implementation process of environment compliance. Review evidence shows that customers will now have to play multiple roles, of receiver of goods, processor of waste as well as supplier to the recycling chain. He becomes a critical part of the material supply chain and creates reciprocal interdependency with the producer. While it makes economic sense to cooperate, the public interest perspective looks at this as a moral hazard which has to be dealt with through active intervention. This intervention could be through incentive, subsidy or any other economic benefit by the producer. Furthermore, environment compliance imperatives make reverse logistical planning important. Each producer is expected to create a life cycle chain for his product, which can add substantially to the cost. When certain preconditions are met, namely, reciprocity and question of survival (shadow of the future), it creates incentives for competitors to collaborate (Axelrod, 1997). Hence producers will seek to have cooperation from consumers as well as other producers, in order to meet the supply chain and reverse logistical complexities.

Proposition 4: Environment legislative compliance may bring about a change in the nature of competition as competitors will have to collaborate for meeting compliance imperatives.

Review evidence also finds that environment regulations may create barriers to entry of new firms through mechanisms that include direct reasons like increased capital requirements as well as indirect reasons where existing firms manipulate regulations to create entry barriers. Theoretical analysis of this impact can be seen from two perspectives, economic and public interest. The public interest theory will view this as a market failure and look for regulatory intervention to encourage entry of new firms. It would expect promotion of high level technological advancement such that firms can choose abatement methods and techniques appropriate to their scale of operation. However till scale mismatch exists between available

abatement technologies and small firm's production processes, there would be either need for increase in scale or absorb the resulting inefficiencies from the organization or develop regulatory support for new and small firms (Dean and Brown, 1995). The economic perspective will take this as market equilibrium but also expect learning curve effects to take place with time. Therefore, costs will decline as firms learn to do things more efficiently (Scherer and Ross, 1990; Porter 1980). Applied to environment compliance activity, the firm would learn to effectively handle regulatory agencies, know which abatement technologies apply to their processes, and how to best modify their administrative and organizational processes to carry out these tasks (Dean and Brown, 1995; Monty, 1991). Thus, direct impact of cost increase would affect the industry structure in the short run. However, due to learning curve effects in the long run and effective government intervention, this may get modified again.

Proposition 5: Environment legislative compliance may bring about a change in the structure of some industries where players may include only a certain scale of firms, in the short to medium time scale.

Consequently, from proposition 4 and 5 emerges the following:

Proposition 6: Changes in the industry structure and nature of competition may see the emergence of a circular business chain model where consumers and competitors play an interactive and collaborative role for firm survival and productivity.

4.3 Impact on the Organization

Indirect or unintended firm level impacts of environment regulations are not independent of economy and industry. However few studies discuss specific firm level impacts and this section reviews those studies. These studies can be categorized under two themes, namely, productivity related and those related to internal systems and processes. The first theme includes studies on productivity and competitiveness and suggests that firm productivity gets indirectly affected in various ways. It may lead to enhanced labor productivity and reduced entrepreneurship and innovativeness within the firm. Additionally, regulators may unintentionally promote ill designed responses adding to economic and human costs and decreasing productivity. The second theme includes studies on organization change in systems and processes. Studies show how environment issues are multifaceted. They make inter and intra firm communication and coordination critical, quality management becomes a prerequisite for environment compliance, and they lead to modifications in incentives, and organization structure.

Productivity Substantial literature on industrial productivity identifies direct consequences of environmental policies on productivity and it is an inconclusive debate. While studies like Meyer (1995), Srivastava (1995), and Porter (1991) show minimum impact, theoretical arguments by Yohe (1979) and Pethig (1975), and empirical studies by Jaffe et al., (1995), Gray, (1987) and Gollop and Roberts (1983) indicate increased economic and manpower costs, thereby reducing productivity. However few studies also identify possible indirect or unintended consequence of environment legislations on firm productivity. Triebswetter and Hitchens (2005) conducted a three country comparison on competitiveness of manufacturing sector and found that 25% of the plants indicated positive labour productivity effect. This was possible as now more work was carried out by the staff in order to undertake environment related initiatives. Earlier, Scarpetta et al. (2003) had found that while stringent regulations hindered productivity directly, they had an indirect unintended effect on productivity by affecting innovation activity and entrepreneurial activity within firms. An interesting angle to indirect influence on productivity was provided by Boghe's (2001) technical paper on latest directive for the UK electronic industry. The author suggested likelihood of less sophisticated electronic equipments like TV and audio also entering the recycling and reuse chain, which would bring more complex but less valuable material available for use. This may indirectly adversely influence the productivity of these manufacturers who may not have sophisticated abatement equipment and also large manufactures as they will have to adapt their product design to use this material. Furthermore, loop structure to firm productivity is suggested by Dion et al. (1996) and Majumdar and Marcus (2001) where along with regulatory design, its implementation is seen to influence firm productivity. Environment regulations have a direct influence on local conditions (extent of environment damage and labour market condition) which unintentionally impacted the monitoring behavior of regulators and vice versa. However, well designed legislations give actors better choices and are seen to enhance entrepreneurship and creativity within firms (Dion et al., 1996; Majumdar and Marcus, 2001).

Organizational systems and processes Environment legislations can alter organization characteristics. Some of the direct consequences are investment in abatement technologies, hiring environment experts, and manufacturing environment friendly products (Togerio et al., 2004; Simon et al., 2000). Literature findings suggest that environment regulatory compliance imperatives unintentionally trigger three organizational imperatives. One, it heightens importance of internal and external communication networks. Second, it makes quality management a prerequisite. Third, it alters human resource systems through modifications in the organization structure by creating new roles, and compensation and incentive system.

Enhanced importance of communication channels with design engineers and community groups was found by Russo and Harrison's (2005) where the authors found clear reverse causality where organisational characteristics were seen to result from (rather than cause) environment performance. For example, increased communication between production engineers and pollution control workers created an iterative problem solving process enhancing environment compliance (King, 1994). Moreover, effective communication channels which allowed for lateral and upward information flows helped managers make better decisions with respect to environment issues (Ochsner, 2000; Sharma et al., 1999; Westley and Vredenburg, 1996). Similarly, Kazmierczak et al.'s (2004) ergonomics analysis of car disassembly production systems found criticality of effective communication structures with design engineers for long term efficiency. Cordano and Frieze (2000) used structured equation analysis to study perception and behavior of 295 environment managers. Using Ajzen's theory of planned behavior they found communication barriers could inhibit environment performance. Restricted communication between environment managers and business managers limits the compliance activity (Shelton, 1994). These studies echo the understanding that environment issues are multifaceted and require consistent cross functional coordination for effective environment compliance. This indirectly influences communication and information flows in an organization. Another system which is seen as a prerequisite for environment compliance for many organizations is quality management. Russo and Harrison's (2005) empirical study on the electronic industry found quality management becoming critical for environment compliance. This was empirically tested by Zuang and Synodinos (1997). The authors analysed 203 chemical firms to understand steps taken in product and process redesign for environment compliance. Their study revealed product quality as the top most concern for firms with experience and proactive intentions towards environment compliance. The third indirect impact on organization is through its systems of structure and incentives. Changes in organization structure through the emergence of new role of eco-champions were seen by Russo and Harrison (2005), Simon et al. (2000), and Henriques and Sadorsky (1999). The authors further suggest promotion of eco-friendliness through incentives and compensation within organizations as a critical requirement for environment commitment. However, the effect of the incentives on employees is not uniform. While it is a critical link between plant manager and environment performance, it was seen to have no value for environment managers (Russo and Harrison, 2005). Hence, organizations structures and systems may get modified to meet efficiency needs with respect to environment compliance.

4.3.1 Discussion

Organizations seek congruence between work and formal structure where they align their needs, demands, goals and objectives such that each of them is consistent with the other (Nadler and Tushman, 1992, 1997). The greater the congruence the higher is the performance of the organization (Russo and Harrison, 2005). Congruence will lead to smoother, efficient systems, leading to direct cost related gains. However, there is no “one best way to organize” and organizations use different structures as suitable for different kind of activities, depending on operational conditions (Nadler and Tushman, 1997). Review evidence shows that environment management demands intricate network of inter and intra organization communication as well as incentivisation of this work at various functional levels in order to be effective. The right formal structures and systems can smooth communications, energize the incentives and balance authority and autonomy (Russo and Harrison, 2005). If we were to consider the process of environment management (work) from the economic perspective, organizations should arrange their internal systems to meet the compliance demands. Similarly, ecological modernization theory views current industry structure as environmentally inefficient as it promotes control technologies and limited organization exchange which hampers any innovation (Murphy and Gouldson, 2000). Therefore there is a role for environment regulation to force or facilitate exchange between organizations in order to facilitate innovation and develop ecologically feasible systems of work.

Proposition 7: Intra organizational environment compliance imperatives and influence of external collaborative pressures may make organizational boundaries more permeable.

5.0 Conclusion

In this paper we examined the indirect and unintentional impacts of environment regulations. Review evidence shows that environment regulations may lead to some unanticipated consequences, leading to lasting transformations in the end results. However our study has limitations. We cannot generalize and conclusively state the consequences unless the propositions are tested empirically. Moreover, though the larger philosophy is the same, but regulations vary in their structure across countries, and their interpretations across regions. This creates a substantial amount of noise in the review. Therefore our agenda for the future is to empirically investigate the propositions, taking the pharmaceutical industry in UK, to assess the generalizability of our findings.

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Table 1: Number of relevant papers sorted at each stage of review

Stage	Included ^a	Excluded ^b
Initial Search*	234	-
Title analysis	178	56
Abstract analysis	109	69
Paper reading	70	6
<p>* Data search included Elsevier Science and Academic Press Journals, ABI/Inform for Business and Management Journals, Emerald Fulltext Journals, IEEE/IEE Electronic Library (IEL), Proquest Science Journals, Springer Journals from LINK, and EBSCO Database: Business Source.</p> <p>a. Inclusion criteria involved looking at all those papers which directly/primarily explored relationship between environmental laws and any dimension of productivity (at the level of firm, economy, industry, nation and international).</p> <p>b. Exclusion criteria involved removing all those papers which did not directly/primarily explore relationship between environmental laws and any dimension of productivity.</p>		

Table 2: Themes wise categorization of papers reviewed

Level of impact	Themes	Focus of studies	No of studies
Economy	Environment damage	Energy use in processing environment friendly material or process; and environment decisions of one region impacting another	8
	Regional level impacts	Community level economic impact; and perception and interpretation of regulations by regulators and firms	6
	Global level impacts	Discrimination and additional trade barriers; and logistical complexity of compliance	15
	Emerging markets and industries	Growth and evolution of new commercial structures like markets in secondary and used goods at the local and global level; and recycling as a separate industry	11
Industry	Supplementary legislative support	Need for of additional government intervention through incentives and subsidies	8
	Entry barriers and decreased competition	Reduced competition due to discouraging effect on entry of entrepreneurs and small firms; and manipulation of this by existing firms to promote legislation which increases capital costs	14
	Emergent business models	Emergent industry level structures namely, non linear, multidimensional supply chain model as a consequence of active participation of customers as suppliers; and strategic collaboration between firms to manage logistical complexity	10
Organization	Productivity	Enhanced labor productivity; reduced entrepreneurship and innovativeness; and design of regulations impacting productivity	5
	Organisational systems and processes	Inter and intra firm communication; quality management; and incentives, and organization structure	16

Table 3: List of studies and the area of indirect and unintended impact covered under each study

No.	Authors	Environment damage	Regional	Global	New industries and markets	Support legislations	Entry barrier and Competition	Business models	Productivity	Org. systems & processes
1	Grerther et al., 2006			1						
2	Anderson et al., 2005							1		
3	Russo and Harrison, 2005				1					1
4	Venables, 2005					1				
5	Finnenviden et al., 2005						1			
6	Triebswetter et al., 2005								1	
7	Hick et al., 2005				1					
8	Herold & Kovacs, 2005				1					
9	Knight et al., 2005	1								
10	Valle et al., 2005							1		
11	Sherlock et al., 2004							1		
12	Almeida et al., 2004	1								
13	Goosey, 2004	1						1		1
14	Gouldson, 2004		1							
15	Kazmicrak et al., 2004									1
16	Huisman et al., 2004	1					1			
17	Togiro et al., 2004	1					1			1
18	Scroa da Motta, 2003	1		1						
19	DTI, UK, 2003							1		1
20	Scarpetta et al., 2003			1		1	1		1	
21	Kim, 2002							1		1
22	Young et al., 2002			1						
23	Boghe, 2001								1	
24	Cardinali, 2001		1							
25	Majumder et al., 2001								1	
26	Esty, 2001			1	1	1				
27	Esty and Geradin, 2001			1						
28	Lawson et al., 2001				1					
29	Fare et al., 2001						1			
30	Fernie and Hart, 2001			1			1			
31	Simon et al., 2000									1
32	Stafford et al., 2000		1							
33	Ochsner, 2000									1
34	Cordano and Frieze, 2000									1
35	Angel et al., 2000		1							
36	BRE, 2000				1					
37	Bhagwati, 1999, 2000			1						
38	The Times, 1999							1		
39	King, 1999									1
40	Sharma et al., 1999									1
41	Kellow, 1999			1	1					
42	Henrique and Sadorsky, 1999					1				1
43	Jenkins 1998				1					
44	Low & Williams, 1998			1						
45	Zuang et al, 1997					1				1
46	Richard, 1997	1						1		1
47	Roarty, 1997					1		1		
48	OECD, 1996				1					
49	Klerovic, 1996			1						
50	Dean and Brown, 1996						1			
51	Barass et al., 1996					1				
52	Dion et al., 1996								1	
53	Meyers, 1995		1							
54	O Riordan, 1995, 1992		1							
55	Veiga et al., 1995	1		1						
56	Brainwaith, 1995			1	1					
57	Prendergast, 1995							1		
58	Barnes, 1994									
59	Shelton, 1994									1
60	Sorsa, 1994				1					
61	Candice, 1994			1						
62	Wheeler et al., 1993			1						
63	Barrett, 1992						1			
64	Cainsross, 1992						1			
65	Jacob 1991					1				
66	Westley and Uredenburg, 1990									1
67	Carlton and Perloff, 1990						1			
68	Scherer and Ross, 1990						1			
69	Brock and Evands, 1986						1			
70	Ungson et al., 1985						1			