SUSTAINABLE DEVELOPMENT:
Sociological Perspectives

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ABSTRACT

The paper is divided into three parts. Part I presents an overview of relevant sociological research before there was ever a concept of "sustainable development". The selected focus is on work falling under the rubric of environmental sociology as well as development sociology. Part II briefly discusses the context and process that led to conceptualizing "sustainable development". Part III considers the response of several sociology theories to sustainable development issues, with the focus on a selection of four major system theories: World System Theory, neo-Marxist "treadmill of production" theory, and modern systems theory, all of which have addressed development issues and eventually sustainability questions. An Epilogue suggests that sustainable development in thinking and in practice has been spreading and articulating what may be the beginning of a major societal paradigm shift, which eventually could match the industrial revolution in transforming social, economic, and cultural conditions. The article concludes, suggesting that sociology can and should play a role in relation to such a potential revolution of sustainable development similar to its role vis-à-vis the industrial revolution, namely monitoring and collecting data, analyzing, explaining, identifying and providing assessments of social impacts and related developments.

Key words: environment, environmental sociology, development sociology, sustainable development, system theories, social structure, revolution, industrialization

PART ONE BACKGROUND

1. Sociological Legacies.

Long before there was a conception of sustainable development, sociologists (as well as other social scientists) were conducting research on development issues (such as modernization, socio-economic development, distorted development, unequal development, etc.) as well as sustainability issues (pollution, environmental degradation, resource depletion, key resource struggles and politics relating to oil, water, land, etc.).

Selected environmental and development studies in sociology are briefly presented below, each in turn, before we go on to consider the emergence of the concept of sustainable development and some features of sustainable development as a sociological area of theory development. The article ends with an Epilogue suggesting that a new societal paradigm relating to sustainable development is emerging – and the study and conceptualization of this paradigm is a major challenge to contemporary sociology.[3]

2. Environmental research

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[3] Such a paradigm consists of a socially shared cognitive-normative framework -- in values, norms, beliefs, and strategies – and typically entails new principles of social organization (see related work on public policy paradigms and their shifts (Carson et al, 2009)). It need not be coherent or complete. Typically, in the early phases, it tends to be incomplete and partially contradictory.

"Environmental sociology" encompasses a substantial body of research.[4] Studies include investigations of attitudes toward energy use, pollution, and environmental degradation, the extent people are ready to try to conserve energy or protect the environment (for references, see below). In addition to attitude studies, there has been also considerable research conducted on, among other phenomena, actual patterns of household energy use and energy efficiency, innovations in energy technologies, human factors in and response to pollution and environmental degradation, and the politics of environment and energy as well as other resources such as land, water, and minerals. Sociologists have especially studied environmental movements and in some instances, their interactions with states (a considerable part this latter research has been institutional as well as historical in character).

Much of the substantial and important work of environmental sociologists emerged initially in the context of mainstream sociology blended in with many other studies up until the 1970s. From the early 1970s, the term "environmental sociology" came into increasing use. The section "Energy and Society" (Research Committee 24) was established within the International Sociological Association in 1971, and some years later (1977) the "Environment and Technology" section was formed in the American Sociological Association.

Several of the major contributions of environmental sociology include (this listing is not comprehensive in designation of either research areas or the many sociologists who have contributed to important bodies of knowledge in the diverse areas; this highly selected listing is merely intended to suggest the diversity of areas – and some of the intensity -- in which sociologists are engaged):

- **surveys of attitudes and opinions** toward the environment and environmental issues (Dunlap, 1994, 2002; Hamilton, 2011; Hamilton et al, 2005; Hamilton and Keim, 2009, McCright and Dunlap, 2011,among others)
- **lifestyle and consumer behavior studies** (Bostrom and Klintman, 2008; Dietz et al, 2003; Spaargaren and van Vliet, 2000, among others)
- **environmental movements** (Brulle, 2000; Brulle and Jenkins, 2005; Flam (1994), Jaimsen, Eyerman and Cramer (1990); Pellow and Brulle, 2005; Rootes, 1997; Richardson and Rootes (1995)), among others
- **studies of regulation and governance**: Carson et al, 2009; Fonjong (2008); Kasemir et al, 2003; Lidskog and Sundqvist, 2011; Lindén and Carlsson-Kanyama, 2007; de Man and Burns, 2006; Midttun, 2010, Nikoloyuk et al, 2010; Pellizzoni, 2011.
- **energy politics and policymaking:** Andersen and Burns, 1992; Baumgartner and Midttun, 1986; Midttun and Finon, 2004; Pachauri et al, 1991)
- **studies of innovation and entrepreneurship relating to alternative energy technologies and energy policies:** Baumgartner and Burns, 1985; Woodward et al, 1994, among others
- **special sector studies**: climate change (Dietz and Rosa, 1998; Giddens, 2008; Merlinsky, 2010; Norgaard, K. 2011; Stehr and von Storch, 2010; biofuels

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[4] Environmental sociology can be understood as the study of the interaction between society and the physical environment (Wehling, 2002).

(Bozzini, 2012; Carolan, 2009; Carrosio, 2012; Mol, 2007); fisheries (Burns and Stohr; Finlayson, 1994; Hamilton et al, 2005; Jentoft, 2005); forests (de Man and Burns, 2006; Nicoloyuket et al, 2010; Puy et al, 2008); tourism (Salvatore and Maretti, 2012); transport (Baker, 1994; Wang, 2012; Yago, 1983; Whitt, 1982); air transport (Midttun, 1992); water, sewage (Apiazu, 2010; Merlinsky, 2011; Tabara and Ilhan, 2008; Tabara et al, 2008); environmental education (Schmidt, 2004; Schmidt et al, 2011).

- **global environmental change studies** (Christen et al, 1998; Kaushik and Srivastava, 2003; Pretty et al, 2007; Redclift, 1987; Redclift and Woodgate, 2007; Rosa et al, 2010; York et al, 2003)
- **ecofeminism** (Mellor, 1998; Mies and Shiva, 1993; Salleh, 1997, 2009)
- **social theory, the environment, and nature-society relationships** (Benton and Redclift, 1994; Buttel, 2002; Christen et al, 1998; Dickens, 2002; Dunlap et al, 2002; Mehta and Ouellet, 1995; Murphy, 1997; Strydom, 2002; Wehling, 2002)

All in all, a substantial number of sociologists – although definitely a minority and to some extent marginal to mainstream sociology –have conducted considerable research on a wide spectrum of environmental questions and issues. A significant part of the research was concerned with humanly caused environmental degradation (fisheries, forests, pollution, etc.). Also, societal damage and loss in the face of environmental degradation has been important, especially its impacts on, among other issues, health, habitat, marginal communities and groups (for instance, women's subsistence livelihood (Mies and Shiva, 1993)). It is an impressive accomplishment and deserves much wider recognition within sociology.[5]

In sum, already starting in the 1960s and 1970s, sociological studies investigated and theorized about environmental issues and the relationship between social and natural systems (Dunlap, 2002:329). Environmental sociology extended its empirical research net (see below), developed a number of particular concepts and models and criticized mainstream sociology – and sociological theory in particular -- for ignoring the biophysical environment and arguing generally that the "material world" was not sufficiently taken into account in sociology (Buttel, 2002; Dunlap, 2002:331; Dunlap and Catton, 1978, 1979).[6] At the same time this emerging sub-discipline was viewed by many if not most sociologists as marginal to mainstream sociology. [7] In the mid-1970s, Catton (1976), Catton and Dunlap (1978), Dunlap and Catton (1979), among others, articulated

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[5] There are a number of anthologies and textbooks covering the general area (Benton and Redclift, 1994; Dunlop et al, 2002; Pretty et al, 2007; Redclift and Woodgate, 1997)

[6] Buttel (2002:39) emphasizes that there existed a *classical environmental sociology* (italics in the original): "Elements of environmental sociology have roots deep in nineteenth-century social thought. Not only did Marx, Durkheim, and Weber incorporate what we might regard as ecological components in their work, they did so from a variety of standpoints. Among the multiple ecologically relevant components of their works are materialist ontologies (in the case of Marx and Engels), biological analogies (Durkheim), use of Darwinian/evolutionary arguments or schemas (Marx, Durkheim, and Weber), the notion of nature-society "metabolism" (Marx), and concrete empirical analyses of natural-resource and "environmental" issues (Marx and Weber) (see Dickens, 1997, 2002)."

[7] Buttel (2002: 38) claims that the core of North American environmental sociology – and, in particular, the new human ecology – tended to be formed in opposition or in response to mainstream sociology.

what they referred to as the "new ecological paradigm", which became an important legacy of environmental sociology (not only in the USA but internationally).

3. Development research[8]

Development research emerged as a major sociological undertaking after the Second World War (there were parallel developments in the other social sciences). This research was particularly oriented to "less developed" or "non-industrialized" societies that were undergoing (or could be expected to undergo) a transition to industrialization (the transitions usually occurred under some form of capitalism but communist countries also launched massive industrialization and modernization programs). A major part of the early efforts had a particular theoretical perspective, namely "modernization theory" (Bernstein, 1971; Eisenstadt, 1966; Huntington, 1968; Inkeles, 1974; Lerner, 1958; Moore and Cook, 1967, among many others) and referred to the emergence of modes of social life, organization, and economy which appeared in Europe from the seventeenth century onwards and which came to have worldwide influence (Giddens, 1991).[9] The approach postulated more or less linear movement from "traditional societies" to "modern societies" (the latter bearing considerable similarity to the USA): the emergence of "rational" thinking and calculation, professionalization, monetization, market economy, urbanization, representative democracy, advanced educational systems, the spread of mass communication systems and literacy, extensive research systems, modern family structure, and much more. "Successful" development (economic, political, and cultural) was expected over time for all nations, and, consequently, a global convergence was predicted: faster or slower as the case may be. In a word, it was a theory not only of societal development but social transformation (Halpern, 1966).

In response to the take-off of modernization theory in the 1960s and 1970s (see references on the previous page) there emerged widespread critique as well as a number of counter-approaches to the analysis of society and its development (and underdevelopment): among others, dependency theory (Amin (1976), Cardoso and Faletto (1979), and Frank (1967)) , neo-Marxist theory (Benton, 1989; Schnaiberg (1980), among others),World Systems Theory (WST) (Hopkins and Wallerstein 1982; Wallerstein 1974, 2004), and modern systems theory (Buckley (1967) and his associates (Baumgartner et al 1986; Burns et al 1985; see also Archer, 1995).

Criticism of modernization theory focused on its simple dichotomization, traditional-modern, the transparent Western ethnocentrism, and strong assumptions of reductionism (individuals and personality structures as key explanatory variables). These critical perspectives highlighted the importance of class and international power relationships, unequal exchange (developed countries gaining at the expense of less developed countries), "underdevelopment" as a source of constraint and other perverse developments and distortions appearing in weaker, peripheral parts of "the Third World."

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[8] Development then referred to a multi-dimensional transformation of society (although many different conceptions in detail). It was not only a field of study but an aspiration, an ideology (or several) (Bernstein, 1971:142)

[9] In other words, modernization referred to development or change toward "modern" economic, political, and social system such as those that characterized the USA and Western Europe. See also Apter (1965), Halpern (1966), Levy (1966), Nisbet (1969), and Rogers (1962)

The opposition became a counterpoint to the optimism and apparent "value neutrality" of "modernization theory," emphasizing rather class exploitation, the perverse "development of underdevelopment", "blocked development, divergence in development patterns, and global inequality generally.

By the end of 1970s, modernization theory faded (only to return a decade later as ecological modernization theory emphasizing ecological considerations, societal learning, and institutional and cultural analysis)(see below). WST, neo-Marxist, and modern systems theory presented and elaborated their considerations of societal development (the following discussion is drawn from Burns (2006). WST, in particular evolved into a major sociological research programme on development, which continues to be active and flourishing and which has in the last decade also embraced environmental issues (see below) (Bergesen 1983; Chase-Dunn 1997; Chase-Dunn and Hall, 1993; Chase-Dunn and Grimes, 1995; Hopkins and Wallerstein 1982; Wallerstein 1974, 2004).

WST shared the Marxian historical perspective paying close attention to economics but shifted the focus from a single state to a global world economic system linked by trade. More attention was paid to market and trade expansion than to modes of production, the latter much emphasized by conventional Marxists. It focused on imperialism and dependency among nations and considered "development" in a global and comparative perspective .[10]

By conceptualizing positions of societies in a matrix of global trade and diplomacy, WST contributed to breaking out of the framework utilized by most sociologists, modernization theorists as well as Marxists, to study the development of individual societies in isolation from one another (Chirot and Hall 1982:102). WST also articulated a variety of systemic concepts and analyses, such as structures of domination, center-periphery relationships, semi-peripheral regions (halfway between center and periphery in terms of economic structure and power), unequal exchange and accumulation, and anti-global system movements (Wallerstein, 2004). While WST has played an important role in development sociology, it neglected until recently the bio-physical environment (a failing it has acknowledged). Increasingly, it gives attention to global environmental issues (see below).

The historical approach of Marx conceived of all societies as evolving in a series of stages. Each stage was characterized by a particular structure, a certain mode of production as well as other structures, for instance, the "superstructure" of politics and culture derived from and dependent on the substructure of production. Human beings generate these structures through their own actions, but not always under the conditions of their own choosing or in the ways they intend. Marxist theory identified and explained

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[10] In the WST perspective, competing states (and their economic agents) are linked together in a global system which is structured as core (rich, developed, and powerful) and periphery (poor, underdeveloped, and relatively weak). Center-periphery is, in a word, relational. The former dominates the latter, yet the functioning of each part is interdependent in the global system. Major wealth and other gains accrue to the core, which is characterized by high profitability, high wage levels, multiple benefits, and high-skill developments producing diverse and advanced goods and services. Profitability, it is argued, is achieved without the brutal exploitation of labor in the core. On the other hand, peripheral areas are systematically "underdeveloped" and are characterized by low profitability, low wages, and the production of less advanced goods and services; labor tends to be highly exploited. Contrary to the view of many Marxists, it is the periphery (not the developed center) that is the locus of great exploitation (and increasing environmental degradation, as suggested below).

why certain modes of production, that is, particular social structures, give advantages to one group or class rather than another. The relative power of social classes is determined by the particular mode of production, the ownership of productive property, and the authority system required by a given technology (Stinchcombe, 1968). Classes have not only different interests (ideology and modes of mental production) but also different capabilities and means of political mobilization and influence.

According to Marx, because of contradictions between structures, the capitalist system has been historically characterized by economic crises, conflicts, and tendencies for continuous transformation not only of economic relations but also other social relationships. Advances in technology and knowledge, increasing size of production units contribute to changes in the mode of production and hence re-distributes power among classes over time. Those agents or classes of agents with growing power under emerging conditions increase their influence over institutional and cultural conditions.

Actor system dynamics (ASD) developed by Buckley, Burns and their associates dealt with some of the same issues as WST and Marxist theories. In investigating and analyzing societal dynamics and development (and underdevelopment), ASD stressed the role of human agency, institutional, cultural, and power factors, interactions (conflict, exchange, and struggle), as well as the innovation and socio-political mobilization and transformation.

Complex, dynamic social systems are described in terms of stabilizing mechanisms (morphostasis) and destabilizing mechanisms (morphogenesis) (Archer, 1995; Buckley, 1967; Burns et al, 1985). The structural and cultural properties of society are carried by, transmitted, and reformed through individual and collective actions and interactions.

Structures such as institutions and cultural formations are temporally prior, relatively autonomous and possessing causal powers, constraining and enabling people's social actions and interactions. Agents through their interactions generate structural reproduction, elaboration, and transformation. In such terms, institutional and stratification structures contribute to creating and re-creating themselves in an ongoing developmental process in which human agents play constructive as well as destructive and transformative roles in the context of complex socio-cultural systems. Active agents with their distinctive characteristics, motivations, and powers interact and contribute to the reproduction and transformation of structure: establishing and reforming structures such as institutions, socio-technical systems, and physical and ecological structures but always within constraints and opportunities and not in precisely the ways the change agents intended. Such an approach was particularly used to identify and analyze mechanisms of innovation and transformation of technologies, infrastructures, and social structures and the genesis of new forms.

PART TWO THE CONCEPT OF SUSTAINABLE DEVELOPMENT EMERGES

There is a substantial scientific consensus that the major global environmental threats are the consequences of human factors – cultural forms, institutional arrangements, social practices and behavior: overconsumption of precious resources (such as water, forests, fossil fuels), overexploitation of nature's "capital" and destruction of ecosystem services,

unsustainable land practices, the unabated release of toxic chemicals, and emissions driving climate disruption, among others. The result is the disruption of carbon, ocean, climate, biotic, and other biogeochemical cycles and the loss of biodiversity, deforestation, environmental degradation, over-exploitation of nature's "capital" and "services" (Rosa et al, 2010; Strydom, 2002). A biosphere catastrophe (beyond one or more of several tipping points (see earlier)) threatens to wreck the economy and society as we know them.

A short look backward—to the decades just before the current millennium—reveals the remarkable acceleration in the pace, scale, and spread of human impacts on the global environment (Rosa et al, 2010). Looking forward, greenhouse gases now in the atmosphere will remain there for a millennium; will increase by releases to which we are already committed, and will almost certainly contribute to weather extremes, flooding and drought, which will seriously affect agriculture and the life conditions of people living on islands and along coastal regions. This, plus the spread of tropical diseases, increased vulnerability to vast epidemics, sea level rise, and more severe storms, will reduce (are already reducing) the welfare of many human communities and populations. A biosphere catastrophe (beyond one or more of several tipping points) threatens to wreck the economy and society as we know them.[11]

The following Figures 1 and 2 show the exponential growth since the 1760s of "drivers" of environmental change (the systems producing increased cars, water consumption, fossil fuel consumption, electronic goods, tourism, garbage, etc.) and the physical impacts (also, exponential growth curves): gas emissions, collapse of fisheries, tropical deforestation, bio-diversity loss, and much more.

Despite these widely held scientific views, policy decisions needed to deal with these threats have been disappointing – thus far arguably not up to the level necessitated by the challenge. Meanwhile, the accumulation of greenhouse gases (GHGs) continues unabated (and humanity still lacks a clear agreement or strategy for enforceable reductions), species extinction rates accelerate to thousands of times "background" extinction rates, and more and more toxic compounds accumulate from pole to pole.

Modernization – whichever its current forms and however it is brought about– appears to make human life increasingly unsustainable on this planet. One of the issues – and challenges raised by contemporary research – concerns what possible forms of modernization are sustainable and how they might be accomplished (see later discussion).[12]

Global environmental change touches upon every facet of human existence - health, diet, health, leisure, quality of life, everyday practices; production, consumption, education, research, politics, and societal values. A "transformation" of ways of thinking,

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[11] The Greenhouse effect is transforming global and local weather patterns, 100 year floods become frequent events, as do the frequency of powerful hurricanes, continental forest fires, and other disasters; all of these draw down the reserves of insurance companies and the emergency funds of even the most prosperous states. The poor ones suffer their fates or receive some relief through international aid.

[12] "Sustainability" and "sustainable development" are political and normative ideas such as "democracy", "social justice", "equality," "liberty", etc. rather than precise and scientific concepts; as such, they are contested and part of struggles over the direction and speed of social, economic, and political initiatives and developments [19-20]. Baker [19-20] emphasizes that they become particularly meaningful and effective in concrete settings where they are to be operationalized, put into practice – they thus service constructive purposes.

judging, and acting, etc. needs to take place – and there are many developments in this direction, but it is not clear or certain that these changes will take place in a number of the most critical areas quickly enough (see Epilogue).
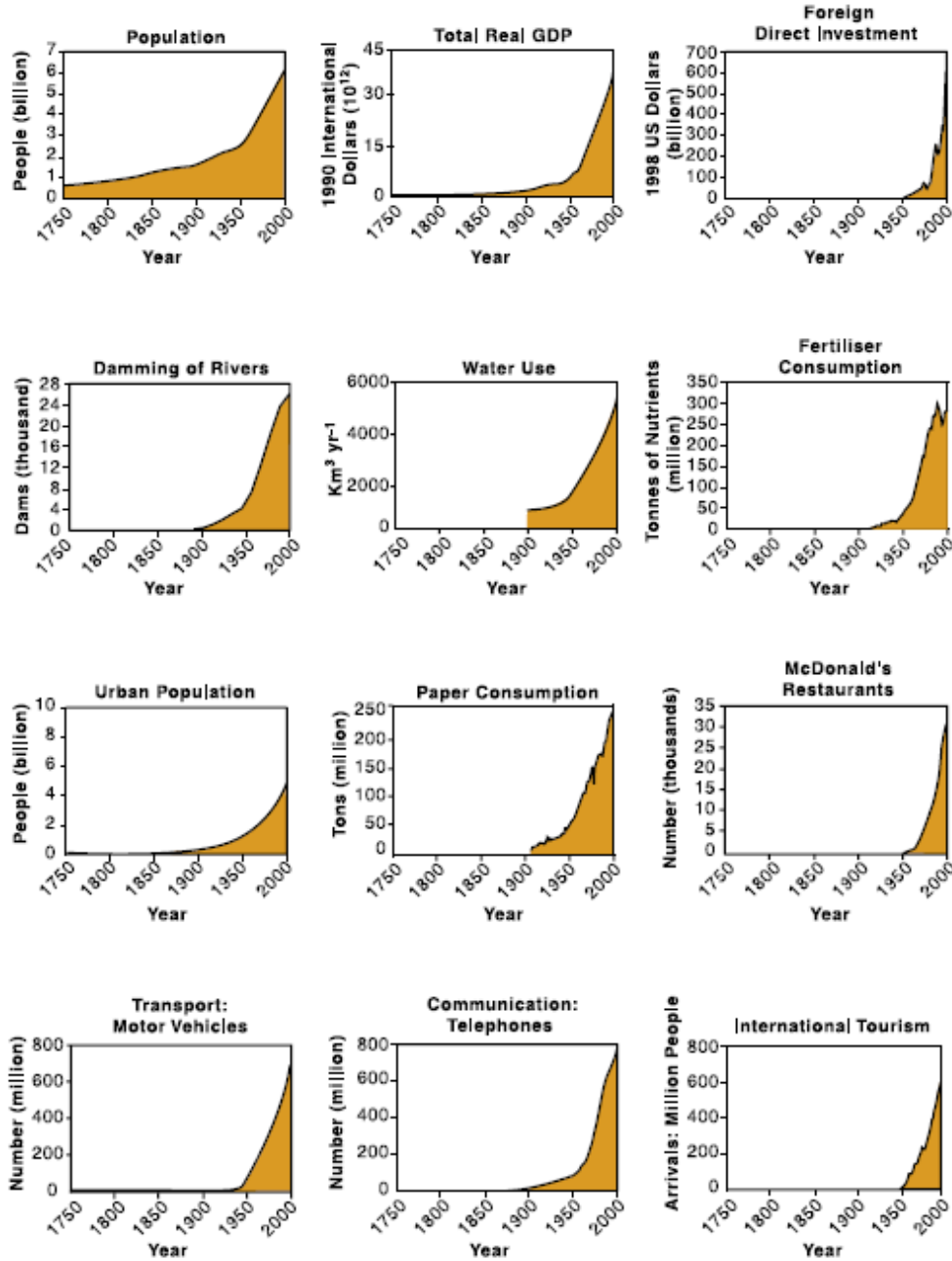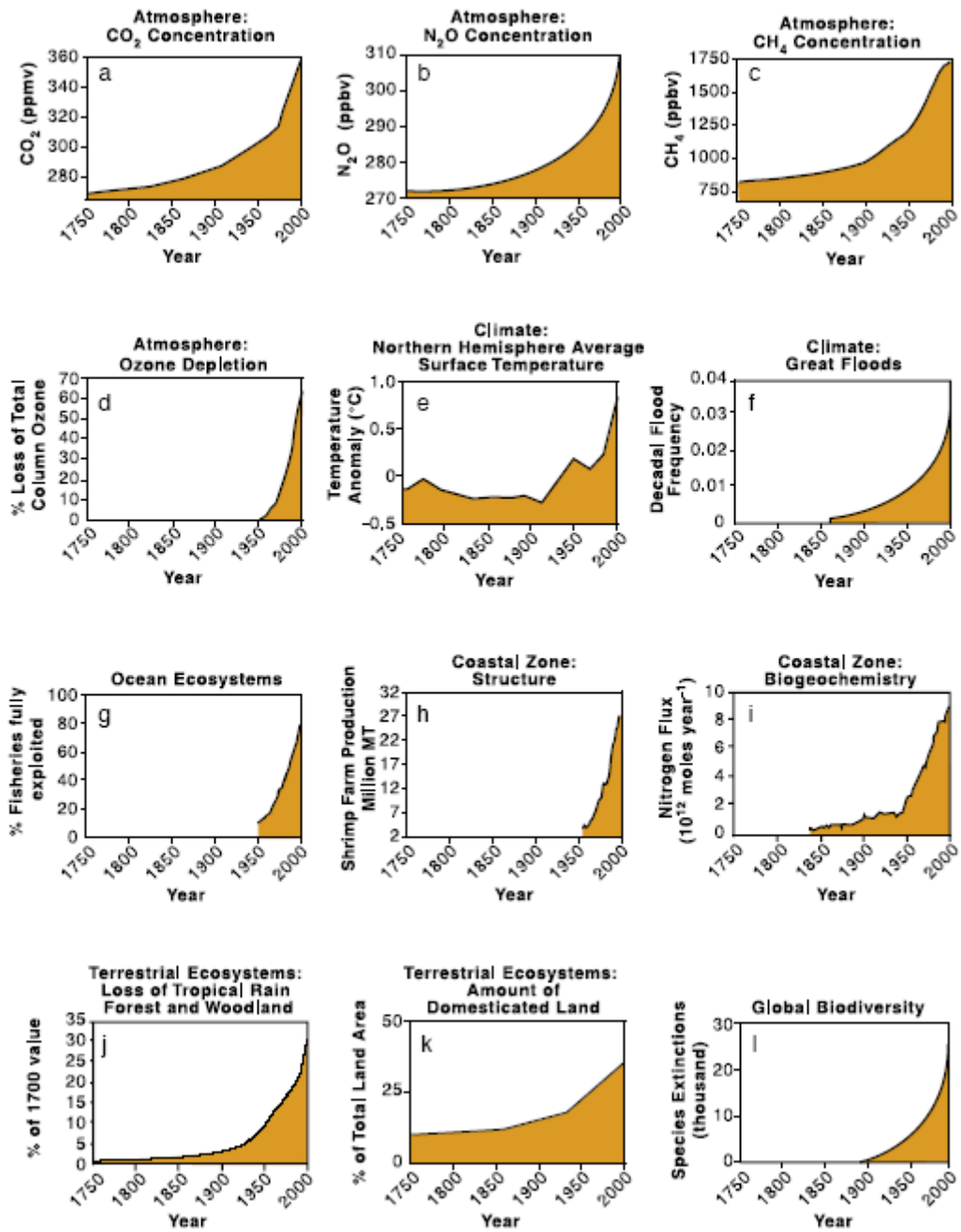

Figure 1: Indicators of Industrial Growth and "Development."
Source: [23]

Figure 2. Indicators Of Physical And Ecological Stress (And Changes In Stress)

Source: [23]

2. Sustainability: Emergence of a Public Normative Concept[13]

The literature on the concepts 'sustainability' and 'sustainable development' is vast. These influential concepts emerged out of political and administrative processes, not scientific ones. Like the concept of development itself, sustainable development has been a contentious and contested concept, not only with respect to controversies between advocates of capitalism and those of socialism, between industrialized and developed countries, or between modernization advocates and their diverse opponents. [14] In other words, to earlier contentious issues have been added environmental issues. These have been and continue to be divisive, for instance between those who advocate constraining or blocking much socio-economic development in order to protect or reclaim the environment (GHG emissions, climate change, depletion of key resources, deforestation of rain forests, etc.) and those who stress the need of socio-economic development to alleviate poverty and inequality, if necessary at the expense of the state of the environment. As Opschoor and van der Straaten (1993:2) point out: "A fair and prudent assessment of the extent of the environmental utilization space leaves much less room for economic development than an anthropocentric, egotistic and risk accepting one."

Historically, the linkage of sustainability and development has been, in large part, the result of global political and administrative processes and the diverse interests driving these processes. The term "sustainable development" was coined as a political-administrative term to bridge differences between developed and developing countries in the context of UN negotiations and resolutions. The UN World Commission on Environment and Development (WED), chaired by Gro Harlam Brundtland (former Norwegian Prime Minister), produced an influential report in 1987, *Our Common Future* (WED, 1987). The Brundtland Commission had been established by the UN in 1993 in response to growing awareness and concerns of the deterioration of the human environment and natural resources at the same time developing countries were pushing for higher levels of economic growth (and the likelihood of increased damage to the environment). The Commission was to address the environmental challenge as it was intertwined with economic and social issues.

The Commission consisted of 21 different nations developed and developing countries including Canada, Germany, Hungary, Japan, and the USA as well as Brazil, China, India, Indonesia, and Sudan. The 900 day international exercise in discussion and

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[14] Lepenies (2008) argues that the development-underdevelopment dichotomy has a long legacy as an asymmetric, dichotomous concept related to dividing the world in two halves: Hellene-Barbarian, Christian-Pagan, civilized-uncivilized, and Human-Subhuman, implying the superiority or advancement of one side and the inferiority and need for advancement of the other side. Of course, underdevelopment is not fixed, development is a process as well as a stage, and development assistance is an obligation for the development, and that ideally the path of development is laid out for all underdeveloped countries alike (2008:203). Clearly the concept is a normative one. "Developing" has become the term replacing to a large extent "underdeveloped" in the parlance of international agencies, academia, and diplomacy (Lepenies, 2008-223). "Developing presupposes a movement toward a satisfactory level of development whereas the notion of "underdeveloped" is static, frozen.

negotiation dealt with written submissions and expert testimonies from a wide range of global stakeholders, NGOs, industrialists, government representatives, researchers, etc. The Commission concerned itself with environment and growth/development as well as a number of related issues. The term "sustainability development" was intended to build bridges between the economic, ecological, and social areas of concern. Above all, the concept was meant to refer to development that meets the needs of the present generation without compromising (or jeopardizing) the ability of future generations to meet their needs [WED, 1987]. [15]

During the course of negotiations, the developed or industrialized countries stressed, in general, the need for societal constraints and the strict regulation of hazardous emissions and waste management, the mitigation of depletion of resources and environmental degradation. The developing countries, on the other hand, stressed economic growth and development, even if it entailed hazardous emissions and environmental degradation. [16] The 1992 (Rio de Janeiro) and 2012 (Rio de Janeiro) Earth Summits engaging thousands of participants from all over the globe are, in part, derivatives of the Brundtland commission and its influential report. Of particular significance, the report brought the problem of environmental deterioration and ruthless exploitation of natural resources into the global context of the relations between North and South. Thus, issues of equity and distributive justice were raised and became part and parcel of the global discourse.

It is not feasible to construct a *definition of sustainable development*, based on entirely technical or ecological criteria, since the concept is a normative and political one (Opschoor and van der Straaten (1993)), much like "democracy" or "justice (see footnote 13)." Its definition and implementation entails political processes, in which diverse agents and institutions with varying conceptual and value orientations are engaged. [17]

Consequently, sustainability, as a normative concept, is used, among other things, to refer to a fair distribution of natural resources among different generations as well as among populations of the world today. It has also concerned values and 'rights' to

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[15] Numerous other definitions have been proposed: WWF (2002:20) put it as follows: "to be sustainable, humanity's consumption of renewable natural resources must stay within the limits of the Earth's biological capacity over the long term…[And] for non-renewable resources (e.g., petroleum), consumption must stay within the limits of the rate and level of replacement with alternatives." Other variants stress physical and economic aspects. Opschoor and van der Straaten (1993:1-2) provide a system conception: development is sustainable "if the environmental impacts do not impair the present and future functioning of resource regeneration systems, waste absorption systems, and the systems supporting flows of other environmental services and good, and when use of nonrenewable resources s compensated for by at least equivalent increases in supplies of renewable or reproducible substitutes..."

[16] The Brundtland report (WED, 1987) stressed that perceived needs are socially and culturally determined, and sustainable development requires the promotion of values that encourage consumption standards that are within the bounds of the ecological feasible and to which all can reasonably aspire. Moreover, the Report argued that economic growth is a necessity in developing countries, while economic growth should be curbed in the developed parts of the world.

[17] Here the concerns obviously go beyond physical conditions or ecological systems. Issues about distributive justice – and the governance systems that would bring this about – are front stage. At the same time, doubts have been raised about whether maintaining a given level of "natural capital" is compatible with non-negative changes in welfare per capita (at least for some measures of welfare)."

existence of other species as well as notions on how much environmental capital one generation should bequeath to the next (Opschoor and van der Straaten, 1993:2). [18]

PART THREE RESPONSES OF SELECTED SOCIOLOGICAL THEORIES TO THE SUSTAINABLE DEVELOPMENT CHALLENGE

1. Merging Development and Environmental Considerations

The focus here will be limited to selected sociological systems approaches that have a history of considering development issues and at the same time have combined development and environmental concerns: ecological modernization theory, WST, and one of the several Marxist inspired theories ("threadmill of production" theory), and modern systems theory (ASD), all of which developed considerations of materiality and the physical environment within their diverse "development frameworks."[19] WST, in particular, extended their past conceptualizion of structural differentiation (core, semi-periphery, periphery) to argue that environmental hazards and degradation were being shifted from the core to the periphery and semi-periphery (Frey, 2006). This type of exploitation is based on a type of "unequal exchange," corresponding to the global production of inequalities in power and wealth, argued and elaborated in WST's earlier work. Just as in the case of world poverty, responsibility for the ecological degradation in developing countries lies with core countries, their multinational corporations, governments and diverse groups including labor unions that tend to align with their corporations and governments when it comes to environmental issues. Rosa et al (2010:110) summarize WST's as follows:

> ….Importantly the accumulation of wealth occurs in the core while
> Environmental degradation occurs primarily in the periphery and
> semiperiphery. Thus core nations where capital accumulation occurs
> are often spared local environmental impacts that occur in the periphery
> and semiperiphery.

According to WST, substantial ecological improvements may occur in the most developed parts of the global system (the center) at the expense of any accomplishment in the periphery and semi-periphery. Such unequal development will continue as long as the

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[18] In the language of policymaking, some refer to the three pillars or fields of sustainable development: economic functioning and prosperity, social welfare and justice, and environmental protection. The challenge is to determine how one balances or combines these in a sustainable way, particularly since under some conditions they are contradictory: economic growth versus environmental protection and conservation, or sustained growth versus fair public welfare and distributive justice.
The concept's power and also basis of contentiousness relates to it bringing together these apparently mutually exclusive issues of environmental, economic and social imperatives (Woods, 2010). Harris (2001:3) emphasizes, "Its contestation arises both from the emphasis placed on these three imperatives and from the difficulties encountered in the practical application of the concept".
[19] Other approaches to sustainable development include such diverse scholars as Susan Baker (1996,1997), Riley Dunlap (1991); Kasperson et al (2010), Bill Lafferty (2006, 2001, 1999), Redclift (1987), and Gene Rosa et al (2010). This overview does not do justice to substantial and expanding work being conducted by sociologists in all parts of the world. Thousands of sociologists from Africa, Latin America, Asia, the Middle East, Europe, and North America are investigating sustainable development issues on macro, meso, and micro levels: studies of consumption, production, energy, renewable energy, water, forests, pollution, GHG emissions, climate change, etc. The research is both theoretical and empirical.

global capitalist system is maintained. The political forces supporting maintenance and reproduction of the system are formidable. At the same time, the global system is not, according to WST, ecologically sustainable over the long run.

WST remains an important approach to issues of sustainable development, because it is attentive to factors of power and contradiction. It has, however, been somewhat rigid in its structural distinctions between core, periphery and semi-periphery. Sustainability is arguably not just a part of the core. It is part and parcel of many successful initiatives of developing countries in the periphery and semi-periphery. ASD's empirical research (see below) shows that there are important initiatives in the "periphery" and "semi-periphery" countries to protect the environment, to resist attempts by core multinationals and governments to extract resources from, and to export wastes to, the periphery. Also, there are initiatives and innovations in regulating the use of resources such as forests, water, and land (Nikoloyuk, 2010; Ostrom, 2005).

Several neo-Marxists extended their legacy of societal development and transformation studies to address issues of sustainability.[20] Of particular prominence in this regard are Schnaiberg (1980) and Gould, Pellow, and Schnaiberg (2008) – with their "treadmill of production" theory (TPT)(for other neo-Marxist approaches, see Benton (1989), Dickens (2002), Foster (1999, 2000); O'Connor (1994), Wehling (2002), among others). They single out the capitalist system as the driver not only of increased production, technological development, and the accumulation of wealth but also systematic environmental degradation. In addition to producing goods and services, its enterprises along with household consumers and government agencies produce and deposit wastes in the environment. The system excessively extracts and exploits resources from the environment at such a rate that it will undermine its natural resource base. Capitalist agents are driven to do this by the competitive spirit engendered in capitalism and the supporting (aligned) interests of governments and other societal agents who adhere to (or, at least, support a highly expansive, wealth-producing capitalism). The immense pressures toward growth and capital accumulation tend to countervail or even negate efforts and programs aimed at protecting or recovering environmental health and achieving sustainability. Like WST theorists, Schnaiberg sees an alignment in modern capitalism of business interests, organized labor, and governments as well as the multitudes of participants in consumerism[21] oriented to externalizing costs of production and consumption and resisting much of the attempts at environmental protection and regulation. At the same time, an unequal distribution of environmental problems and risks is generated (WST sees such externalization in the "exports of hazards and costs" to peripheral parts of the world, therefore enabling the accomplishment of some degrees of sustainability in developed countries (see above)).

This sustained and systematic exploitation of the environment constitutes the "second contradiction" of capitalism (O'Connor, 1994; Rosa et al, 2010: 103). For Schnaiberg, *capitalism is not sustainable*, eventually it will undermine its natural resource base, which has been taken for granted for so long. Reform efforts driven by the

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[20] Also, see Benton, 1989; Dickens, 1992, 1997, 2002; Foster , 1999, 2000, O'Connor (1994), Wehling (2002), among others

[21] In other words, the integration of working classes and the formation of the welfare state and consumerism in developed industrial states have gone hand in hand with sustained economic growth as well as environmental degradation.

environmental movement serve to countervail to some extent the juggernaut of "treadmill production" and manages to force limitations and improvements (Gould, Schnaiberg, and Weinberg, 1996).[22] But in this perspective, the only solution, ultimately, will be to transform capitalism into another kind of institutional arrangement – in a certain sense, eliminating capitalist economics with its endless pursuit of monetary growth, excessive production, and wanton environmental destruction.

Another influential sociological theory in the area of sustainability – *ecological modernization* (EM) – differs substantially from WST and the neo-Marxist frameworks including that of Schnaiberg and his collaborators. EM was developed in the early 1980s; in a certain sense, it continued the earlier modernization ideas but with several significant differences (see Part One, section 3). The theory challenged the environmental movement's conventional wisdom that a fundamental re-organization of the core institutions of modern society – in particular the industrial production system, the capitalist organization of the economy, and the centralized state -- were essential to achieving long-term sustainable development. Adjustments and reforms, yes, but, according to EM, there was no need to do away with major institutions of modern society.

A key EM principle is that as socio-economic development advances and society becomes maturely developed ("late industrial society"), cultural patterns, institutional arrangements, and organizations becomes increasingly "environmentally rational" and decision-makers take into account environmental criteria and try to minimize human environmental impacts (Janicke and Weidner, 1995; Mol and Sonnenfeld, 2000; Rosa et al, 2010:104-105; Spaargaren and Mol, 1991). "Externalities" become internalized, and social production *and consumption* become cleaner, and the production of goods and services becomes environmentally compatible, according to their perspective on advanced modernized society. Thus, the theory implies that late capitalism is environmentally competitive, and both at home and abroad there is convergence and compatibility between the aims of capital and the environmental goals of society – as a new societal environmental logic.

In the EM perspective, this type of development trend is the result of broad and effective coalitions (group alignments) emerging in advanced industrial society to concern themselves with, and to try to protect, the environment. This presumably leads to reduced environmental impact but with further growth continuing: that is, the quantity of resources used per unit of output is minimized, and the wastes emitted per unit are also reduced. The underlying principle of environmental rationality becomes incorporated into corporate, government, and organizational policies and strategies. Ultimately, these ideas and policies drive technological innovation, market dynamics, political pressures (direct and indirect) of NGOs, and government regulation.

The theory purports to offer a general explanation of the current transformations of environmental institutions, practices, and discourses in advanced phases of modernization. Major changes can be observed currently in the organization of production and consumption in ways that bring about environmental improvements. The

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[22] Buttel (2002:45) is highly critical of the strong assumption in US sociology environmental movement mobilization resulting in state policy change is the master process. This is justified since there are multiple mechanisms of change that have operated in the past and operate now in the "sustainability revolution" (see later).

theory focuses on those institutions, in particular economy and technology, most important to bringing about a transition to more sustainable production and consumption. It stresses that environmental questions do not enjoy undisputed authority but share this with other societal objectives and considerations.

According to EM, as countries reach advanced or late capitalist development, they will increasingly adhere to ecological rationality which complements economic rationality. Sustainable development will be the next phase of modernization, following the phase of advanced industrialization. Spaargaren and Mol (1991) argue that environmental problems can best be solved through further advancement of technology and industrialization.

Productive use of natural resources and environmental media (air, energy, water, soil, ecosystems) – that is, "environmental productivity" -- can be a source of future growth and development in the same way as labour productivity and capital productivity had been for industrial development. Research is particularly focused on eco-innovations, and the interplay of various societal factors (scientific, economic, institutional, legal, political, cultural) which foster or hamper such innovations (Klemmer et al., 1999; Olsthoorn and Wieczorek, 2006): product and process innovations such as environmental management and sustainable supply chain management, clean technologies, benign substitution of hazardous substances, and product design for environment. The approach assumes "sustainable development" growth -- but failing to problematize that such growth, as currently envisioned, entails the consumption of natural and human capital at substantial cost to ecosystems and society (Fisher and Freudenburg, 2001).

In the EM perspective capitalism is neither an essential precondition nor an obstruction to, stringent or radical environmental reform. It becomes redirected so that it causes less and less environmental harm and increasingly contributes in a fundamental way to sustainability (and society's sustenance). While there continue to be "environmental issues", fundamental conflicts about environmental reform programmes in industrialized countries have in the EM view been decreasing since the late 1980s (although this certainly does not apply to the USA and several of the newer members of the EU – which are very observable in relation to, for instance, climate change issues and COP meetings.) (nor to Brazil, China, India and other developing countries opposed to modern industrialized countries).

In sum, ecological modernization assumes then a more or less linear development – a further phase of modernization largely with minimal conflict and struggle – assumptions that it shares with the original modernization theory. However, it is much more sophisticated and conceptually rich – for instance, it gives greater attention to concrete innovation processes and developments – than the earlier modernization theory.

EM can be criticized for its overemphasis on and optimism about technological innovation – and that many of the technological efforts to save humanity are likely to lead to negative unintended consequences. One should not have blind faith in technological breakthroughs and progress in that they may not come on stream quick enough (see later) and inevitably will generate unintended risky consequences..

Ecological modernization theory, while representing a type of systems theory, suffers from some of the same failings as the earlier modernization theory: its linearity, insufficient attention to human agency, conflict and power, and many unintended

consequences of system development; its optimism about the course of societal development (in particular, a high level of technological optimism).[23]

The fourth type of systems theory – applied to sustainable development issues – has been developed by Buckley, Burns and their associates in the form of a dynamic systems analysis, actor-system-dialectics (ASD). In ASD, there is no one factor explaining environmental degradation – or that guarantees a sustainable development, for instance, by simply controlling or eliminating capitalism or the world system. The global environmental problem complex are systemic phenomena – in particular industrial systems and their functioning and development. The systems are institutional arrangements and cultural formations powerful in relation to their human populations but also in relation to the material/ecological environment (Burns and Hall, 2012). Established institutional arrangements and cultural formations associated with industrial systems with mass consumption and/or mass exports not only include advanced capitalism but socialism and kingdoms such as Saudia Arabia. These all have proved their capability to contribute to ecological degradation. Change toward sustainability is difficult – there are powerful institutional and cultural barriers -- inertia inherent in the established industrial institutions and cultural formations. Established institutional arrangements and practices – an industrial paradigm of values, power arrangements governance structures, technologies, infrastructures – are destructive factors, degrading the environment beyond sustainable limits and threatening to undermine the resource base of the systems of production. At the same time, vested interests are able to mobilize and exercise power – and block or derail many sustainability initiatives.

These industrial/modernized systems are historic constructions – and in part operate as they should, in part they operate in unintended ways, for instance in degrading the planet. Established institutional arrangements and practices – an industrial paradigm of values, power arrangements governance structures, technologies, infrastructures – are destructive factors, degrading the environment beyond sustainable limits and threatening to undermine the resource base of the systems of production. At the same there are counter-movements and tendencies toward accomplishing some aspects of sustainable development – but not without the need of change agents to mobilize power, to overcome institutional barriers and/or agential opposition from vested interests. There is then a micro-, meso-, and macro- politics of sustainability and paradigm shift (Carson et al, 2007; Burns and Stohr, 2011b; Burns, 2012).

ASD teams have worked on three types of studies/investigations relating to particular ways in which sustainability initiatives take place, succeed or fail and, thus, the ways more sustainable technological, institutional, and policy and societal transformations take place:

(1) Sustainable technological innovations. ASD theorizing about technological innovations and development has been combined with numerous case studies of technological innovations relating to sustainability (wind, solar, geothermal, wood and hay heating systems, garbage burning for heating, reclaiming of gas byproduct for district

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[23] Some point out that there are substantial differences in perspective within the ecological modernization research programme, namely those who are techno-corporatist in orientation as opposed to those who have a more institutional and democratic political orientation (which allows for conflict and struggle). But this discussion would take us beyond this overview.

heating, among others.[24] Also, constraining factors and blockages have been investigated, e.g., in the case of solar heating in California, heat pumps in Germany, geo-thermal in the USA (Baumgartner and Burns, 1984).

(2) Sustainable Policy and Program Initiatives. A second major area of relevant theoretical and empirical research has concerned policy and program initiatives, public as well as private (Carson et al, 2007; Burns and Stohr, 2011a, 2011b; deMan and Burns, 2006; Nikoloyuk et al, 2010). One study concerned an investigation of arguably the most radical regulatory framework for chemicals every instituted, the EU REACH scheme.[25] This framework took almost 10 years to accomplish, engaged thousands of actors, and involved the mobilization of sector, national, EU, and global powers (for instance, the opposition of the European, American and Japanese chemical industries as well as the leadership of Germany, France, and UK. Another major EU initiative was the establishment of the Baltic Fisheries regulatory regime, which was successfully established but failed to function properly in effectively regulating fish catches and securing fish stocks. Another EU failure was in not being able to pass a carbon or energy tax, although this was a priority for the Commission, some member states (and the EU Parliament); the initiatives were blocked by powerful interests and a few key member states. Ultimately, the EU successfully established an emission trading system -- which however failed initially because of design but continues to function.

Several ASD investigations concerned private initiatives: BP set up an emissions trading program within its global organization; WWF and Unilever launched a regime to regulate palm oil plantations and to protect rain forests in South East Asia (Indonesia and Malaysia) ; Greenpeace and Springer Publishing took initiatives to made Nordic paper and pulp production more sustainable and to protect Russian forests and forest workers. All in all, these initiatives have been partially successful, but, in general, there is no easy "march" in contrast to the optimism of EM.[26]

(3) Major Transformations of Social Orders. ASD has conducted studies of social transformation, with a focus on identifying the key mechanisms of paradigm shifts and transformation of social order: complexes of institutional arrangements, new paradigms are realized -- significant changes taking place on all levels and in very different sectors. The development relates to: (a) Transitions where autocratic power combined with paradigm shift in cognitive-normative framework for governance and policymaking (if

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[24] Also the use of peat was investigated; peat was at the time considered renewable. More recent research has indicates it takes a very long time for peat to renew itself. The EU has banned the practice, and the programs established in Ireland, Finland and Sweden are being phased out.

[25] REACH = Registration, Evaluation, Authorisation, and Restriction of Chemicals, passed in 2006, and resulting in the establishment of a major regulatory agency, the European Chemical Agency (ECHA) located in Helsinki.

[26] Studies were also conducted during 1980-1985 of municipality initiatives to save energy and/or to develop renewable energy sources for oil (Woodward et al., 1994). The studies showed that change toward greater sustainability could be initiated by diverse actors and emerge from differing institutional spheres: politicians, bureaucrats, public utilities, grassroots engaged citizens, consultants (it needs to be emphasized that sustainability was not part and parcel of the language and discourses of the times). Typically, there was oppositioin and power had to be mobilized on the part of the "movers and shakers", and there were conflicts and struggle. Not only did new paradigmatic concepts emerge but also the initiators improved their capacities to mobilize resources – or to convince others to do so – and to exercise to a greater or lesser extent effective transformative powers.

hegemonic power remains committed to the old order, then change, paradigm shift is unlikely to take place, except due to external forces, for instance major change in material and social structural conditions).

(b) Pluralist distribution of powers where multi-agency negotiations can lead to a new paradigm: While key shifts have taken place through central or multi-agent negotiation: Kyoto agreement, EU fisheries, REACH. But also, there are cases of blocked or a stalemated state so status quo and business as usual continues (this was the case in the EU multi-agent negotiations about an EU energy or carbon tax (Carson et al, 2009; Burns and Hall, 2012). (c) Polyarchy where major changes takes place through the diffusion of ideas, techniques, and technologies.[27] These organic change mechanisms are characterized by processes of diffusion and emulation (mimetic function) where a multitude of actors make autonomous yet similar decisions to bring about a transition to a new order.[28] (d) Power shifts take place in such a way that a group with a paradigm differing from the established or hegemonic paradigm takes place (Green Parties entering into coalition governments have made some difference.

Key transformation factors concern then not only power factors (and agents exercising power) but their values and interests and the formulation and development of models or paradigms concerning the design and functioning of societal governance and development in new areas such as that of sustainability. The paradigm entails a type of "knowledge," although a knowledge that need not be necessarily correct or contribute to effective performance of the governance regimes.[29]

In sum, the focus on agency (on, for instance, entrepreneurs and movements) and structure (institutional arrangements, rule regimes, infrastructures, and the material/ecological environment) in relation to processes of social constructions and transformations has been a hallmark of ASD. [30] The research considers processes of developing new technologies, infrastructures, governance systems, economic practices, and cultural elements relating to sustainability.

In sum, the four systems approaches, EM, WST, TPT, and ASD offer substantially different perspectives, although there are a number of overlaps. WST, TPT, and ASD pay particular attention to social structure, power, class and global relationships, although the structures and stratifications they consider differ to a greater or lesser extent. EM contends that capitalism is, in general, not a deterrent to the

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[27] Material and social structural conditions also make up a "selective environment" which favor one structure rather than another, or make obsolete or defunct the existing arrangement (Burns and Dietz, 1992; 2001).

[28] "Organic" is a more encompassing notion than "grassroots", since the innovation and transformation processes are being launched and developed at multiple levels by collective agents that in some cases are very large and globally active and would not be understood as "grassroots" actors.

[29] Stinchcombe (1968) stresses the structural factors (including the power positions of actors in social structures) which enable them to initiate developments of new organizational arrangements *within* existing social structures.

[30] Ostrom and associates (1990, 2005, 2007, among others) developed and applied an institutional and systemic approach, "Institutional analysis and development" (IAD) framework. Her programs conducted numerous case studies, in developing and applying the concept of the commons – and human cooperation and community development in solving commons (and "free-rider problems") -- identified what they considered key elements of conservation and sustainable practices. Through their global empirical work, they constructed a massive archive of commons governance and its relation to the conservation of water, forest, grazing resources, and fish stocks, among other areas.

accomplishment of sustainable development, whereas TPT and WST stress that sustainable development will require the elimination of capitalism; for WST, this means global capitalism. ASD is more ambiguous in this regard in that from an institutional perspective, the shift to a substantially different capitalist paradigm – along with other system changes, for instance in governance and in education and research – *might* make a path to sustainability achievable (Burns Witoszek, 2012). However, although substantial changes are already taking place, it is doubtful whether the movement to another paradigm will be rapid and encompassing enough (see Epilogue). Both EM and ASD emphasize eco-innovation on multiple levels, but ASD stresses opposition and barriers, the importance of established and mobilized powers, that is, while the new ecological development is "a march" according to the former, it is often a struggle according to ASD (and although numerous such struggles, some relatively successful, are currently going on). There is an assuredness and optimism in the EM perspective that is not found in the social structural and power-oriented theories of WST, TPT, and ASD.

2. Concluding Remarks

To sum up, the sociology of development – including increasingly sustainable development – were relatively separated from environment research in Sociology. In the past two decades or so, there has been growing focus on environmental concerns and globalization, although for much of its history the sociology of development had little to say about the environment.[31] At the same time, most environmental sociologists neglected issues of development. Until recently, there were, quite simply, two distinct epistemic and paradigmatic communities in sociology, each with its own concepts, discourses, research designs, analyses, and publications. The emergence of the concept of sustainable development has contributed to bringing these research traditions closer together. As suggested in this article, conceptualization and research programs concerning "environment and development" have emerged, and the notion of "sustainable development" is being given increasing sociological attention. This has also given new life to system theorizing (since obviously such theories are more oriented to societal and global functioning and change).

The Epilogue suggests that there is an ongoing "sustainability revolution" comparable in several ways to the industrial revolution and which numerous case studies and observations of the mechanisms of organic transformation indicate is taking place (Burns, 2012).

One might envision sociology developing a major scientific and policy analytic role in relation to the emerging revolution of sustainable development similar to its role vis-à-vis the industrial revolution, namely data collection and monitoring, analyzing, explaining, identifying and providing assessments of social impacts and related developments in what are already complex social transformations.

EPILOGUE
Emergence of a Potential Sustainability Revolution: A Challenge to Sociology

From the 1960s there has been rapidly increasing global awareness and concern about damage to the environment – Rachel Carson's book (*The Silent Spring, 1962),* the UN

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[31] There were exceptions, for instance in the institutional-evolutionary approaches of dynamic systems analysis (see later variants in Burns and Dietz, 1992, 2001),

Stockholm Conference on the Human Environment (1972), the 1987 Brundtland report (The World Commission on Environment and Development, *Our Common Future*), the 1992 Rio de Janeiro "Earth Summit" (UN Conference on Environment and Development (UNCED)), and so on. The "Stockholm Declaration" was formulated at the 1972 Conference -- a number of guiding principles for the protection of the environment were adopted. These have been critical in the successive development of other instruments.[32]

From the 1960s, processes of defining threatening environmental realities, mobilizing agencies, enterprises, and citizens etc. have been taking place, and continue to do so;[33] these processes relate to a cascade of private and public initiatives and accomplishments in addressing environmental issues and challenges. The UN, environmental agencies, many enterprises, public "intellectuals," researchers, NGOS, and media have succeeded to a greater or lesser extent in convincing multitudes of people that the environment and human life as well as life generally are threatened on planet earth and action is necessary[34] (this is not to overlook the deniers and opposers who make for formidable resistance (see below)).

Today we may be witnessing the early stages of a new *societal revolution* comparable in scale and import to the industrial revolution (Ayers, 2011; Burns, 2011; 2012; Edwards, 2005; Neeman, 2011).[35] This "sustainability revolution" – *sustainalization* –

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[32] Another important outcome of this conference was the agreement to create a new programme for global environmental protection under the United Nations: Then United Nations Environmental Programme (UNEP).

[33] Obviously, there was growing and widespread concern with conservation, environmental pollution and degradation long before there emerged a "sustainability" concept, as suggested above.

[34] Some instances of radical steps have been accomplished such as the EU chemical directive REACH (2006) in which Swedish EU agents and pressure groups played a significant role in passing it over the opposition of the European, American, and Japanese chemical industries as well as the political leadership of Germany, France, and the UK (Carson et al, 2009).

[35]The early Industrial Revolution (toward the end of the eighteenth Century) entailed many small and medium initiatives in the emergence and transformation of technologies, institutional arrangements, social relations, and values such as those relating to the formation of factories, built environments, and entire industries. Such transformations could occur without any single agent or group of agents planning or even negotiating the overall pattern. (Industrialization became a "development" concept which was more than a description. It became as well a metaphor of progress and advancement and a powerful normative idea (to be "developed", "industrialized" was good, to be undeveloped or underdeveloped was backward, a failure).
.   Much of the early industrial revolution involved then multiple agents initiating and developing a variety of innovative technologies and socio-technical systems. The transformations encompassed not only major innovations in technologies and technical systems, e.g., the invention of the steam engine, the development of mining, textile manufacturing, metal tools, optics, advances in transport, among other developments, and, of course, the shift from human/animal power to water and to coal. Critical to all these engineering advances was the development of organizational and institutional means (governance arrangements) to utilize and develop the varying technical possibilities: factory systems, methods to coordinate and control large numbers of workers, ownership arrangements, regulatory agencies, legal innovations, the ideas – and realizations of the ideas – of mechanization and of standardized mass production, and new research and educational organizations, among other constructions. The revolution encompassed also to a high degree new governance arrangements in diverse sectors combined with machines to make use of, for example coal, iron ore, and cotton on a scale and with a rapidity never achieved (or imaginable) before. In other words, there was not just machines and material technologies but organizational, legal, conceptual and normative innovations. Almost all aspects of everyday life came to be affected, but without any direct or central coordination (although later variants of industrialization (for instance, in the cases of Germany, Japan, and the Soviet Union) entailed more a top-down development guided by an overall design or blueprint)

implies a new type of society – or family of societies. It is being forged, piece by piece ("organically", so to speak). Masses of "sustainability" designs, plans, and initiatives at different levels have been developed as people try to forge new orders (local, meso-, and –macro) as occurred in the case of industrialization. Another way of thinking about this transformation is that a "green" or sustainalization world is emerging – just as an industrial world perspective emerged in and through the industrializing process. In the "green revolution", one finds:

- The increasing stress on green values: that is, articulation and development of new values, norms, standards, in a word, the "green" normative perspective
- An ever-growing generalized judgment that "green" patterns of action and developments are "good." And patterns and developments which are "non-green" or "anti-green" (use of high gas consumption vehicles, overuse or wastage of water or other critical resources, etc.) are "bad".
- New practices, for instance new accounting conceptions and standards such as "triple bottom line".
- The growing role of "green thinking, conceptions, standards and practices" in many areas of social life; there are also increasing narratives about green ideas, values, and standards, which circulate in wider and wider circles.
- The growing role of "green" entrepreneurs (for whatever reasons, they initiate projects-- beliefs in a green future, profitability, pressures of competition, or combinations of such motivators).
- Green governance; new regulatory mechanisms: distinguishing "good" (green) versus "bad" (non-green) innovations and developments

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Inventors, innovators, entrepreneurs, scientists and engineers, business leaders, and government officials took a multitude of initiatives not only to make money but to gain fame and respect, to experience the power of changing and developing themselves and the world around them, and to advance the national power of Great Britain. Tens of thousands were involved in these developments over the decades during which industrialization took off. The revolutions in mining, manufacturing, transport, chemicals, and agriculture were followed by those in electricity, electronics, and communications.

The development of the industrial social order – with its technologies, experts, and governance and regulatory systems -- spread from England to North America and the rest of Europe and eventually to most corners of the globe. It was characterized by, among other things, the widespread application of engineering, science, and systematic knowledge to production, products, technology and technological development, standardization, and economies of scale; the environment was exploited to the fullest for economic and related purposes, "unspoiled areas" would be defined as "wasted" and "should be effectively exploited" in the name of progress and "welfare." The great success of the industrialization paradigm reinforced the idea that humans could ignore or, at least, overcome, environmental detriments and resource problems. Consequently and progressively, industrial society engaged in a reckless and extensive exploitation of nature. This was done on the basis of faulty assumptions and conceptions of real impacts and in many instances, in ignorance of long-term consequences.

Nevertheless, historically there was substantial opposition to many aspects of industrialization: In a number of countries, for instance, in Europe and North America, concerns about urbanization, pollution, water and air quality, and deforestation led to powerful reactions. NGOs were founded to promote environmental protection, conservation and wildlife protection—a whole battery of policies, programs, and parks were established. For workers, socialist and trade union movements emerged to fight for social protection, welfare, and justice. These movements and the governance and regulatory developments they helped bring about operated on many levels and with varying degrees of effectiveness.

- Institutionalization of green standards and considerations in decision and policymaking settings in government agencies, corporations, and associations.
- Increasing stakeholder involvement in the corridors of economic and policymaking power (Friends of the Earth, Greenpeace, WWF)
- Green technological developments; design and production of new "green" technologies, development of "green" (or "greener") systems.
- Greening of consumption
- Massive experimentation (accompanied by failures, of course) with "green" initiatives. These concern not only businesses but NGOs, other private agents, government agencies, etc.
- New alertness and readiness to experiment or innovate with green ideas, designs, technologies and practices;
- Today we are witnessing the initial stages of a new societal revolution comparable in scale and significance to the industrial revolution. Tens of millions of people are considering and adopting new conceptions, goals, techniques and technologies, and practices relating to a wide spectrum of environmental concerns and developments. The ongoing paradigm development – a gradual shift from the economistic, industrialization paradigm to one or more forms of a sustainability paradigm entail the establishment of new ways of thinking, acting, organizing, and regulating (in part, the establishment of a *new cognitive-normative discursive framework and context*). Sustainability ideas, norms, and values permeate an ever-increasing part of modern life and have a significant impact on everyday thinking and practices in substantial parts of the world. This is occurring not only in developed countries but also in developing ones such as China, India, and Brazil.

In the sustainability revolution we see hybrid cars, re-development of the electric car, solar energy innovations and other renewable energy developments, "smart switches," recycling systems, banning or tighter regulation of chemicals, increased controls of many pollutants, movements to protect forests and threatened species. These changes take place more in some parts of the world than others, but there is a powerful and sustained thrust, involving many thousands of initiatives and innovations. The emerging social trend is manifested in the plans and actions of thousands of international regimes, international bureaucracies, national agencies, local and transnational activist groups and expert networks. At the same time, "earth system governance" can be understood as a political project that engages more and more actors who seek to change the current architecture of institutions and networks at local-,meso-, and global-levels in order to advance the cause of sustainability.

Sustainable development initiatives and programs of different degrees of dignity and scale are taking place on all societal levels and often through multi-level mechanism. A revolution is taking place – not without conflict and struggle, but possibly not rapidly enough to save the planet (see later discussion).The ASD programs have shown through their case studies in diverse sectors and at different governance levels.

The "green revolution" represents then multiple paradigm shifts, not only in production, technologies, consumption, and lifestyles, etc. but in governance and practical ethics and related normative developments. The new paradigm (or family of paradigms) is spreading readily – horizontally -- new knowledge, values, and practices.

"Green modernization" entails "green re-industrialization", "green capitalism", "green governance," "green thinking and lifestyles."

In sum, it is being suggested that a "sustainability revolution" is in all likelihood already taking place on multiple levels: (1) a moral-cognitive level; (2) a level of action and the establishment of new practices on the part of individuals, groups, and organizations; (3) an institutional level as "green" institutional arrangements and policies are promoted, often cautiously, but sometimes boldly – with varying degrees of success.

The emerging sustainability paradigm is being established then by *a process of multiple initiatives facilitated by diffusion of values, ideas, and practices through associations, communities, business, and political networks.* There are not only values shifting -- and some reordering (still limited) of priorities, but governance changes, and changes in many daily practices. The conditions of initiative and innovation encompass multiple agents who enjoy some power and means of structural control over their own situations and are able to make relatively autonomous independent decisions. This process results *on an aggregate level* in adaptations and shifts in the industrial paradigm complex and its particular institutional and cultural arrangements. The latter with its massive nexus is being challenged piece-by-piece by the sustainability paradigm.[36]

The transformation process is an organic one with many different agents at different levels driven by diverse motives and interests. Gradually, blueprints will be developed specifying standardized designs and strategies. Industrialization was also characterized first by such a highly organic phase and then later a more blueprint-like modality: where Germany, Japan, the Soviet Union, and others adopted and imposed a design.

Some of the drivers and facilitators of the sustainability revolution: (1) normative pressures and resource and power mobilization; (2) open, new sectors are able to develop quickly on green dimensions by utilizing new ideas, models, methods, technologies and techniques where there is often less resistance from, or resilience of established arrangements; (3) some strategic sectors – such as energy and chemicals – are subject to particular attention and pressures to transform themselves, because in the case of energy some forms such as fossil fuels are becoming increasingly scarce and also because these fuels contribute significantly to pollution, GHGs, and climate change.

Several key factors explain why the sustainability revolution is likely to continue and even to accelerate:

- continuing environmental crises (that will not go away)
- continual outpouring of critical analyses and prognoses about the current failings and hazards
- normative ethos and collective pressures
- sustained creative challenge; the excitement of innovating, experiencing the new, its opportunities as well as exhilarating risks and uncertainties
- the paradigm shift itself entails new ways to frame, think, judge, and act that are challenges to be mastered and developed

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[36] But the ongoing sustainability revolution is much more than a "Third Industrial Revolution" to which Jeremy Rifkin refers in a book (*The Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World*) that has recently (2011) appeared. But significantly Rifkin recognizes the organic character of the transformative processes.

- diffusion and imitation mechanisms through diverse social networks

While the sustainability revolution shares the organic character of the industrial revolution, the two differ significantly in a number of ways, as would be expected given their obviously very different historical, institutional, and cultural contexts as well as the difference in levels of scientific and technical knowledge.

- *Complexity*: sustainalization is taking place in a much more developed and complicated world in terms of institutions, cultures, and technologies including of course communications; for instance, the infrastructures of agriculture, manufacturing, government, science, education, etc. are very different
- *The numbers and diversity of stakeholders and regulatory and governance systems* that must be taken into account is much greater (partly a result of democratization and partly learning to deal with modern complexity).
- Our modern world has *its established expectations about consumption levels, lifestyles and welfare* (this is also the case in developing countries)
- There are greater explicit concerns about *issues of general welfare, justice, human rights* (see Stockholm Memorandum (2011).

In spite of the complexity and the many institutional and cultural as well as power constraints, sustainalization is likely to proceed much more rapidly than industrialization did in large part:
-- because of the resources and capabilities of modern science and technology and
-- because of the availability of more rapid and widespread advanced communications (scientific and technical associations, the WWW, twitter, facebook, blogs linking people concerned about environment and sustainability and facilitating the spread of sustainability ideas and accelerating rates of innovation and application)
-- because of the large numbers of people and collective agents already mobilized and acting to drive sustainability improvements and transformations.

While "sustainability" initiatives continue to grow and spread by the many tens of thousands, the ongoing transformation will be no walkover. This is not ecological modernization, or only to a very limited degree; rather, it is a development in the context of established social structures and power configurations (capitalist, socialist, Saudi Arabian Monarchy) and powerful vested interests and in many ways an historically successful industrialization/modernization paradigm. As pointed out earlier, *there is a formidable opposition (including deniers and opposers) among the powerful, for instance, many in the established industrial-commercial-banking complexes and their allies. The struggle will be long and difficult.* Whether the sustainability revolution will be fast enough or comprehensive enough to save the planet remains to be seen. History provides numerous examples of great societies that collapsed, and visions that failed or were never realized.

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theoretical and empirical developments referred to in this article. This will be accomplished in a book I am
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