Natural Blends, Sustainable Innovations and Income Growth

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Abstract:

The paper discusses innovations for both income growth and the generation of better environmental qualities. This is possible in theory but progress in practices is slow. We argue that social pressures to contain pollution were effective insofar they invoked environmental policies all over the world, which enabled to reduce pollution in some countries at decreasing costs. This is achieved in the past five decades despite fierce resistance of vested interests in industries and policymaking. Economies are still extremely wasteful but there is progress in many countries toward eco-efficiency, which is illustrated for the European Union. In the future, a growing demand for sustainability is expected. This demand is not primarily because of costly natural resource in consumption, they decrease in real prices, but due to the changes in social structures towards more knowledge work and growing leisure time. The knowledge work and leisure time require more personal interactions even though the labour costs increase and more environmental qualities through cleaner production and consumption. These demands invoke innovations that blend environmental qualities with artefacts. Such natural blends are highly demanded and the qualified blends are highly paid. Sustainable innovations through blending of natural and cultural attributes are in progress. Innovators become a driving force for sustainability and the innovative networks key elements for the resulting outcomes. These networks entail distributed business models. Environmental qualities constitute highly demanded values. The challenge is to translate this social sense of urgency into new policies and market arrangements in support of innovators for sustainable development.

1 Introduction

Nowadays, environmental advocacy faces a dilemma with regard to the present economic crisis. In general, a slower economy and lower incomes can reduce the pressure on the environment, but at the same time there is a risk of less public support to address environmental issues. De-growth is advocated to resolve this dilemma, which means lower income for better common goods, such as a quality environment. This would foster welfare; it means satisfying individual preferences given scarce resources. In 2010, the Journal of Cleaner Production (18, 2010) gave editorial space for various views on the question of how to foster de-growth. According to the journal authors, it would be achievable through strict limits on pollution and squandering (van de Bergh and Hueting), far reaching distribution of goods and labour time (Kerschner and Spangenberg) and self-organisation in favour of new norms and aspirations for property (Griethuysen and Matthey). Following Jackson (2009), we agree that higher income is only a means for welfare, income distribution is necessary because the present large disparities undermine morality and social cohesion, and stakeholder participation enables better decisions. However, we expect that delinking income and prosperity is unsustainable.

People desire income for the purchase and consumption of private and common goods. The use of a higher income is to expand consumers' stocks of goods and services, which implies the attraction of hoarding. Most of us cheer up when our salary grows and shiver when our pension is at risk, and the policies that aim to restrict these thrifts usually end up in disasters. Hence, we need to find ways for an income growth taking into consideration limited natural resources. In theory it is possible. If we assume the annual global income grows 2% along with 3.5% labour for materials substitution and 5% renewable energy for fossil fuel substitution the global material use would be reduced by nearly 15 times after 40 years -with an additional 2% pollution prevention and recycling even by nearly 33 times- and note that such substitution rates are observed in a few EU countries during several decades. The issue, therefore, is how to enhance such patterns in practices.

Our starting point is an observation that personal income enables the appropriation and consumption of many attributes that are considered to be common goods; an example is the enjoyment of good environment. Contrary to a development that limits consumption, income growth with enlarging environmental efforts is widely accepted and appreciated, including increasing expenditures on healthy work and living, renewable resources and energy, nature and spatial diversity, attractive culture and heritage, clean soil, water and air and other issues that we call the environmental qualities. These expenditures grow faster than income entailing an increasing share in national incomes globally. The results, in the sense of lower environmental impacts per income unit, called eco-efficiency, should not be glorified and the total (absolute) decrease of pressures on environment is rare though it occurs in practices (Krausman et al., 2009). Nevertheless, the present world is considered to be in a better position in many respects than fifty years ago, when environmental policies began to emerge (Stiglitz et al., 2010). The question is whether even more and better efforts on preservation of the environmental qualities could create more and better distributed welfare, allowing us to overcome the current economic crisis. Indeed, the "Green Deals" to combat the economic crisis -essentially investment pulses in

renewable energy and resource efficiency- have gained popularity in political wording albeit less in deeds, as yet.

With reference to the Lao Tzu proverb “those who have knowledge, don't predict and those who predict, don't have knowledge”, we do not make forecasts about the sustainable world but underpin opportunities for income generating activities that contribute to the enhancement of environmental qualities. These income generating activities we call sustainable innovations. A few definitions should be clarified in order to prevent misunderstanding. Income growth is used here in the sense of the total (aggregated) income. This is due to the productivity growth, which means an increase of the aggregated output per aggregated input unit during several subsequent years in real prices (corrected for inflation), given that all outputs are ultimately consumed. Innovations are defined in line with the Schumpeter (1989:59) term “doing things differently” through the use of novel methods, products, services and images, which involve high development costs and uncertain rewards. The innovations that diffuse across societies are supposed to drive productivity growth (Rosenberg and Birdzell, 1986), which fluctuates in long waves of expansion, crisis, recession and revival every 40 - 60 years due to basic innovations (steam, rail, electricity, petro- and agrochemical throughout the past two centuries are often mentioned), while within each long wave a few business cycles of 10 – 15 years occur due to new infrastructure and machines’ developments (Mensch, 1975 Schumpeter, 1989). Herewith the end of the informatics wave is sometimes pinpointed. For example, in the Netherlands Mecking (2008) argues the Dotcom burst of 2001 as the end of it and the cause of the financial crisis, whereas Frijns et al (2009) argue that the Dotcom burst of 2001 as well as the financial crash of 2008 are less severe than the Wall Street crash of 1929 that resulted in the Great Depression. This dispute is outside the scope of this essay.

We adhere to the argument that innovations – though unpredictable – need forceful novel institutions to help overcome the hurdles created by vested interests (Helpman, 2004). We add that the novel institutions can emerge when a high urgency to act is widely sensed. The threat of wasting important income and improvement opportunities, such as those embedded in international migration and diversity, in life-long learning in education and in activating elderly care, is significant factor that feeds this urgency. We also support the view that good working and living conditions are highly valued and generate demands for quality of life (Ehrenfeld, 2008). Following this view, we argue that quality of life demands invoke sustainable innovations, if the risk-taking innovators in businesses, authorities and social organizations overcome the risk evasion in the prevailing institutional arrangements empowered by vested public and private interests, though precisely such arrangements of – missed – checks and balances could have prevented the present economic crisis.

2 Toward sustainability

During a long period, economists acknowledged the importance of environmental qualities for welfare and economic growth, as well as the social abilities to overcome the impacts of economic activities on the environment through innovations. The founder of modern economic theory,

Adam Smith, wrote in 1776, “The beauty of the country besides, the pleasure of a country life, the tranquillity of mind which it promises, and wherever the injustice of human laws does not disturb it, the independency which it really affords, have charms that more or less attract everybody; and as to cultivate the ground was the original destination of man, so in every stage of his existence he seems to retain a predilection for this primitive employment” (Smith, (1776), 1979:481). In the 19th century, the pastoral community that had prevailed thus far was threatened by the industrial revolution and John Stuart Mill remarked sadly in his economic masterwork, “If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a better or happier population, I sincerely hope, for the sake of prosperity, that they will be content to be stationary, long before the necessity compels them to it” (Mill, (1848), 1970:116). Mill and many other scholars from his generation argued that the population growth due to higher income and better public health jeopardized the environmental qualities needed for welfare growth. Meanwhile, better income, education and the status of women effectively limited population growth in many countries.

Throughout the last century, industry has been blamed for environmental degradation. In 1920, Pigou emphasized that industrialization caused negative side effects, in particular unemployment but also pollution. He pointed at the poor legal framework in market economies as the main cause of the problems, which could be solved through regulation to prevent these side effects (Pigou, 1920). Such regulations - based on the ‘polluter pays’ principle - are nowadays common sense nearly all over the world, which is largely due to environmental activism in the second part of the last century. Fifty years ago, on the basis of a theoretical (computer) model the Club of Rome predicted that the global economy was close to collapse, because of mounting pollution and resource degradation (Meadows et al, 1972). However, other studies taking innovation into account have shown that in principle welfare could grow infinitely if environmental impacts are reduced at a faster pace than consumption growth, through a shift from industry to services and eco-efficient innovations (Kuipers and Nentjes, 1973; Solow, 1973; Weitzman, 1977), a proposition which is supported by historical studies on innovations (Rosenberg 1973, 1975a). Moreover, within one decade political consensus was reached on social, economic and environmental stewardship to satisfy present and future generation needs, an approach referred to as ‘sustainable development’ (WCED, 1987). Closed cycles, non-toxic production, low-input farming, durable products, renewable energy and others are envisaged, underscored by biological metaphors such as sustainable metabolism, tree-like business, green consumption, industrial ecology, biomimicry and other concepts (Reijnders, 1984; Winter, 1987; Ayres, 1989; Elkington and Burke, 1990; Graedel and Allenby, 1995; Benyus, 2002). As a result, the present roadmap on the notion of sustainability embraces many stones of wisdom.

The challenge we now face is how to create a revival of the sense of urgency that is needed in order to innovate, since in the last two decades many heralded the end of the economy – environment stalemate because the market economy would spontaneously generate sustainability. It was assumed that corporate management would ‘do good’ (Porter and van der Linden, 1995), recycling for high grade products would be profitable and embraced by industries (McDonough and Braungart, 2002), prudent

materials use would generate productivity growth and overcome economic slump (Bradfield and Nogrady, 2010), and issues would be resolved through voluntary agreements between managers and regulators, called transition management. None of these happened. At best it was wishful thinking, since too often this voluntarism was an arrangement to resolve social pressures and postpone innovations. Following are a few cases. Climate changes as a result of fossil fuel combustion and demands for renewable energy are often opposed. Mineral resources are depleted, however recycling at sources and on landfills stagnates. Water scarcities remain despite technologies available for closing fresh water cycles and desalination of sea water. Biodiversity degrades because sustainable farming must compete with subsidized and polluting agriculture. Plastics pollute land and oceans despite recycling possibilities and the availability of degradable, low-toxic resins. As a conclusion: forceful social demands are necessary in order to innovate for sustainable development.

3 Innovations for eco-efficiency

In the past century many innovations that foster environmental qualities have been demanded, enforced and they have contributed to income, despite the resistance generated by vested interests. Table 1 summarizes the environmental issues and envisaged solutions.

Table 1 Changes in issues and solutions

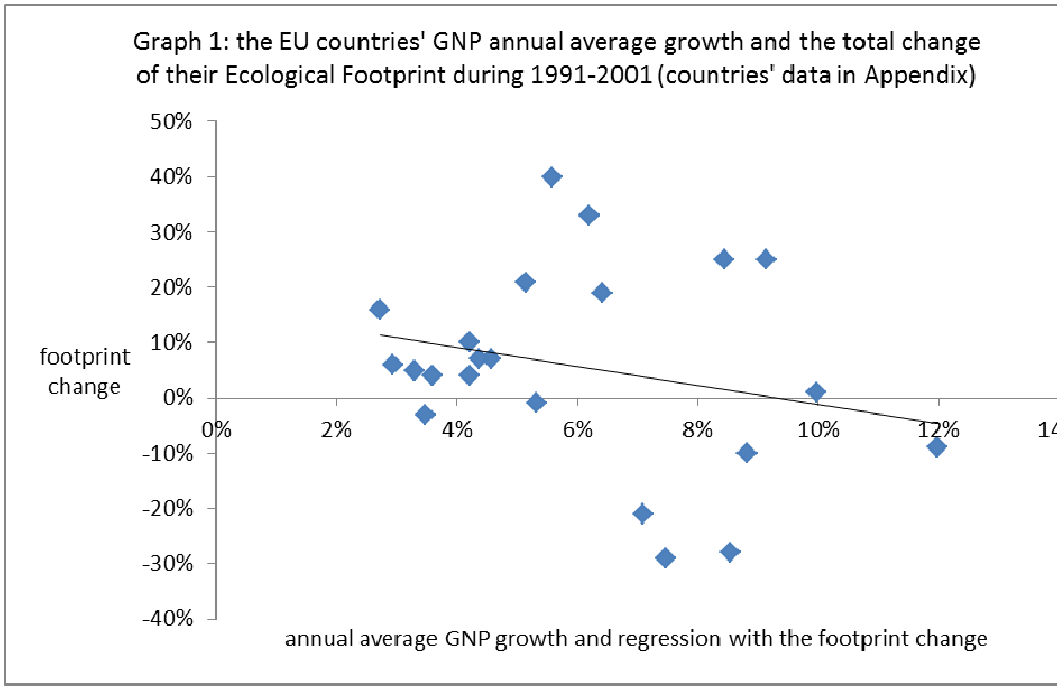
Period	**Issue**	**Solution**
Until the 1960s	Health	Infrastructure
Seventies	Industries	Environmental technology
Eighties	Products	Life cycle management
Nineties	Resources	Eco-efficiency
Presently	Consumption	Sustainable Innovation

From the early decades of the last century, the demands for better work and living conditions invoked innovations that were met with opposition. For example, the introduction of sewage systems in European cities was obstructed by farmers, whom argued that their mineral resources were being taken away. Also, gas producers in the U.S. resisted the entry of the electric lighting through monopoly entitlements for street lights (DiLorenzo, 1996). By now, about 80% of the world population has access to the sanitation and electricity services, albeit far too many people cannot afford these services even though these services are heavily subsidized. A lot more is achieved in the past fifty years. From the sixties on, headlines about acidified lakes, asthma from smog, brain damage from lead in fuel, dioxin in milk from incinerators, and other issues triggered policies that enforced the

implementation of environmental technology. Despite fierce resistance, cleaner production in Japan, U.S. and Europe reduced biodegradable matter in water by 80% - 85%, acidifying pollutants by 90% - 95%, lead, tar, mercury and other hazards by nearly 100%, and so on. Thereafter, the demands for cleaner products and producers' responsibilities invoked innovations in foods, textiles, electronic equipment, cars and more through eco-design and life cycle management.

Many industries increased the eco-efficiency of pollution prevention and control, e.g. in the Netherlands this was improved by 3% to 12% a year. Many environmental technologies became eco-efficient, on average by 5% to 6% per year, which is better than the improvements in the manufacturing equipment, some even by 11% per year, which is similar to progress in the high-tech businesses. The costs per energy output of solar cells decreased by up to 20% per year. Presently, the front-running countries benefited from exporting such technologies; for instance, in renewable energy Austria, Denmark, Germany, Spain and Sweden are now world players through sound policies. In Europe as a whole, 4% annual average renewable energy growth in the past decade is combined with more eco-efficient energy systems due to resource diversification (Krozer, 2009). Unfortunately, changes in consumption lag far behind. With respect to consumption, the economic system is still ineffective and many innovative opportunities are unused. For example, Fussler (2000) has highlighted that only 4% of the energy content in gasoline is functionally used to move a passenger in a car, though better transport means and modalities are available. Von Weizsacker (2009) has shown that bringing a bucket of water to the top of Mount Everest would require about 0.5 kWh, which is the equivalent of one hour traditional lighting in a classroom, while modern lighting concepts can be many times more energy-efficient. Nevertheless, a growing number of economies are becoming eco-efficient, albeit some polluting activities are being moved abroad (Jänicke, 2008).

Globally there is progress towards eco-efficiency if measured by the Ecological Footprint (the area to store carbon dioxide) and the Gross National Product (income proxy) per capita with the UN data respectively the World Wildlife Fund data for the period 1991 – 2001. Global income has increased by total 163%, which means 4% annual average income growth, compared to a total 2% decrease of the Ecological Footprint, although a few large countries lag behind, such as China and the US. In the European Union, data on 22 countries suggest that 7 countries have increased income and decreased their Ecological Footprint, mainly in the former Socialist countries that shifted from industries to services. The correlation between the annual average income growth and the total Ecological Footprint increase in this period across the European countries is negative (-0.24). All these are positive signs. Graph 1 shows the EU countries' annual average growth of the Gross National Product (horizontally) and the Ecological Footprint change for the whole period (vertically) in 22 European countries during 1991 – 2001. Furthermore the regression line of annual GNP growth and the total Ecological Footprint change is presented. Data and sources can be found in Appendix 1.



The data shows that many environmental problems resulting from industrialization can be contained along with reasonable economic growth rates through innovations, which is due to decisive entrepreneurial actions and strict policies that determine the level playfield with respect to the environmental qualities. However, it takes time to overcome the resistance created by vested interests. For example, the revision of water pollution policies from the seventies in European countries took nearly thirty years despite the availability of better technologies. The barriers are, for example, vested interests privileged with political powers, subsidized polluting activities, the lack of liability for damage to the environment, public procurement biased towards cheap and low quality goods, politicians focusing on large-scale projects instead of on regional capabilities, a business focus on sales instead on life cycle costs, and so on. There are also encouraging signs, such as environmental issues remain on the political agenda due to social demands, the successful emergence of many environment-oriented new ventures and start-ups, and a broad acceptance of environmental policies around the world.

4 Emerging demands

It can be observed that modern eco-efficiency growth is mainly driven by social demands, and less so by materials costs since materials are generally too inexpensive to contribute much to productivity growth. This was already observed by Mill in 1848, “But the crude material generally forms so small a portion of the total cost, that any tendency which may exist to a progressive increase in that single item, is much over-balanced by the diminution continually taking place in all the other elements; to which diminution it is impossible at present to assign any limit” (Mill, 1985, p. 64). Likewise, over time the real prices of most materials have been decreasing, though with

fluctuations, alongside with the steadily lower share of the material costs in product costs and the lower material content in products. Lower material content at lower material costs indicates that the involved eco-efficiency innovations are not primarily due to the cost savings, though pollution prevention can pay off, but they are invoked by other factors and cause decreasing demands for material use resulting in lower material prices. Despite high and increasing labour costs people demand more labour units on top of materials embedded in engineering design, marketing, distribution and other value adding tasks. The demand for these services despite high costs is difficult to explain using conventional economic thinking (Krozer, 2002). An important factor at stake is the demand for quality of life that emerges not only because more people can afford better living, but also because social structures change toward a knowledge society and leisure time is increasing. These provide a bandwagon for emerging environmental qualities' demands.

Today, knowledge work continues to expand, for instance in the areas of engineering, education, science, management, policymaking, and communication. The share of knowledge workers of the total labour force has increased from practically nothing to about one third during the last two centuries in high income economies, and other economies are catching up. Machines and service workers perform the routine jobs in agriculture, industry and services, whereas knowledge workers pursue innovations and reinvent these into routines that foster productivity growth (Drucker, 1993). Knowledge work does not require bulky factories and offices but instead interactions that foster the sharing of know-how (Cooke and Morgan, 1998). The interactions add value, apparently even more value than the increasing labour costs. Herewith, cultural and natural diversities foster the valuable interactions in knowledge work, and progressive policy makers are at pains to create the appropriate conditions for the diversity process (Florida, 2002). In such a development, it can be observed that the tranquillity and beauty of countryside spaces is inspiring for work, whereas urban life creates an attractive condition for the sharing of know-how. This could reverse commuting patterns, which implies that a penny on natural amenities could be worth a pound on road paving. In addition, there is more leisure time since working hours are shortened, life expectancies are longer all over the world, and leisure services become affordable due to income growth. In fact, consumption of leisure services has increased rapidly in the past decades. For example, tourism business revenues have grown by an annual average 9% compared to 4% global income growth in nominal prices throughout the past half century. As a result, the tourism business that hardly existed fifty years ago has become the largest global business after the finance sector, while the consumers of tourism services demand a high quality environment.

Environmental degradation hinders emerging activities in knowledge societies and incurs the increasing social costs to counteract this hindrance since the impacts of this degradation cumulate across the economy. For example, pesticide use on farms results in costly food controls and unexpected immunities in organisms that must be contained through the development of new pesticides. These defensive costs are estimated by Christian Leipert (1986) to have approached 12% of the German National Income in the 1980s and it is even doubted whether economies would show income growth if defensive costs would be subtracted from the national accounts (Daly and Cobb, 1989). In effect, policies must take social and

environmental issues into consideration because they impede quality of life and income growth.

During last half century the income growth and progress towards sustainability was largely driven by the innovators that linked knowledge and technologies with prevention environmental degradation. For the next decades we expect more and more innovators that are capable to generate income through linking high environmental qualities with the quality of life demands.

5 Towards Natural Blends

As a result of the shifts from industries and services toward a knowledge society, the demands for environmental qualities are strengthened which create the conditions suitable for sustainable innovations. Herewith it should be noted that society's notion of a good environment is also changing. Natural, in the sense of original untouched areas and independent cultures are rarely tangible. Good environment is usually considered a blend of attributes from the arts, technology and nature that can be called a 'natural blend'. It does not prevent people to demand the natural blends and conditions that maintain environmental qualities. The artefacts and designs with an image of natural realms are highly demanded since people wish to sense nature instantly, for example right around the corner in a park.

Today the demand for natural blends seems overwhelming. Just consider that wellness resorts flourish, heritage sites attract masses, regional products have premium prices, thousands of people are city gardeners, millions go camping on weekends, the market for cottages is growing, and more. Nature can also be a cultural event. For example, some television channels show nature around the clock, local crafts and traditions are in revival, ancestors and places of origin are 'in', organic represents the fastest growing segment in food life style, ambient music is an experience, nature pictures are used as computer screen savers and whale watching is an event. People also pay a high price for these natural blends. Excellent tap water costs about €1 per cubic meter, yet people pay 500 times more for the equivalent of bottled water. Home gardens in cities are so precious that their value per square meter is higher than that of a bedroom. The neighbourhood in a city counts as well, thus a room in a nice district costs more than a flat in a mediocre one. Pennies are discounted on foods but fortunes spent for diving at coral riffs. Some communities create excellent natural blends. For example the Ameland municipality, an island on the Dutch Wadden Sea which is on the UNESCO world heritage list, has a population density in the summer peak that exceeds that of the City of Amsterdam, but virtually all tourists consider this island a nature resort (Krozer and Christensen-Redzepovic, 2006). It can be concluded that people pay for a good environment and that possibilities exist to satisfy the demand for natural blends without degrading environmental qualities.

Pursuing these natural blends provides ample opportunities to mimic natural processes for sustainable innovations. Many inventive entrepreneurs take advantages of the growing demands for the natural blends. To mention a few examples: (1) regional foods and meals based on diverse crops and

animals; (2) local wildlife vegetation in support of hygiene and personal care; (3) tourism that generates novel sports products and innovative transport means, like solar boats and electrical cars; (4) localized smart grid services that substitute costly infrastructure; (5) home energy management through gaming for energy saving; (6) communication and information technologies in support of education and social care in the countryside; (7) localized business centres that reduce commuting; (8) customized public transport for those with less mobility and so on (Krozer and Tijsma, 2005). Natural blends emerge though significant efforts are needed here to resolve controversies about the ethics, definitions and ownership of natural resources since the distinction between culture and nature is blurred, and in addition, to enable an ever widening array of options for sustainable development. In order to benefit from the natural blends and its entrepreneurial outcomes, the policymaking needs to shift from protectionism of vested interests towards encouragement of the innovators aiming for sustainable development.

6 Distributed practices

Successful sustainable innovations are difficult to predict, let alone to steer, and there is no ‘golden bullet list’ or success guaranteeing instructions for development of the institutions that generate the growth of sustainable innovations. Meanwhile, several institutional pathways emanate from these innovations and can be explored in addition and conjunction to each other.

Firstly we mention here the prevailing view, based upon the idea that the authorities should take care of environmental qualities through price setting, reflecting the true costs of environment, putting limits on pollution through permits, enforcing liabilities for damage, abolishing pervert subsidies that impede sustainable innovations and so on. All of these elements are needed. Nevertheless, the experience is that it takes much time to generate political decisions and the authorities usually postpone actions until innovators act. Therefore, other ways that enable more innovative activities must be found as well. With regard to the vested interests, March (1971) in his seminal work on decision making, argues that organizations are often attach to past patterns because innovations are perceived as a risk for the hierarchies. He advocates more “foolishness” in organizations in order to foster innovation, which is not an abstract concept in his view, but is a functional unit directly linked to the corporate executive with the responsibility to push new ideas through the hierarchy, with seed money and expertise. Thirdly, services are needed that add value to the use of environmental qualities. Examples include high value use of ambient water for tourism, resource-saving services for households, services that recover degraded spaces, solar energy based equipment, wastewater treatment with nature reserve, and others. Such services link the demands for environmental quality with income generating activities as the basis for sustainable innovations. In addition, the knowledge economy employs a large number of small enterprises that are high profile in the sense of know-how, relations and revenues, operating on local and regional levels but with the potential to communicate globally through modern media. This localized development enables the local authorities to apply their specific endowments and capabilities for the support of innovators through scouting of inventors, matching creativity with seed money and expertise, guarantees for designers and business start-ups, dissemination of first movers’ experiences and so on. In the fifth place,

meeting points between consumers enable the exchange of experiences and self-organization of citizens in problem solving groups, via mechanisms such as open source databases and crowd sourcing. Such interactions foster social learning and productive activities by consumers, described as 'prosumers' by Alvin Toffler (1980). Finally, people can learn creativity. Along this line, Robert Lepage described his innovation process towards natural blends at his art exhibition 'Méttissage' in Quebec (Canada) in 2001 in the following way, "All my travels, my far-away projects, every attempt to flee my origins finally brought me back to the place I started, now transformed but still itself. This very tug of war between the notion of authenticity and our invented notion of purity is what exhibition is all about." (Lepage, 2001). All these pathways in additional to each other create new institutional framework for sustainable innovations. Obviously, this is not a limitative list and more pathways can be found.

The range of business innovation models widens, embracing approaches with a focus on networks of professionals, service sharing enterprises, participants in a social shareholding, co-operatives of business units, consumers' participation in entrepreneurial activities through trusts, and more. This emerging diversification of business model and the community networks' concept have consequences for the position of the presently prevailing market model, based on hierarchic decisions with respect to the supply chain and allocation of funding. In parallel to the present model, a market model based on networks emerges, referred to as the "distributed economy" (Johansson et al, 2005). This model is based on a network of participants, for example a number of small and medium size related firms that are interconnected through media on distances, or consumers in a district that both use energy as well as produce it through local networks such as solar based electricity. It is still to be seen whether such networks will become successful and bring far reaching institutional changes.

7 Conclusions

There is reason for optimism about our progress towards sustainability. The classic environmental issues of industrial pollution are tackled at low costs or even sometimes at a benefit. The modern environmental problems of resource degradation can be addressed through better technologies and consumption patterns without value loss. Sustainability brings together the necessary ingredients to become an innovation wave of the future because people do care about and are willing to pay for sustainability, provided that natural resources are tuned to their culture. Greater social value can be created based on good environmental qualities. It is a prosperous perspective, particularly for all those who research, design, develop, produce and like to use new products, services and businesses, with the challenging potential to improve quality of life through the blending of cultural and natural attributes while saving resources. Particularly, the challenge here is to foster the innovators aiming for sustainability through thoughtful and forceful policy making and social engagement.

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Appendix 1

Comparison of the annual average changes of the EU countries' Gross National Product (GNP growth) and the total change of the Ecological Footprint during 1991 – 2001

Countries in the EU	Gross National Product [(1)]	Ecological Footprint [(2)]
Austria	4%	4%
Belgium	4%	10%
Czech republic	10%	1%
Denmark	4%	7%
Estonia	8%	25%
Finland	3%	16%
France	4%	4%
Germany	3%	-3%
Greece	6%	19%
Hungary	9%	-10%
Ireland	9%	25%
Italy	3%	5%
Latvia	7%	-21%
Lithuania	7%	-29%
Netherlands	5%	7%
Poland	12%	-9%
Portugal	6%	33%
Slovakia	9%	-28%
Slovenia	6%	40%
Spain	5%	21%
Sweden	3%	6%
United Kingdom	5%	-1%
Ecological Footprint data is not available for Romania, Bulgaria, Malta, Cyprus, Luxemburg		
[(1)]Development Data Group, World Development Indicators, World Bank Online http://publications.worldbank.org/ecommerce/catalog/product?item_id=631625. [(2)] World Wildlife Fund, Ecological Footprint, Europe 2005, WWF European Policy Office, Brussels.		