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The business angle of a circular economy – higher competitiveness, higher resource security and material efficiency

Walter R. Stahel
The Product-Life Institute, Geneva. *www.product-life.org*
walter_stahel@genevaassociation.org

Abstract

The present economy is not sustainable with regard to its per capita material consumption. A dematerialisation of the economy of industrialised countries can be achieved by a change in course, from an industrial economy built on throughput to a circular economy built on stock optimisation, decoupling wealth and welfare from resource consumption while creating more work. The business models of a circular economy have been known since the mid-1970s and are now applied in a number of industrial sectors.

1 Introduction

"*Previous patterns of growth have brought increased prosperity, but through intensive and often inefficient use of resources. The role of biodiversity, ecosystems and their services is largely undervalued, the costs of waste are often not reflected in prices, current markets and public policies cannot fully deal with competing demands on strategic resources such as minerals, land, water and biomass. This calls for a coherent and integrated response over a wide range of policies in order to deal with expected resource constraints and to sustain our prosperity in the long run*." (EU COM(2011) 571 final)

This statement by the European Commission analyses today's resource efficiency and policy shortcomings. But it does not give solutions, it does not address labour as a resource and it leaves out a number of other challenges.

Economic actors in the circular economy have started to tackle many of these issues in a bottom-up approach by introducing new private sector business models of the circular economy, such as 're-use, repair and remanufacture instead of replace', and 'selling goods as services'.

This includes an efficient use of labour as a renewable resource with a qualitative edge and "an economy as if people mattered" (Schumacher 1973).

The multiple advantages of a circular economy have been described decades ago by Stahel and Reday (1976/1981), and have started to transcend into policy making, as for instance in the 2008 EU waste directive. However, politicians' reflexes are still geared to overcome economic problems by promoting growth in the industrial production economy—witness the "cash for clunkers" initiatives in 22 countries in 2010—or by focussing on singular issues, such as environmental solutions. The quest for sustainable (holistic) solutions, which would simultaneously address economic, social and environmental issues, is jeopardised by the "silo" structures of public administrations, academia and many corporations. Stahel (2001) showed that most sustainable solutions are intersectoral and interdisciplinary and thus contradict existing regulations, do not fit into academic career structures and demand a 'new think'.

This paper shows the advantages inherent in the circular economy and argues that the shift to a circular economy can be accelerated by one simple shift in public policy—adapting the tax system to the principles of sustainability by not taxing renewable resources including work. This will bring about a rapid expansion not only of the circular economy for manufactured

capital (infrastructure, equipment and goods) but equally of all other economic activities based on stock optimisation and “caring”, such as health services, education, organic agriculture, producing goods from such locally available renewable materials as leather, wood and wool. Caring is also the foundation for maintaining our cultural heritage.

2 A Circular Economy is about economics and profit maximization

This section details the circular economy, its focus on stock optimization, and its structure of three loops of different nature and five principles. It explains why re-use and service-life extension of goods are the most profitable and resource efficient business models of the circular economy. From an economics view, maintaining value and performance of stock replaces value added of flow, and utilization value replaces exchange value as central notion of economic value.

Before 2012, few studies existed which analysed the economic benefits of a circular economy on a national or supranational level. In time for the World Economic Forum 2012 in Davos, the London-based Ellen MacArthur Foundation (2012) published a report which calculates that a circular economy (better design and more efficient use of material) could save European manufacturers US$630 billion a year by 2025. The report produced by consultancy McKinsey, only covers five sectors that represent a little less than half of the GDP contribution of EU manufacturing, but still calculates that greater resource efficiency could deliver multi-billion Euro savings equivalent to 23 percent of current spending on manufacturing inputs.

The following abstract of “The Product-Life Factor” (Stahel 1982) for the Mitchell Prize Competition 1982 on “The role of the private sector in a sustainable society” is still an excellent summary of the circular economy:

The extension of the use-life of goods is, first, a sensible point at which to start a gradual transition towards a sustainable society in which progress is made consistent with the world’s finite resource base and, second, a strategy consistent with an active and independent role for the private sector. Product-life, or the period over which products and goods are used, governs their replacement speed and thus the consumption of natural resources required for their manufacture and the amount of waste they create. Shortening product-life increases demand for replacement goods where these can be afforded. Extending product-life optimizes the total life-span of goods and reduces depletion of natural resources and consequently waste; it builds on and increases wealth. Compared to fast-replacement, product-life extension is a substitution of service activities for extractive and manufacturing Industries, and a replacement of large-scale capital-intensive companies by smaller, labour-intensive, locally integrated work units. The private sector, whether R&D, manufacturing or finance, will find innumerable business opportunities in product-life extension activities—Reuse, Repair, Reconditioning and Recycling. Indeed, while increasing the number of skilled jobs available and reducing our dependence on strategic materials, such activities will provide the private sector with fresh impetus to make cheaper goods available as part of a self-replenishing economy built on a closed-loop pattern which allows a substitution of manpower for energy. In this way, unemployment and poverty which certainly aggravate the fundamental instability of the world economy might be substantially reduced. The private sector has, moreover, resources and skills that uniquely qualify it to initiate this transition towards a sustainable society where a balanced use of resources and other societal goals are achieved. Potential disincentives and obstacles can, we believe, be overcome with appropriate education and fiscal and policy measures. (Stahel, 1982)

A circular economy is about stock optimisation. New metrics to measure changes in the quantity and quality of stock—wealth in the form of manufactured capital stock, but also of health, education and skills—are needed to manage stock. We know how much money governments spend on building schools and employing teachers, but we do not know if as a result the students are better prepared for life. The stock of buildings in a given country and

their qualitative conditions (thermal insulation, annual energy consumption) are not known, nor the residual service-life of infrastructure or technical equipment—which makes a national stock and thus wealth management difficult.

Turning the linear industrial economy into a loop or circular economy is, by definition, reducing the economic importance of resource extraction and waste management, and also reducing the environmental impairment caused by these industrial sectors. This change of focus from a linear throughput to a stock management opens opportunities in three loops of different characteristics, which are described in this section and shown graphically in figure 1: (a) a re-use and remarketing loop for goods, (b) a loop of product-life extension activities of goods, and (c) a recycling loop for molecules (secondary resources).

A circular economy is characterised by a number of principles which do not exist in the linear industrial economy, with the exception of principle 5. Policymakers and economic actors of the manufacturing economy therefore do not know them, nor their impact on the economy:

Principle 1: The smaller the loop (activity-wise and geographically) the more profitable and resource efficient it is.

Principle 2: Loops have no beginning and no end.

Principle 3: The speed of the circular flows is crucial: the efficiency of managing stock in the circular economy increases with a decreasing flow speed.

Principle 4: Continued ownership is cost efficient: re-use, repair and remanufacture without a change of ownership save double transaction costs.

Principle 5: A circular economy needs functioning markets.

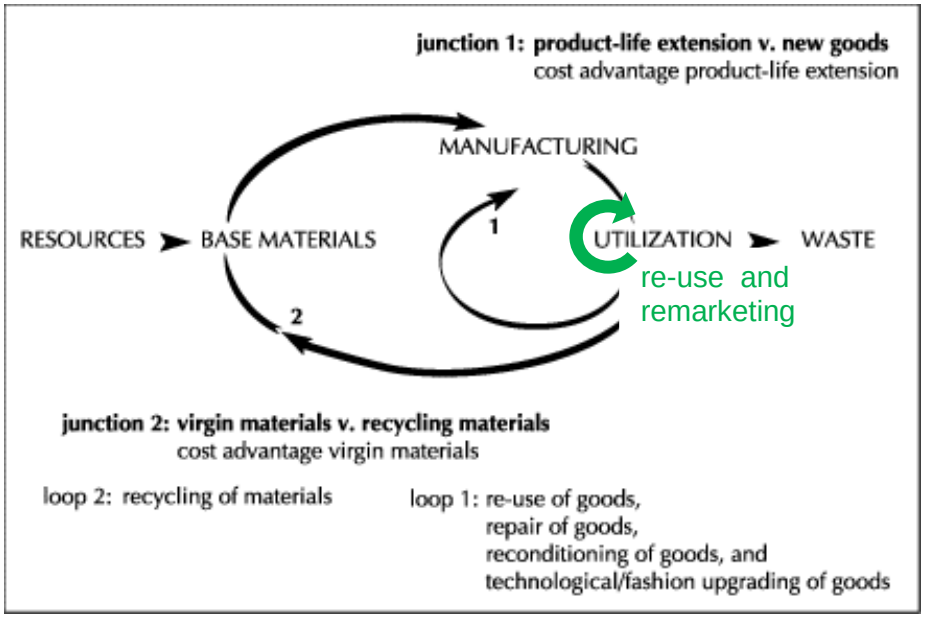


Figure 1:

The main loops of a circular economy

Stahel W.R. and Reday, G. (1976/1981)

3 A Circular Economy is about material and resource sufficiency and efficiency

This section presents new metrics to measure material efficiency, and quantifies the reductions in material consumption and emissions that can be achieved in the circular economy.

Stahel (1985) showed that many different types of innovation to increase material efficiency exist in the circular economy, including technical, commercial and 'utilisation' innovation. Technical innovation includes systems solution instead of product innovation (e.g. Plane Transport Systems).

A longer utilisation—long life products, re-use and service-life extension of goods and components—are one option. A more intensive use of goods is another utilisation innovation to achieve a higher material efficiency, for instance through shared utilisation (together: public transport) or serial utilisation of goods (one after another: washing machines in Laundromats and rental cars). These options need a "new relationship with goods" and have extensively been discussed in the early 1990s (IFG 1993) but are only now finding a real interest on both the supply and demand side, for example in car sharing initiatives.

Two distinctively different types of resource efficiency govern the circular economy: loop 1 in figure 1 is about resource sufficiency in the re-use and service-life extension of manufactured capital, loop 2 is about material efficiency in recycling materials (molecules).

The strategies of loop 1 are product specific—re-refining engine oil, solvents and other products with a catalytic function need a different approach from the service-life extension activities for buildings or mobile durable goods. The latter's resource efficiency can be improved by modular system design, component standardisation and other eco-design (design for environment) approaches which are now known and well documented.

The strategies of loop 2 are material specific—metals, ceramic materials and plastic use processes of physical and chemical recycling often derived from manufacturing processes, as well as new processes such as the depolymerisation of polymers. Materials with a low price/weight ratio, such as brick and concrete waste from demolishing buildings, are best crushed, using mobile equipment, for re-use as recycling concrete on-site for new constructions.

All materials come with a multiple backpack (*rucksack*) of mining waste (Schmidt-Bleek 1993) and environmental impairment. These backpacks differ for each material and are highest for rare metals such as gold (with a backpack of 500,000), lowest for plastics (with a backpack of 0.1). Manufactured capital in the form of infrastructure, buildings, goods and components has individual accumulated backpacks of all the materials and energies they embed, which have to be calculated individually.

Manufactured capital contains, in addition to the backpacks of the materials it is made of, the sum of the embodied energy and GHG emissions as well as the (virtual) water of the manufacturing steps from basic materials into finished goods and up to the point of sale.

The re-use, remarketing and service-life extension activities in a circular economy preserve the mining backpacks of water and energy inputs and related GHG emissions in the manufacturing chain up to the point of sale, which are embodied in the finished goods. In addition, they also prevent the environmental impairment of the material recycling and/or waste management processes.

Higher resource efficiency also means reduced costs for material and energy procurement, as well as for waste disposal, waste water treatment and emissions.

4 A Circular Economy is about an intelligent use of human labour—job creation in a regional economy

This section explains why human labour—work—is different from the other renewable resources: creative, versatile and adaptable, able to be educated but perishable if unused. The circular economy needs workers familiar with past technologies and thus offers jobs for "silver workers".

"Roughly three quarters of all industrial energy consumption is associated with the extraction or production of basic materials like steel and cement, while only about one quarter is used in the transformation of raw material into finished goods such as machines and buildings. The converse is true of labour, about three times as much being used in the conversion of

materials to finished products as is required in the production of material." (Stahel and Reday-Mulvey 1976/81)

Compared to the traditional manufacturing process, the labour input of the circular economy is higher as (a) its economies of scale are limited in geographic and volume terms, and (b) remanufacturing comprises additional steps of dismantling, cleaning and quality control, which are absent in manufacturing.

No estimations exist on the impact of a circular economy on a national labour market. The 2012 report produced by McKinsey for the London-based Ellen MacArthur Foundation renounced to give such estimations because the economic models available to McKinsey do not allow such a calculation.

Yet employment is at the heart of the social pillar of sustainability. Furthermore, substituting labour for other resources is also an intelligent solution for reasons which are inherent in human labour—it is the only renewable resource with a qualitative characteristic. Work is the most versatile and adaptable of all resources, with a strong but perishable qualitative edge: (a) It is the only resource capable of creativity and with the capacity to produce innovative solutions, and (b) human skills deteriorate if unused—continuity of work and continued learning are necessary to maintain skills and upgrade capabilities. A person who has been unemployed for a few years risks becoming unemployable.

Governments should give priority to human labour in resource use because a barrel of oil or a ton of coal left in the ground for another decade will not deteriorate, nor will it demand social welfare, and not taxing labour reduces incentives for black labour in the shadow economy and thus reduces the costs for governments to monitor and punish abuses.

5 A Circular Economy is about caring

One of the objectives of a circular economy is to preserve the quality, performance and value of the existing stock, wealth and welfare. This certainly concerns manufactured capital, such as buildings, infrastructure, equipment and goods is a key criteria if selling performance (goods as services).

Stock management needs statistics and metrics to measure the variations of wealth due to variations in the quality of stock. GDP is a flow metric, ignoring if our wealth—the stock—has increased as a result of the flow. This situation has been compared to a bath tub where only the inflow of hot and cold water is measured, but the outflow and the water level are ignored. (Giarini and Stahel, 1989)

And stock management includes people's skills, education and health, knowledge and know-how. Preserving culture is also linked to stock, not flow management; maintaining UNESCO world heritage sites, museums and examples of technological achievements will all profit from the shift in taxation towards the non-taxation of renewable resources. And caring is a high-quality world: Stradivari instruments and expensive watches do not live forever by design, but through periodic remanufacturing, motivated by caring.

Caring is a key characteristics of managing stock—caring for keeping up existing values and qualities. Most car owners will credit the manufacturer of their vehicle for its continued reliable functioning, rather than their mechanic who provides the maintenance and repair services. A change in popular values and beliefs would multiply the perception of caring as a pillar of the (circular) economy. The fleet of vintage and oldtimer cars in the UK could be a point in case.

6 Retained ownership of goods and embodied material provides future resource security

This section looks at why selling goods as service, or performance, is the most profitable and resource efficient business model of the circular economy. By focusing on systems solutions, it internalises the cost of risk and of waste; by retaining the ownership of goods and the embodied resources, it creates a corporate and national resource security for the future.

Many economists have a problem accepting that this is a discontinuity in traditional economic business models, and look at the sale of performance as an extension of the aftermarket (Cohen, M.A. et al 2006).

Economic actors retaining material ownership over the full life of their products gain a future resource security but accept a liability for the performance of their goods. Such a Performance Economy (Stahel 2010) is based on the triple objectives of more growth and more jobs in combination with substantially reduced resource consumption. This triple objective can be achieved through three new business models: producing performance, selling performance and maintaining performance over time.

Success is measured using two new metrics in the form of absolute decoupling indicators: value per weight ($/kg) and labour-input per weight (man-hours/kg).

In the Performance Economy, providing materials services can be achieved, for instance, by building residential housing without capital. The developer rents all material and equipment from the manufacturers, say over a period of 50 years, who in return receive a yearly rent, financed by the rental income from the apartments. As the manufacturers have to give a 50 year guarantee for their material, they will make sure that the most appropriate material is used and applied correctly (renewable urban space initiative, in: Stahel 2010, p. 156).

Selling performance differs according to the characteristics of products and is widely present in today's economy: selling goods as services by operating private and public networks (railways, telecom, motorways, airports); chemical management services and rent-a-molecule; energy management and integrated crop management services; rental and operational leasing of real estate; selling custom-made indoor climate for energy companies; Private Finance Initiatives (PFI) as a strategy to sell the utilisation of infrastructure according to the "Consumer Pays Principle", such as the French and Italian toll motorways; facility management of real estate and industrial plants; textile leasing (professional attire**,** hotel and hospital linen). These are but a few examples of the business model of selling performance, which also include rent a wash, rent a molecule and chemical leasing, as well as renting fashionable consumer goods (taking the waste out of fashion, see websites to rent ladies' handbags).

Selling performance is the most profitable and most material-efficient business model of the circular economy, as it is built on exploiting the small loops. It focuses on utilisation optimisation and exploits resource efficiency as well as sufficiency and prevention options to gain financial advantages and higher competitiveness. And it can be applied to all types of goods, see Table 2.2, key business strategies of the Functional Service Economy on the next page.

Water and energy savings as well as waste prevention now become profitable activities that positively impact the financial bottom line of corporations. Whereas in the industrial economy, sufficiency and prevention options during the utilisation phase of goods present a loss of income, and are thus undesirable.

Selling performance, results, utilisation, services instead of goods means that economic actors

a) retain the ownership of goods and embodied resources.

b) internalise the cost of risk and of waste.

By comparison, the industrial economy maximises its profit by externalising the cost of risk and of waste. After the point of sale, it offers a warranty for a limited period of time and limited to manufacturing defects.

By internalising the cost of risk and the cost of waste, economic actors selling performance have an economic incentive to prevent any future liability after the point of sale.

Table 1: Key business strategies of the Performance Economy

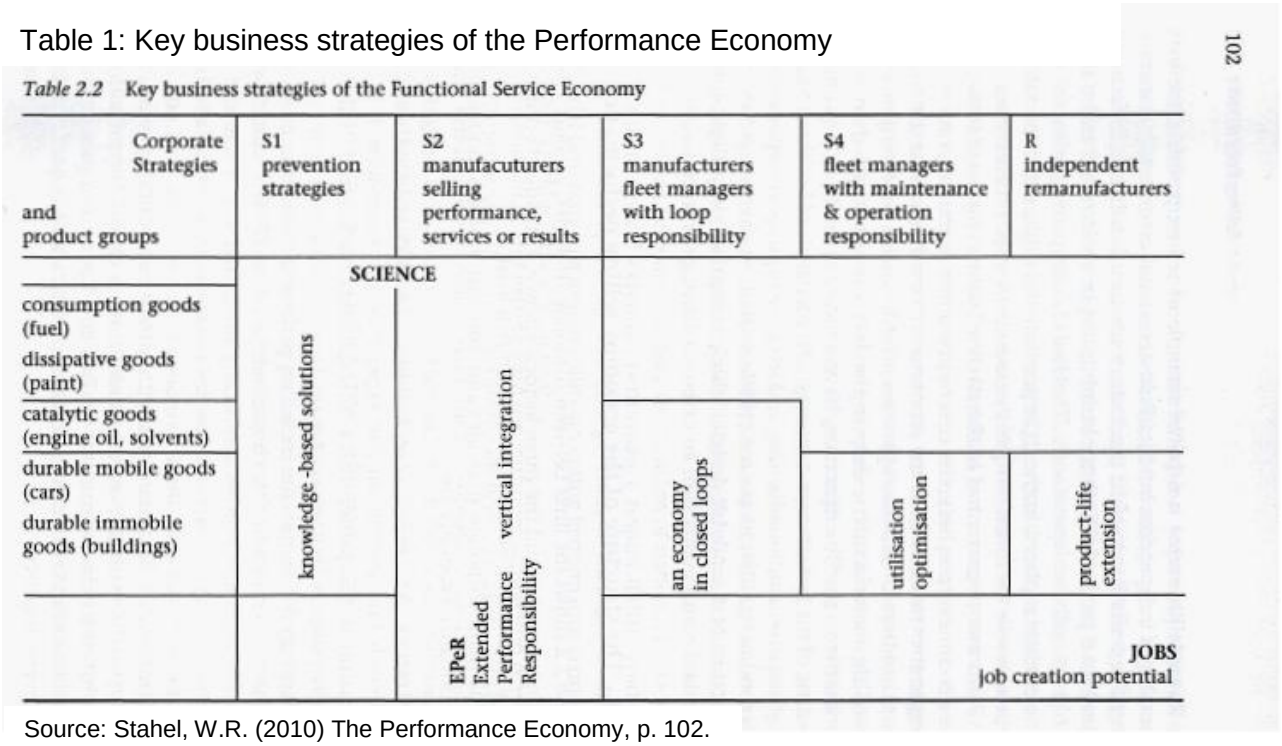


Table 2.2 Key business strategies of the Functional Service Economy

Corporate Strategies and product groups	S1 prevention strategies	S2 manufacturers selling performance, services or results	S3 manufacturers fleet managers with loop responsibility	S4 fleet managers with maintenance & operation responsibility	R independent remanufacturers
	SCIENCE				
consumption goods (fuel)	knowledge -based solutions	vertical integration			
dissipative goods (paint)					
catalytic goods (engine oil, solvents)			an economy in closed loops		
durable mobile goods (cars)				utilisation optimisation	product-life extension
durable immobile goods (buildings)		EPeR Extended Performance Responsibility			
					JOBS job creation potential

Source: Stahel, W.R. (2010) The Performance Economy, p. 102.

Retaining ownership of their goods and embodied resources over the full life of their products gives corporations in times of rising resource prices (see next section) a high future resource security and resource price guarantee as well as a competitive cost advantage against throughput-based competitors, along my motto:

"the goods of today are the resources of tomorrow at yesterday's prices".

Buying performance is the-demand side strategy equivalent to selling performance. Buying goods as services creates the same resource efficiency advantages and can be regarded as a new green public procurement policy. Buying services instead of hardware is the preferred procurement option of parts of the U.S. administration, such as NASA and the Pentagon, and has sparked a number of innovative start-up companies. NASA now buys exclusively orbital services from companies such as Space-X; the space shuttle was the last NASA-owned and operated hardware to provide Earth orbit services.

Michelin provides tyre-use services to all parts of the U.S. armed forces: for aircraft tyres, a fee per landing is charged; vehicle tyres pay a fixed fee per 100 miles. This service of "pay by the mile" is now also offered to French and U.S. fleet managers of lorries, using a business model of mobile tyre service workshops to make tyres last as long as safely possible. *http://www.michelintruck.com/michelintruck/services/MichelinFleetSolutions.jsp*

7 Policy for material efficiency: the role of sustainable taxation and sustainable framework conditions

Sustainable framework conditions should treat the circular economy on its own merits, by:

(a) not taxing work—human—labour as a zero-carbon renewable resource,

(b) not charging VAT on such value preservation activities as re-use, repair and remanufacturing, with the possible exception of technologic upgrading activities.

Major re-marketing activities, such as flee-markets and ebay, are already de facto except from VAT, and,

(c) giving carbon credits for the prevention of GHG emissions, not only for their reduction.

The small loops (fig. 1) constitute a prevention of GHG emissions (and waste) but receive no carbon credits under any of the existing or planned GHG emission programmes, such as the Kyoto Protocol, which are based on the linear thinking of the industrial economy: first pollute, then reduce pollution to receive carbon credits!

Sustainable politics should build on simple and convincing principles, such as "do not tax what you want to foster, punish unwanted effects instead", and it should promote sustainable solutions. Ideally, sustainable solutions create self-reinforcing virtuous circles, which guarantee their longevity.

Not taxing renewable resources including work, and taxing non-renewable ones instead, creates virtuous self-reinforcing circles, by creating incentives to work more (no penalty for higher income) and by creating more wealth from less new resource input (increasing caring in resource use including long-term resource ownership).

Sustainable taxation should reward desired developments and discourage unwanted effects of activities. In a sustainable economy, taxes on renewable resources including work—human labour—are counterproductive and should be abandoned. The resulting loss of state revenue could be compensated by taxing the consumption of non-renewable resources in the form of materials and energies, and of undesired wastes and emissions. Such a shift in taxation would promote and reward a circular economy with its local low-carbon and low-resource solutions. These are inherently more labour-intensive than manufacturing because economies of scale in a circular economy are limited. Taxes on non-renewable resources could be charged in a similar way to today's Value Added Tax (VAT), also for imported goods.

The intelligent use of human labour has traditionally been discouraged through taxation, whereas the waste of it has been "encouraged" in some industrialised countries through generous welfare. This shows that the role of work as a renewable resource in the economy has been misunderstood by policymakers.

Summary

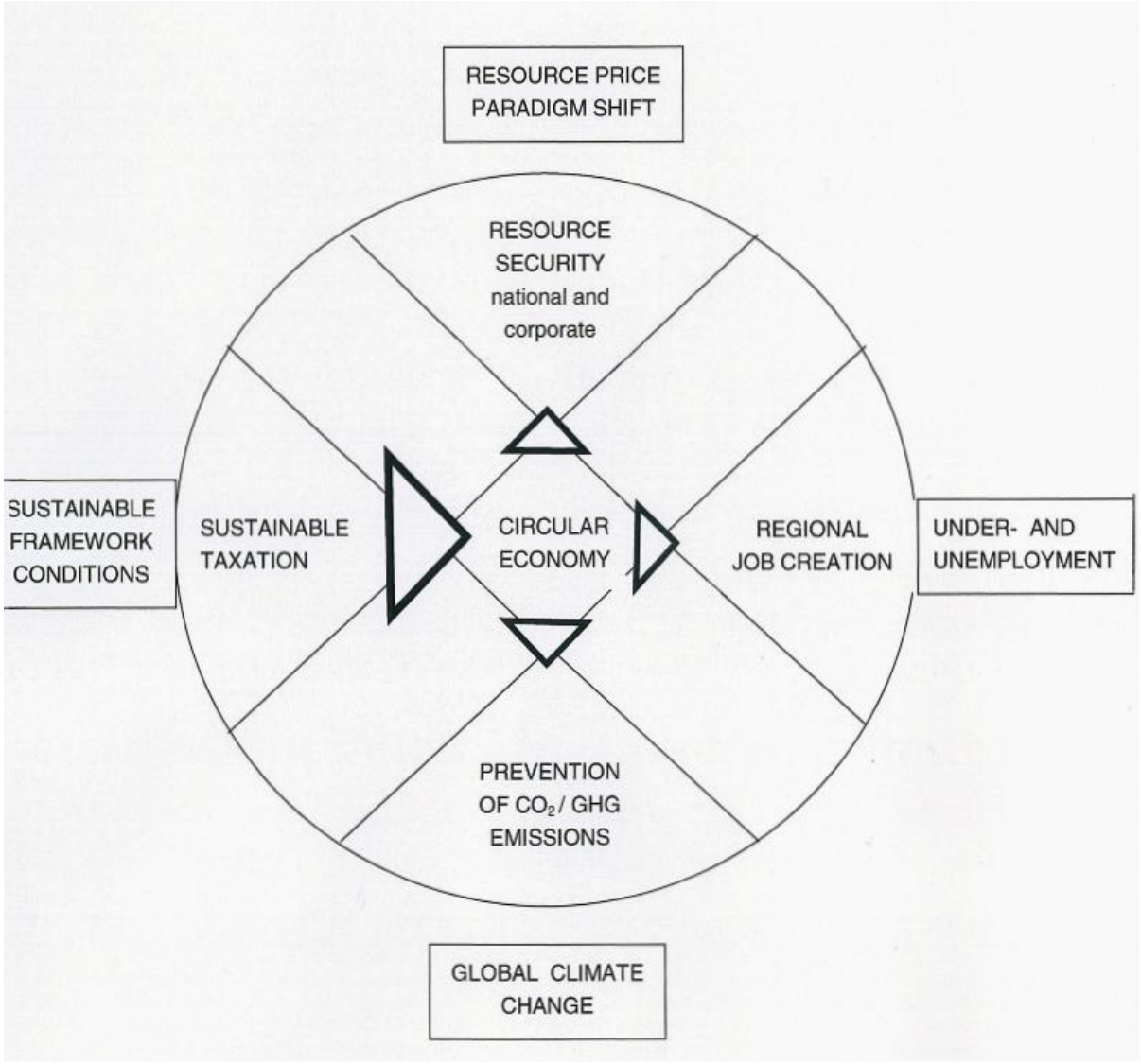
The linear industrial economy is best in overcoming situations of scarcity of food, goods, shelter. But in a situation of saturated markets, a circular economy is best suited to manage existing stock. In 1980, the market penetration for durable household goods in France was already above 90 per cent for all social classes (Stahel, Jackson 1993). In Germany, from 1995 onwards, the number of cars scrapped each year has been roughly the same as the number of cars newly registered. Continued production in saturated markets constitutes a substitution of, not an addition to, wealth, at the cost of "*intensive and often inefficient use of resources*" (EU COM(2011) 571 final).

For the last 100 years, resource prices for energy and material have constantly decreased; maintaining ownership of materials to assure access to future resources made little sense. At the beginning of the 21st century, this trend has changed, and it is expected that resource prices in the 21st century will constantly increase—a theory formulated by experts at the European Commission and prominently by the asset manager Jeremy Grantham (2011) who called it "the big paradigm shift". Resource security could therefore become a major political bone of contention; and economic actors maintaining resource ownership will enjoy a certain guarantee of resource availability and price in the future, at the same time providing resource security for nations.

A sustainable tax policy of not taxing renewable resources including work constitutes a very powerful lever to accelerate, boost and generalise the circular economy and its positive impacts on resource security and regional job creation, while simultaneously reducing GHG emissions, as summarised in figure 2.

Figure 2:

Sustainable taxation will promote the circular economy which in turn boosts resource security, regional job creation and the prevention of GHG emission -- Copyright Stahel 2011



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