

# A pluralist assessment of industrialization

## Abstract

The established method of health technology assessment (HTA) is in this study expanded to a Pluralist Technology Assessment (PTA) including the Ecosystem in the production function. Market economy can grow by moderate reciprocal relations where the Government supports the framework for free market enterprise. However, the PTA concludes that industrial side-effects such as global warming and job-related stress today more than outweigh contemporary gains by GDP growth. Sustainable development requires a stronger economic reciprocity with collaborative (public) finance of interventions for the common good in accordance with the democratic social contract claimed by Rousseau 1762. A development from moderate to strong reciprocity is definitely a biological option based on across-the-center collaboration between Social Liberal and Social Democrat parties.

A critical economic-political reform for such sustainable development is a CO<sub>2</sub> Tariff (ET) towards global warming. However, in a globalized economy there is a national conflict of interests between Eco-protection by ET and business/employment which slows down the implementation. So, a globalized economy requires that the ET is implemented from the international level. A major part of the international ET revenue, for instance by the partners of the Paris Agreement 2015, can be used for Direct Air Capture of CO<sub>2</sub> (DAC) and spillover technologies for instance synthetic fuels for heavy transport by sea and aircrafts.

At the national level, the ET revenue must be used partly for social compensation to low-income groups, partly for new technology development in special sectors as agriculture and transport by sea and air. At the population level, "Simple Living" as a bottom-up alternative to consumerism complements the political interventions. Part of Simple Living is meditative in-depth-relaxation for better stress-management where a professional collaboration between Medicine and Health Economics can accelerate the development.

**Keywords:** technology assessment, market failures, greenhouse effect, job-related stress, meditation

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## Introduction

The simple condition of economic growth is that ordinary consumers are able to maximize the utility of buying alternatives provided by a minority of profit-seeking entrepreneurs. Such a simple growth model is self-stabilizing by "The invisible hand."<sup>1</sup> If Supply exceeds Demand in a period stocks increase and the supply price declines in the next period and vice versa in the case where stocks decline. In the early phase of industrialization, it was discovered that not all markets are perfect wherefore Anti-monopolist legislation was established at the end of the 19th Century. Until recently monopolistic exploitation of markets has been considered a minor rather than a dominant effect.

After WW2 more limitations were recognized in the economic rationality of liberal market growth. Firstly, individual behaviors in institutions and firms may hold career considerations as more important than simple market rationality as expressed in the concept of Bounded Rationality (BR).<sup>2</sup> Secondly, it is demonstrated that anxiety distorts rational decisions in the direction of risk-aversion for instance as a loss-aversion in periods of economic crisis.<sup>3</sup> Thirdly, risk-aversion dominates rationality in complex subjects as healthcare as a third limitation of BR.<sup>4</sup> Despite these limitations in rational economic decisions, BR has so far been considered the best available behavioral paradigm behind economic growth. because it does apply to simple economic choices, for instance regarding the consumption of daily necessities.

The enormous growth in multinational companies since the Fall of the Iron Cur 1989 and the development of digital technology has turned basal market conditions in these markets upside-down. Modern brand marketing implies that a new product by social reinforcement

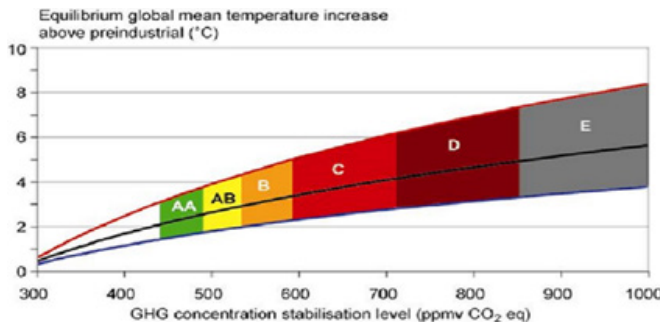
raises the Demand breakthrough towards a much higher level of saturation.<sup>5</sup> The Supply-function is turned around, too, due to various economies of scale other than the physical size of the assembly line:<sup>6</sup>

- I. *Ownership* encompassing the development of proprietary technology where MNC often are technological leaders investing heavily in developing new products, processes and brands, which are kept confidential and protected by intellectual property rights
- II. *Relocalization* benefits include that the headquarters and/or special departments near the final buyers or closer to cheaper labor, expert engineering, raw materials and tax shelter
- III. *Internalization* of ownership benefits that are risky or unprofitable to rent or license to another corporation
- IV. How favorable the new conditions have been for multinational companies (MNC), is documented by several studies of the reinforcing inequality of income, for instance<sup>7</sup> and International Monetary Fund.<sup>8</sup>

Besides reinforcing profits to MNC that widens economic inequality, the whole process of economic globalization implies a global greenhouse effect as illustrated in Figure 1.

Already, the Greenhouse effect was described in the 1970s.<sup>9</sup> Today, the Intergovernmental Panel on Climate Change (IPCC) is monitoring the Greenhouse effect on behalf of the UN. When atmospheric CO<sub>2</sub> rises beyond 450 ppm, corresponding to 1.5°C, a series of reinforcing climate changes start, for instance melting of the Russian Tundra releasing a significant amount of Methane with a far stronger heating effect. The UN agreed in 2015 the Paris Agreement, aiming to hold "the increase in the global average temperature well below 2°C above

the level before industrialization” and pursue efforts to “limit the temperature increase at 1.5°C.” However, the latest evaluation is this target is rather improbable with the actions planned so far by member-countries.<sup>10</sup> Another negative side-effect of technological growth is epidemic job-related stress. WHO warns Depression by 2030 becomes the most heavy burden of disease.<sup>11</sup>



**Figure 1** Reinforcing global heating

In healthcare, Technology Assessment (HTA) integrates quantitative and qualitative options as well as technology risks in the concept of Quality-adjusted Life years (QALY) graduating a life year from 1 through 0 in accordance with eventual handicaps. Such HTA extends to a Pluralist Technology Assessment (PTA) including Eco-effects in the production function. PTA is the methodological approach in this study that aims at an approach to sustainable social development that is both pluralist and positivistic.

## Method

Adding the Ecosystem to the Material\*Personnel complex in HTA gives the Formula of PTA:

$$\text{QALY} = F(\text{Capital, Personnel, Eco-effects})$$

**Ad 1. Economy as determined by the Capital\*Personnel complex in market goods** Market goods accumulate to the GDP and the expected annual growth rate in the global GDP relates to QALY in the way that the growth rate correlates significantly with the average life-expectancy.<sup>12</sup>

This implies that the QALY effect of real growth in the GDP is considered the overall outcome of technological development since Industrialization began about 1750.

**Ad 2. The qualitative dimension of Personnel is the stress load**

This quality is operated as the social costs of stress to the workforce, which are set-off in the rate of growth in the GDP. The costs of stress include 1) Absentees from work, 2) Early retirements and 3) Costs of treatment of stress and stress-related diagnoses in both primary and secondary health sectors.

The stress factor must include, too, stress related to for instance damages to Biodiversity and anxiety for nuclear fatalities in energy production or other modern HiTec warfare.

**Ad 3. Eco-effects**

- I. Direct damage to the climate is calculated as the costs of substituting CO<sub>2</sub>-emission by alternative non-fossil energy sources as a percentage to set-off in the growth rate.
- II. A margin may be added to substitution costs for other direct toxic effects of earth and air.

III. The PTA requires that international scientific databases, such as PubMed, PsychInfo and EconLit, are searched for relevant studies on correction of evidenced market-failures (Factors 2-3). Also basal data is searched from international organizations, such as OECD, WHO, IMF and World Bank. The Results are structured in three parts:

- a. Summary of the Pluralist Assessment of Industrialization (PTA)
- b. Sustainable Economic Policies to correct market-failures (Like medical interventions to cure human dysfunction)
- c. Bottom-up alternatives to consumerism for the broad population (Like self-care for human dysfunction).

## Results

### Summary of the pluralist technology assessment (PTA)

#### Empirical findings

##### QALY by market-based economic growth

The most probable rate of real long-term economic growth is 2% p.a. A study shows the relation between economic growth and life-expectancy is a strongly significant logarithmic relation ( $R^2=0.62$ ).<sup>12</sup> This implies the average annual growth in Life-expectancy is about 2 months. With a global population of 8 billion, the growth effect amounts to 1.300 million QALY per year.

#### Burden of stress

Stress is an epidemic job-related disease burden that typically leads to a Depression and/or other fatalities, for instance Cardiovascular disease. Depression is expected to be the most heavy disease burden 2030.<sup>11</sup> In the USA, a workplace survey estimates the costs of Workplace stress to 500 billion USD or 2% of GDP.<sup>13</sup> A estimate for stress costs in Europe, where stress comprises all costs of mental diseases, accounts for 4% of GDP.<sup>14</sup> The US study is to our assessment closer to WHO,<sup>11</sup> wherefore we prefer such cautious estimates of social stress costs amounting to 2% of GDP following Hellebuyck.<sup>13</sup>

#### Damages on the global ecosystem

The global CO<sub>2</sub>-emission aggregate 2023 to 35 Billion tons or 28 Billion more than the level before WW2. By the most effective substitution and catching from the Atmosphere the average cost is estimated to 150 USD per ton. With global GDP aggregating to 100.000 Billion USD, substitution down to the WW2 level (28 Billion tom) costs 4% of global production capacity. Total fatal environmental diagnoses accounted for the loss of 600 million QALY in 2012 byb[Prüss-Üstün which today roughly account for 1% growth.

Climate research has identified a critical threshold of practical no return with an atmospheric concentration of CO<sub>2</sub>>450 ppm.<sup>15</sup> In 2023, the level is 420 ppm and rising by 2-3 ppm p.a. Already, the costs of stress and the environmental damages outweigh the QALY gained by liberal market-based growth more times representing a state of negative net growth where the present generation erodes the living conditions of future generations!

### Global scenario by fulfillment of the Paris agreement 2015

The concentration of CO<sub>2</sub> starts to decline before reaching the critical limit of 450 ppm and global temperature increases <1.5°C without serious long-term damage to the climate.

## Global scenario when the original Paris agreement fails

CO<sub>2</sub> rises beyond 450 ppm and Global Temperature rises >2.5°C with exponential growth incosts and negative net growth. This most probable scenario resembles the Great Depression 1929 leading to WW2, with a high level of conflict between the Global North and South. In this situation, the study focuses on long-term interventions to correct market-failures before they become irreversible. Specifically, this includes 1) The Greenhouse effect, 2) Epidemic Job-related stress and 3) Increasing economic inequality.

### Sustainable democratic economic policies

#### Conflict, collaboration and democracy

In human interaction the opposites are conflict versus collaboration. Economic behavior represents a mediation termed reciprocity in social psychology based on the theory that humans aim to belong, often achieved through maintaining positive relationships.<sup>16</sup> In Economics, reciprocity is a compliance strategy that involves giving or doing something for someone in exchange for something in return.<sup>17</sup> The first step beyond survival of the fittest appeared as *weak reciprocity* among hunters and gatherers giving gifts and favors to each other in primitive societies a million years ago. The democratic “Minimal State” in the early state of Industrialization from 1750 stabilized a *moderate reciprocity* beyond the long-term self-interest with a constructive symbiosis in-between market economy and Government with the least possible interference.<sup>18</sup>

Strong reciprocity where the collective interest rules was investigated by Experimental Economics as the option to develop human solidarity by punishment of asocial behavior in small-groups.<sup>19</sup> However, the positive results of punishment were poor, wherefore this study focuses on *strong reciprocity by collective finance of interventions for the common good* in accordance with the philosophy of modern democracy.<sup>20</sup> The French Revolution 1789-99 implemented the Ancient Greek idea of democracy, rule by the people, by a model of a representative democracy where a directly selected Parliament constitutes a Government that’s controlled by an independent judicial system.

In the second half of the 19th Century, democracy was dominated by an ideological fight where a revolutionary change challenged the ruling Economics.<sup>21</sup> Simultaneously, democratic movements for the “Common Good” were supported by Utilitarianism emerging from each of the democratic wings.<sup>22</sup> *Social democrat* worker-parties were formed in a number of European countries as national parties within 1. International Socialist Association of Workers. *Social Liberalism* developed by the end of the 19. Century. The first notable implementation of social liberal policies occurred under Liberal Party in Britain 1906-14 and included pensions for poor older adults, health, sickness and unemployment insurance financed by progressive taxation.

A modern example of strong economic reciprocity is Keynesian fiscal policy to recover from demand-based recessions as the Great Depression 1929 by expansive fiscal policy.<sup>23</sup> Another example is collective finance of healthcare in far the most industrialized countries, but the USA with a privatized health system. Comparison of the USA and Other G7 by figures from the OECD Database show that healthcare in Other G7 is both cheaper (9% versus 16% of GDP) and has a better Outcome (Life-expectancy is 84 versus 79 years) (Figure 2).

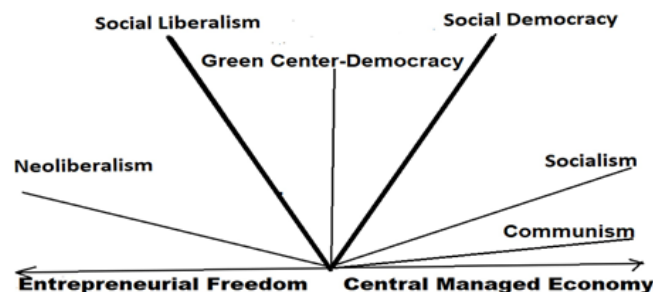


Figure 2 Complementary democratic economic ideologies.

### Model of strong reciprocal economic policy

Correction of market-failures requires that reciprocity expands beyond selfishness to *economic actions for the common good*. Neoliberalism is outdated by Social Liberalism due to negative side-effects, and the Communist experiment in Eastern Europe 1917-91 rejects centralized economic planning as a growth model.<sup>24</sup> So, the spectrum for securing the common good ranges today from Social Liberalism to Social Democracy as illustrated in Figure 3, where the X-axis represents “Entrepreneurial Freedom” versus “Central Managed Economy”. A prototype of Figure 2 is Germany with a coalition across-the-center of Social Liberals (FDP), The Green Party and Social Democrats. Denmark has a similar across-the-center government. A field study related to this project of economic preferences among Danish social liberals confirms the top-priority of common goods as a CO<sub>2</sub> Tariff at the level of social liberal voters which is also the recommended intervention towards the greenhouse effect by the economic profession since Pigou<sup>25</sup> 1920.<sup>26</sup>



Figure 3 The basic consumer choice.

In all, the EU seems to have the better options for such a coalition across-the-center. For comparison, the US lacks the Left-wing making implementation of center-orientation an exclusive option by long-term dominance of the Democratic Party. Democratic growth economies without a long history of fighting wings, like India, seems to have this option, too.

Center-orientation as alternative to the historical fighting of wings implies that the new opposites to the normal are 10% socialist Left-wingers and 20% national-conservative Right-wingers. However, this leaves 70% of the voter population as potential supporters of across-the-center policies which is a far more stable base for long-term policies like a CO<sub>2</sub> Tariff. The critical group for center-orientation is Neoliberalists that so far have believed in market-driven growth with as little public regulation as possible. Such collaboration across-the-center risks, too, that short-term symbolic policies take over, for

instance by small subsidies to marginal voter groups on each side. Strong reciprocal economy needs a majority of voters capable of distinguishing between symbolic and sustainable policies.

### Shortcomings in the implementation of a broad national CO<sub>2</sub> Tariff

The effectiveness of ET relies on the changes in the price structure which activates entrepreneurial ingenuity to find non-fossil energy alternatives. Also, ET can serve social democrats using part of the revenue for social compensations, without weakening the transition incentive. A broad CO<sub>2</sub> Tariff is crucial, but cannot stand alone, bottom-up initiatives for sharing, reuse and minimization of waste can involve the local municipality and is an important complement to political interventions.<sup>4</sup> The crucial challenge of implementing ET in a globalized economy is that the speed of national political implementation of ET is slowed down due to the risk of deteriorating national competitiveness in a way that relocates production and employment to other countries. This serious limitation in ET calls for a new approach! In a globalized economy, the implementation of ET must arise from the international level to affect a comprehensive technological transition towards carbon neutrality. For comparison, the ongoing method to implement the Paris Agreement 2015 (PA15) is a centrist political-technocratic model where national plans are negotiated centrally to achieve some kind of administrative coordination. This method resembles the inefficient Communist model in Eastern Europe much more than the entrepreneurial market model it aims to interact with. An alternative implementation model for PA15 is simply to impose member-countries a CO<sub>2</sub> Tariff corresponding to their emission. The target of PA15 is to half the level of CO<sub>2</sub> emission compared to 1990 which corresponded to around 2 tons per capita on earth. So, the metering out criteria of the ET by PA15 must be the actual CO<sub>2</sub> emission per capita with a bottom deduction of 2 tons. This criteria implies, too, some social justice as countries with a low level of CO<sub>2</sub> emission have to pay a relatively little amount to the global ET on CO<sub>2</sub>.

The crucial task is to optimize the level of the PA15 ET that has a tax base of 20 Gigatons CO<sub>2</sub> and must cover, too, the agreed Solidarity Fund of 100 billion USD per year with the "Poor Global South". This implies a minimum tariff of 5 USD per ton CO<sub>2</sub> emission. The maximal tariff corresponds to the typical difference per emitted ton CO<sub>2</sub> between fossil and non-fossil sources of energy which is estimated to 100 USD per ton CO<sub>2</sub> corresponding to billion USD or 2% of the global GDP. Based on public national statements a PA15 ET on 50 USD per ton corresponding to 1% of global GDP appears as the highest possible level of international economic solidarity. This level represents, too, a strong incentive to accelerate the implementation of the national ET.

The PA15 ET is not simply a cost for the contributing nations. Direct Air Capture of CO<sub>2</sub> (DAC) is a collective good as the atmospheric concentration of CO<sub>2</sub> is the same all over the world. It is analyzed by the International Energy Agency to have an estimated long-term price <100 USD/ton.<sup>27</sup> If all the revenue of the PA15 ET is used for DAC Plants, it represents a national value of 50% of the national costs. The national value to the PA15 member-countries becomes even larger, if the geological storing of CO<sub>2</sub> is replaced by productive uses, for instance production of Methanol for transport by sea and air. The major challenge of an international ET is probably not financial, but rather lack of reciprocity for a supranational budget share of this size. For comparison, the only supranational budget share

of this size is that of the EU where the internal conflicts of economic interests are far less compared to the UN.

### Bottom alternatives to consumerism

Modern behavioral economics understands economic behavior as determined by group processes rather than by classical individual sovereignty.<sup>28</sup> A bottom-up alternative to Consumerism is "Simple Living"<sup>29</sup> which is a rational response to the low marginal utility of basal consumption that makes alternatives more and more attractive. Figure 3 illustrates that a majority of consumers dispose of the double of what's needed to satisfy basal physiological and social needs. "Simple Living" is driven by positive motives such as personal development, health, ecology and household economies and the additional recognition that mass consumption is blown-up by marketing. The "Rise of the Creative Class" labels this development<sup>30</sup> which is confirmed by a European follow-up study in Denmark.<sup>31</sup>

The follow-up estimates the share of the creative class to be 40%+ of the workforce in Denmark while the former working-class majority is reduced to 20%. Simple Living has various forms:

### Unfoldment of creativity

The roots of the creative class go back to the Renaissance (1400-1600) which represents a positive willingness to learn and explore, belief in the decency of man (Humanism), rebirth of Naturalism and Secularism. After WW2 a central revival of this historical line has been a hierarchical model of personal development towards self-actualization.<sup>31</sup>

Better unfoldment of creativity is a strong motive for the rising creative class and creative man is in this Century operated as a "Pilot-in-the-plane" with the following four personality traits:<sup>32</sup>

- 1) *Pragmatism* to prioritize "Bird-in-hand" fore "Birds on the roof"
- 2) *Moderation* to clarify "Affordable Loss" by an Alternative Worst-case-budget
- 3) *Versatility* to diversify team building as much as possible like a "Crazy Quilt" of all relevant skills stimulating original selection of components and technology for the product/service.
- 4) *Optimism* to overcome unforeseen obstacles as "Sweeten a sour citrus"

A management study demonstrates the comparative efficacy of entrepreneurs compared with other managers.<sup>33</sup> Excellent production management requires far more than maximization of profit, but an entrepreneur must recognize, too, the necessity of a long-term ROI, whether the business is for-profit or not.

### Savings/Investment

Net household saving is the classical domestic source of funds to finance capital investments for the old age and coming generations. The net household saving rate varies according to OECD Data typically from -10% to +20% with a median of 10%. It's remarkable that the savings rate of Chinese households is exceptionally high at about 33% which explains the high growth rate of China since 1980. The rise in household investments in non-fossil technologies is a notable facilitation of the fulfillment of the Paris Agreement, too.

## Charity

Another classical alternative to consumerism related to Christianity is Charity. Two major forms are voluntary work and financial donations. Charity corresponds to about 10% of GDP whereof the two third is voluntary work. Unfortunately, voluntary work is not directly accounted for in the GDP.

## Eco-Activism

Doughnut Economics inspires bottom-up Eco-activism,<sup>34</sup> for instance has the Doughnut Economic Action Lab contributed to greening projects of more large European cities, for instance Amsterdam, Stockholm and Copenhagen, see.<sup>35</sup> This type of bottom-up Eco-Activism is an important new trend of populist striving for the common good. The thesis from Figure 3 is that social liberal and social democrat political movements are central to implementation of sustainable policies, like a CO<sub>2</sub> Tariff and UBI. This thesis is tested in a field study of preferences for economic policy among members of the social liberal party in Odense, Denmark. 15 members or 50% of active members replied to the Questionnaire after reading a summary of Result 2. 27 persons formed a control group representative to the Danish population. The findings are that ET has Top economic-political priority for both social liberals and the controls, but the social liberal preference for ET is significantly higher than that of the controls. The preference for UBI was at the same moderate level in both groups. An additional learning arises from the comments of 20% of the participants. They find it difficult to state their economic-political preferences on the basis of the short background note. In such cases, the preferences were typically moderated to 5 on the Dohmen scale 0-10. Participation in social-liberal or social democrat parties is recommended to strengthen the support of sustainable democratic economic policies.

## Stress-management

The state of epidemic stress is confirmed in a recent Danish statistical query on stress among an important share of youngsters<sup>36</sup> where early personal signs are identified as 1) Lack of time for self-actualization and 2) Increased career expectations in post-industrial economies. WHO recommends meditation as a complementary fitness intervention.<sup>11</sup> The action-mechanism of meditative in-depth-relaxation is reinforcement of the interoceptive sense.<sup>37</sup> In accordance with this finding, the essence of meditation is interpreted as a "Psychology of Silence".<sup>38</sup> The neurodynamics of meditation is explained by the Neuroeconomic Decision-Making Model (NeM).<sup>28</sup>

## Discussion

The second part of the concept of "The Common Good"<sup>20</sup> is *collectively agreed*. This implies that policies for the common good as developed by Economics, for instance a CO<sub>2</sub> Tariff, are not completed until they are communicated in a comprehensible way to the democratic public. Such an economic module to public dissemination of findings on "The Common Good" calls for active mutual support among social scientists!<sup>39</sup>

## Conclusion

This study analyzes Industrialization as the most comprehensive health intervention that has redoubled human life-expectancy. This reveals that negative-effects such as global warming and job-related stress now outweigh the positive effect of Industrialization leaving

a significant ecological burden to future generations. Mainstream economics recommends a broad CO<sub>2</sub> Tariff (ET) towards, however, in a globalized economy the ET must be implemented from the international to the national level. However, due to the budget size such a project must develop new standards for international economic reciprocity. A simple and effective mental tool for improved stress-management is a pragmatic use of classical meditative in-depth-relaxation as instructed by a number of different NGO's and easily controlled by a simple Galvanic Skin Resistance Meter.

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## Conflict of interest

Authors declare that there is no conflict of interest.

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