MEASURING SUSTAINABLE WELL-BEING ON SUB-NATIONAL LEVEL WITH GENUINE PROGRESS INDICATOR (GPI) IN FINLAND:

Päijät-Häme, Kainuu and the area of Center for Economic Development, Transport and the Environment for South Ostrobothnia, 1960–2009

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fresh. INTERREG IVC INNOVATION & ENVIRONMENT REGIONS OF EUROPE SHARING SOLUTIONS Kainuu The Regional Council of Päijät-Häme European Union European Regional Development Func

THE REGIONAL COUNCIL OF PÄIJÄT-HÄME
B66 * 2011
ISBN 978-951-637-193-4
ISSN 1237-6515

Project Report 21.2.2011
Lahti Science and Business Park Ltd, Päijät-Hämeen liitto

Abstract

Current economic and political systems foster economic growth as a path to happiness and the Gross Domestic Product (GDP) remains the most important measure of societal planning and decision-making. Economists have for long recognized that the GDP is misleading as an indicator of the welfare of a nation and many initiatives have been taken to develop more adequate measures of well-being. Genuine Progress Indicator (GPI) is designed to measure such economic welfare that can be sustained over time and it can be applied both on national and sub-national level. GPI looks at the well-being from the consumer's point of view. Personal consumption expenditure figures are the starting point for GPI calculations since we are ultimately interested in the welfare associated with consumption rather than the monetary value of production (i.e. GDP). While GDP counts all economic activities as positive, GPI adds the value of benefits such as housework and volunteer work and makes deductions for such things as declining environmental quality, disadvantages of urbanization and increasing income inequity.

In this study the GPI is calculated on sub-national level for Kainuu, Päijät-Häme and area of Centre for Economic Development, Transport and the Environment for South Ostrobothnia (CEDESO). The study was conducted as a part of European Union's (EU) Interreg IV C FRESH Project (Forwarding Regional Environmental Sustainable Hierarchies) and GPI is here tested as a potential new composite indicator to measure regional economic, social and environmental progress. GPI measures sustainable welfare creation at the macro level, and therefore well fits the purposes of FRESH.

The Finnish GPI was first calculated in 2008 by Hanna Rättö using the methodology developed by Talberth et al. (2006). With sub-national GPI study one can obtain information about the locally most important sustainability and welfare issues. If GPI shows positive development it can be suggested that the development has been achieved in a rather sustainable way, so that the future prospects are not endangered

The results obtained here follow the same development that was seen in 2008 with the Finnish GPI study. Year 1989 was the peak year in all regions and after that a substantial decline can be noticed. Päijät-Häme, nevertheless, is showing steady progress since 1995 and the development seems again very positive after 2005. Other regions continued the downward path until the year 2005. In recent years the decline measured by GPI has ceased and the development seems somewhat positive again. Area of CEDESO follows the Finnish average development trend quite closely while the GPI graph for Kainuu lies well below the others. This is due to the fact that the U.S. GPI-methodology gives a significant value to the loss of wetlands. As

wetlands in Kainuu are vast in comparison to other areas, the GPI figures go down. When this component is omitted, Kainuu's performance is close to the Finnish average.

According to this study Päijät-Häme has been able to keep its inhabitants' standard of living adequate while reducing the burden on the environment. The development can therefore be considered sustainable, although high unemployment and increasing cost of commuting cut down Päijät-Häme GPI figures. In Kainuu, instead, while the level of material welfare is rather low, the income distribution is quite even and the negative externalities such as commuting, noise pollution and crime are on a low level. The use of renewable energy (hydropower) cuts down the CO_2 emissions in the area. Kainuu can be considered to be relatively sustainable when it comes to environmental factors, although the differences to the Finnish per capita averages are small. The area of CEDESO instead causes a rather big burden on the environment due to its heavy industry and emissions from scattered sources. Nevertheless the unemployment, commuting costs and crime rate are relatively low, which improves the area's GPI-results. In order to make more national comparisons GPI could and should be applied to more regions in Finland. For example the influence of Helsinki and other big cities to the Finnish average should be distinguished.

Despite its good qualities there are still details in GPI that need refining. As suggested in the report the model used in here may not be the most optimal for the Finnish society. Some additional components could be included and the American pricing methods should be reviewed in order to produce an ideal measure for sustainable well-being. GPI remains the most promising composite indicator for measuring the sustainable well-being of a post-industrial country.

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1. Foreword

The study was conducted as a part of European Union's (EU) Interreg IV C FRESH Project (Forwarding Regional Environmental Sustainable Hierarchies) and GPI is calculated and tested as a *good practice* –tool, a composite indicator to measure region's economic, social and environmental progress. The general aim of the project was to calculate Genuine Progress Indicator (GPI) for Kainuu and Päijät-Häme counties and analyze the results and thus provide policy makers with new measures to evaluate the region's economic progress and environmental problems and potentials. The FRESH partners participating in the regional GPI-project are Päijät-Hämeen liitto, Kainuun Etu Oy and the Joint Authority of Kainuu Region. The study was conducted at Lahti Science and Business Park Ltd by M. Sc. (econ.) Inka Lemmetyinen. Head of research Jukka Hoffrén at Statistics Finland and Hannele Ilvessalo-Lax at ELY Center for South Ostrobothnia took the initiative to carry out the Finnish sub-national applications with the GPI.

The FRESH project aim is to strengthen Sustainable Value Creation (SVC) – based development at regional level. Sustainable value creation occurs when economic growth is secured through sustainable actions, which also create social and environmental benefits. Sustainable value creation thus reconciles long term with short-term growth. It is therefore the key to sustainable development. In practice, sustainable value creation is linked to resource productivity and societal values relevant to sustainable development (www.kanuunetu.fi). GPI measures sustainable welfare creation at the macro level and is therefore well fits the purposes of FRESH. The effects of green technology can be seen in improved GPI figures in many ways as improved quality of life for the inhabitants on many ways and harmful effects to the environment can be reduced.

GPI looks at the well-being from the consumer's point of view. Personal consumption expenditure figures are a valid starting point for the GPI calculation since we are ultimately interested in the welfare associated with consumption rather than the monetary value of production (GDP). GPI is first adjusted with income distribution, then certain others factors are added (such as the value of household work and higher education), and other subtracted (such as the costs of crime and pollution). Because the GDP and the GPI are both measured in monetary terms, they can be compared on the same scale. With sub-national level GPI study one can obtain information about the locally most important sustainability and welfare issues. If GPI shows positive development it can be suggested that the development has been achieved in a rather sustainable way, so that the future prospects are not endangered.

The data compilation for sub-national level GPIs for Kainuu, Päijät-Häme and area of Centre for Economic Development, Transport and the Environment for South Ostrobothnia (CEDESO) was started at Statistics Finland (Tilastokeskus) in June 2010 by research trainee Ms. Hannakaisa Andersson. Within summer trainee period only preliminary data compilations and calculations were carried out. The challenges faced in the process included the lack of data and difficulties due to changes in the provinces' administrative boarders. This is especially the case for the last area, hereafter called "Area of CEDESO" (CEDESO may appear somewhere in this report as "EP-ELY", Etelä-Pohjanmaa ELY Center, Finnish for South Ostrobothnia). The Finnish GPI time series compiled by Hanna Rättö in 2008 and ISEW-study by Jukka Hoffrén in 2001 formed the basis for this study. The Finnish GPI time series cover the years 1945-2009, while this study only concentrates on period after 1960. The data for the Finnish GPI has been updated alongside with the regional GPIs to make the data consistent and comparable. The changes made to the Finnish GPI do not cause any major changes and the perceived trend remains the same.

This work will provide an outlook of regional developments and progresses in Päijät-Häme and Kainuu. The results will be compared with the national GPI-calculation by Hanna Rättö and the preliminary local results for Etelä-Pohjanmaa ELY-region. The research questions to be answered are:

1. How has the sustainable economic welfare evolved in these areas in comparison with the development of the traditional measures such as GDP?
2. How does the regional progress differ from the national?
3. What differences do the GPI-calculations point out between regions and what are the critical sustainability issues and potentials for each region?
4. What are the benefits and drawbacks of sub-national GPI-measure for regional policymaking at national and EU-level?
5. Is there need to develop GPI to meet regional needs in Europe? What possibilities for development do the existing data allow?

Chapter 2 gives a short presentation about the work done in the field of alternative measures of well-being including the Genuine Progress Indicator. Chapter 3 represents the results, first by giving an overview of all areas and then by taking closer looks at Päijät-Häme and Kainuu. In Chapter 4 I draw some conclusions about the GPI indicator itself, its feasibility and critiques.

2. Composite Indicators and the History of Measuring Sustainability and Well-Being

2.1 History and Development of Well-Being Measures

Current economic and political systems still foster economic growth as a path to happiness and the Gross Domestic Product (GDP) remains the most important measure of societal planning and decision-making. Economists have for long recognized that the GDP is misleading as an indicator of the welfare of a nation, let alone as a measure of people's well-being, although the makers of economic policy commonly think to the contrary. Several studies show that economic growth no more increases the happiness of the people in industrialized countries (e.g. see Kahneman et. al 2003). The problem with using GDP as a measure of well-being of a society became apparent in practical economic policies in most industrialized countries in the early 1970s and launched the development of improved welfare indicators trying to overcome the problems of the GDP measure. However, advancements in the area have been limited and they have not yet gained the general acceptance of the GDP measure. (Hoffrén et al. 2010; Hoffrén & Rättö 2010.)

The "policy of sustainable development" was first introduced in 1987 to provide concrete answers to the problems caused by the extensive economic growth. In the UN's Rio de Janeiro Conference the Sustainable Development (SD) was adopted as the foundation of environmental policies (Brundtland et al. 1987). The three dimensions of the SD, economic, social and environmental, were seen as equally important components. After the political consensus on SD, the monitoring of SD policies proved as a major challenge since there are no obvious measures available. Combining of the three dimensions of SD to a single indicator proved a major challenge. Consequently several proposals about indicators that measure SD have been made.

The most famous examples of the attempts to develop improver welfare indicators are the MEW (*Measure of Economic Welfare)* measure developed by Nordhaus and Tobin in 1973, the Japanese NNW (*Net National Welfare*) indicator developed by Uno in 1973, the ISEW (*Index of Sustainable Economic Welfare*) indicator of Daly and Cobb in 1989, its later derivative GPI (*Genuine Progress Indicator*), and the UN's HDI (*Human Development Index*) in 1990. All except the HDI use as a starting point the System of National Accounts (SNA) and include the non-marketed commodities in an aggregated macro indicator in monetary terms as the neoclassical economic theory demands. HDI on the other hand is an index valued from 0 to 100, and thus not in monetary terms. HDI depicts the potentials of the developing countries to develop in the future. Later the UNDP has applied the HDI also to industrialized countries. The HDI's major components are life expectancy at birth, adult literacy rate, combined enrolment ratio and purchasing power parity adjusted income per capita in US dollars. The HDI also suffers from the exclusion of environmental dimensions in it, although in principle this shortcoming could be redressed.

World Bank's *Genuine Savings* (GS) looks at the sustainability from the resources point of view, and aims at estimating nation's net investments to man-made, human and ecological capital in monetary terms. So called pure ecological indicators measure only environmental aspects of sustainability. For example *Ecological Footprint* (EF) aims at estimating the quantities of biosphere available to mankind in physical measures and has no linkages to economic values. Purely ecological indicators have the advantage of taking the carrying capacity of biosphere into account. Their problem however is that pure quantity measures turn poorly to the languages of economic and social systems. These indicators are also often heavily determined by the size of population. (Hoffrén et al. 2010; Hoffrén & Rättö 2010.)

All three dimensions of sustainable development are included in the Index of Sustainable Economic Welfare (ISEW), but they are too partial and insufficiently quantified and valued to be convincing. The Genuine Progress Indicator (GPI) developed after ISEW tries to correct these deficiencies by weighting sufficiently the natural resources consumed and environmental hazards caused by human activities. Therefore ISEW and GPI give a better picture of people's actual well-being. However, they require the "correct" pricing of environmental hazards in order to function properly. An American organization Redefining Progress first introduced GPI as an alternative to GDP in U.S. in 1995, and has since updated and developed the indicator. The Genuine Progress Indicator (GPI) is a further derivative of ISEW. (Hoffrén & Rättö 2010.)

2.3 The Genuine Progress Indicator

Herman Daly and John Cobb developed Genuine Progress Indicator, GPI in year 1995 from the Index of Sustainable Economic Welfare, ISEW. The Genuine Progress Indicator (GPI) measures sustainable economic well-being and was developed to address some of the major short-comings of the traditional Gross Domestic Product (GDP). Talberth, Cobb and Slattery (2006) published the methodology followed here within an American organisation called *Redefining Progress*. GPI is designed to measure such economic welfare that can be sustained over time and it can be applied both on national and sub-national level. GPI evaluates the performance of a country or area by taking into account more than just the sheer volume of market transactions. While GDP counts all economic activities as positive, GPI adds the value of benefits such as housework and volunteer work and makes deductions for such things as declining environmental quality, disadvantages of urbanization and increasing income inequity. While GPD treats the cost of the negative effects related to economic activity as additions to well-being, the GPI accounts take them as costs, as it is the money people spend just to prevent erosion in their quality of life or to compensate for misfortunes of various kinds. Examples are the medical and repair bills from automobile accidents, commuting costs, and household expenditures on pollution control devices such as water filters. The GPI counts such "defensive" expenditures as most people do: as costs rather than as benefits. The indicator is especially useful in looking at trends in long-term. As a monetary-valued indicator it can link the environmental and sustainability issues as a part of economic well-being and is helpful in monitoring different trade-offs.

The developers of GPI, Daly and Cobb (1989), stated that the entire GNP cannot be consumed without eventual impoverishment, so in order to find out the economy's true "income" (*Hicksian income*), the depreciation of capital must be subtracted to get the net national product (NNP). However, even the original NNP cannot be consumed without impoverishment, as the production of the NNP at the present scale requires ecologically unsustainable environmental extractions and insertions. Therefore NNP overestimates the net product available for consumption for example by counting the defensive expenditure required against the unwanted side-effects of production as a final product. GPI can be considered as a "green GDP" type of accounting framework.

The GPI considers households as the basic building block of a nation's welfare, and thus begins its accounting exercise with personal consumption expenditures. To this the GPI adds benefits associated with welfare enhancing activities such as parenting, housework, volunteering and higher education as well as the services which flow from household capital and public infrastructure. The GPI then deducts costs associated with pollution, loss of leisure time, car accidents, destruction or degradation of natural capital, international debt and resource depletion. The end result is an index that attempts to measure our collective welfare in terms of principles of sustainable development drawn from the economic, social, and environmental domains. The GPI does not account for the perceived well-being and subjective feelings of happiness are not included. The index rather focuses of the preconditions the individuals have in pursue of happiness.

Cobb and Daly express the GPI index of using the equation

$$GPI = C_{adj.} + B - F - H + I,$$

where $C_{adj.}$ is consumer expenditure adjusted to account for income distribution, B stands for non-market production and benefits, F private costs and defensive expenditures, H costs of environmental degradation and depreciation of natural capital and I the growth in capital and net change in international position. A rising path of the GPI over time will indicate that an economy is becoming more sustainable. A falling path will indicate the opposite. (Rättö 2008; Talberth et al. 2006; Hoffrén & Rättö 2010.)

In this report the components of GPI are divided into four sub-groups following the division by Rättö (2008). The groups include the following components:

1) Private consumption expenditure adjusted to account for income distribution.

2) Non-market production and benefits: The value of household work and parenting, value of higher education, value of volunteer work and the service flow from consumer durables and public infrastructure (highways and roads).

3) Private costs and defensive expenditures: Costs due to automobile accidents, cost of crime, commuting costs, value of lost leisure time and cost of underemployment. The cost of consumer durables is also deducted in group 3.

4) Costs of environmental degradation and depreciation of natural capital: Cost of water pollution, air pollution and noise pollution, loss of wetlands, loss or increase of forest area and damage from logging roads, depletion of nonrenewable energy resources and carbon dioxide emissions damage.

In Table 1 GPI in broken down into components and denoted by the corresponding letter. Each component is a separate column in the calculation database. Appendix 1 describes the methodology in detail.

Table 1: GPI components (+/-)

Component	Column
Personal consumption weighted by income distribution index	D
+ Value of household work and parenting	E
+ Value of higher education	F
+ Value of volunteer work	G
+ Services of consumer durables	H
+ Services of highways and streets	I
- Cost of crime	J
- Loss of leisure time	K
- Cost of unemployment	L
- Cost of consumer durables	M
- Cost of commuting	N
- Cost of household pollution abatement	O
- Cost of automobile accidents	P
- Cost of water pollution	Q
- Cost of air pollution	R
- Cost of noise pollution	S
- Loss of wetlands	T
- Loss of farmland	U
-/+ Loss of forest area and damage from logging roads	V
- Depletion of nonrenewable energy resources	W
- Carbon dioxide emissions damage	X
- Cost of ozone depletion	Y
+/- Net capital investment	Z
+/- Net foreign borrowing	AA
= GPI	

The progresses of the Finnish Gross Domestic Product (GDP), Index of Sustainable Economic Development (ISEW) and Genuine Progress Indicators (GPI) at real prices of year 2000 are depicted in Figure1. The Finnish GDP grew quite steadily from 1945 till 1990. The growth of GDP from 1945 depicts the continuous transformation of Finnish economy from closed market society to open market economy. There is only one exception to this trend, the economic recession of the early 1990's that hit Finland with force. Due to this economic recession, the GDP turned down and descended till 1993. During the recession unemployment rose sharply, bankruptcies became a common issue, foreign trade shrunk and general economic development weakened. Upward turn begun in 1994 and since then GDP has been on continuous growth path. After the recession, the growth of GDP has been rapid, and the 1990 level was reached in 1997. There was a period of slower growth between 2000 and 2003, after which that the Finnish GDP has been growing forcefully till autumn 2008 when global financial crisis begun to create much doubt about the direction of economic development. Overall GDP gives very positive picture of the Finnish development, without any disturbing signs about global warming, growing environmental burden of economic activities, over exploitation of natural resources or imbalance of income distribution. (Hoffrén & Rättö 2010.)

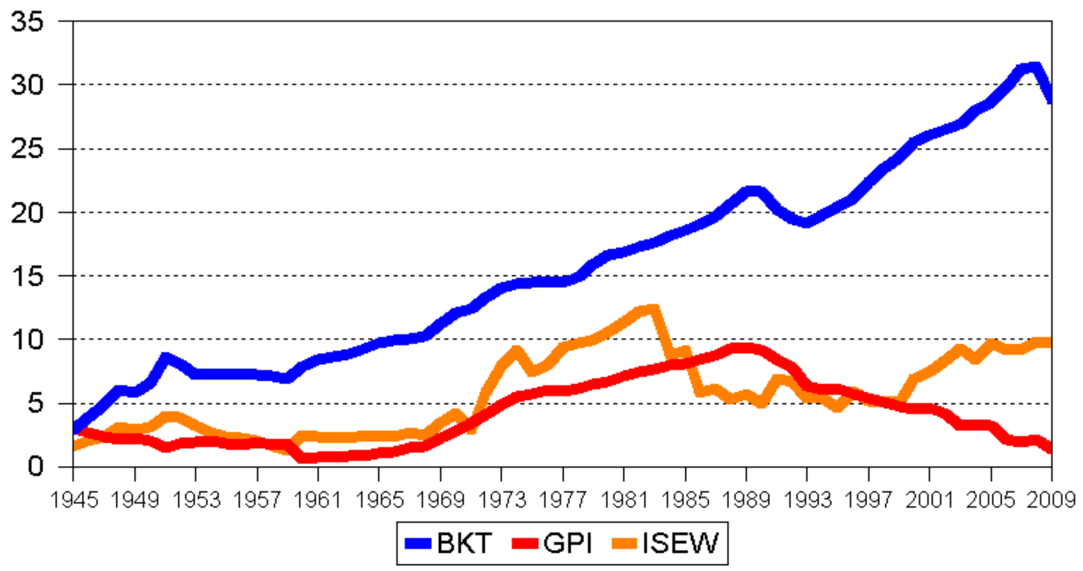


Figure 1: The development of GDP, ISEW and GPI in Finland 1945-2009 per capita, real prices 2000. Source: Hoffrén 2001, 2010 and Rättö 2008

The time series of the Finnish ISEW from 1960 to 2000 were first presented in 2001 by Jukka Hoffrén (2001). Later the time series has been updated, converted to Euros and continued till 2009 (update by Hoffrén, 2010). The Finnish GPI was calculated in 2008 by Hanna Rättö using the methodology developed by Talberth et al. (2006). Only a few changes to this methodology were made. The variables Cost of household pollution abatement and Cost of ozone depletion were left out due to lack of data. Also, instead of Value of volunteer work, value of participatory and organisational activities was included in Finnish GPI, and instead of Cost of underemployment, cost of unemployment was calculated. It can be also assumed that the lack of data is at least partly due to insignificance of the U.S. variable to the Finnish society, and that the included factors describe Finland better (see Rättö 2008).

The ISEW- and GPI-measures give quite a different view of the state of the economy than GDP (Figure 1). The largest differences between the two measures, GPI and ISEW, are related to the artificial pricing of environmentally harmful impacts and the treatment of some social factors. GPI evaluates many environmental impacts, especially the ones with long-term effects, higher than ISEW. The income index used in ISEW is on the other hand more receptive to changes in income distribution, which makes ISEW to react faster to changes in income differences. ISEW also accounts for some public expenditures that are absent in GPI. In Figure 1 both ISEW and GPI rose steadily in the 1970s and early 1980s, but have since then declined and stabilised. In case of Finland one of the main reasons for this development is the income distribution which apportioned the welfare derived from increased production. In the mid- 1980s income disparities started to grow again, flows of capital (investments) abroad increased and environmental hazards escalated, resulting in a decline in weighted personal consumption, on which the ISEW and GPI are actually based. Table 2 illustrates the major components of the Finnish ISEW and GPI in numerical values. The concept the "weighted personal consumption" concept used in GPI differs from that used in the ISEW, since the income distribution index used to weight personal consumption is constructed differently in the two indices. (Hoffrén & Rättö 2010.)

	ISEW	GPI
Weighted personal consumption	96.6	59.4
Household work	15.6	34.1
Other positive contributions	9.1	16.2
Other negative contributions	- 20.9	- 21.5
Environmental damage	- 66.4	- 69.6
Total	33.8	18.6

Table 2: The major components of the Finnish ISEW and GPI (Hoffrén & Rättö 2010).

It can be concluded that neither ISEW nor GPI is a pure indicator of sustainable development, even though they both try to take into account the sustainability of the welfare generation of an economy. From the compositions of ISEW and GPI it can also be concluded that GPI is more congruent with the ecological viewpoint of sustainable development while the perspective of ISEW is more related to the social point of view of sustainable development.

Several studies using GPI have been carried out internationally. GPI has been applied for example for United States, Australia, France, Austria, Canada, Chile, Italy, Holland, Scotland, England and Finland. The conclusions drawn from the studies have been quite unified: the growth paths of GDP and GPI usually part around 1980s or 1990s. In addition to the national studies, many regional councils and central government agencies have lately shown interest towards the Genuine Progress Indicator as a way of monitoring a range of economic, environmental and social indicators. Several sub-national applications following the GPI-methodology have already been carried out for example in the United States, Canada, Australia and China (see Appendix 2). An American organization Center for Sustainable Development (CSD) has recently launched a "Program on Genuine Progress Accounts for the European Union" as a response to the EU's Beyond GDP. CSE is now planning to gather non-governmental organizations and academic institutions to implement a comprehensive Program on Genuine Progress Accounts (PGPA). PGPA would include national and sub-national GPI accounts, application of the GPI in policy debates, non-market studies to improve GPI accounts over time, and a popularization campaign that includes an on-line MyGPI calculator (CSE web pages).

It's important to keep in mind that these applications do differ in methodology to some extent: some include different components in GPI, some use different valuations for the items. Therefore the different studies are not fully comparable. GPI in this project is composed using the U.S. methodology created by Talberth et al. (2006) and is therefore comparable with the U.S GPI and the Finnish GPI calculated by Rättö in 2008.

3. Results

3.1 Main Features of the Regions

Genuine Progress Indicator (GPI) time series has been compiled for three Finnish regions: Päijät-Häme, Kainuu and the area of the Centre for Economic Development, Transport and the Environment for South Ostrobothnia (CEDESO). This last region is hereafter called "area of CEDESO", although in the pictures it appears as EP-ELY (for Etelä-Pohjanmaa, Finnish for South Ostrobothnia). Päijät-Häme is a part of Häme Centre for Economic Development, Transport and the Environment (ELY) -region and Kainuu has its own ELY -center. The administrative borders of today's centers for Economic Development, Transport and the Environment have shifted during the timescale 1960 – 2009 which made the data acquisition somewhat more difficult. This is the case especially the area of CEDESO.

Kainuu is a large, sparsely populated area in north of central Finland. The population of 83 000 and area of 26 212 km^2 (2009). Päijät-Häme is located in southern Finland and is the smallest of the areas with 5 126 km^2 and 201 000 inhabitants (2009). Etelä-Pohjanmaa ELY –region consist of three different counties Ostrobothnia, South Ostrobothnia and Central Ostrobothnia has 26 212 km^2 and population of 439 000 (2009).

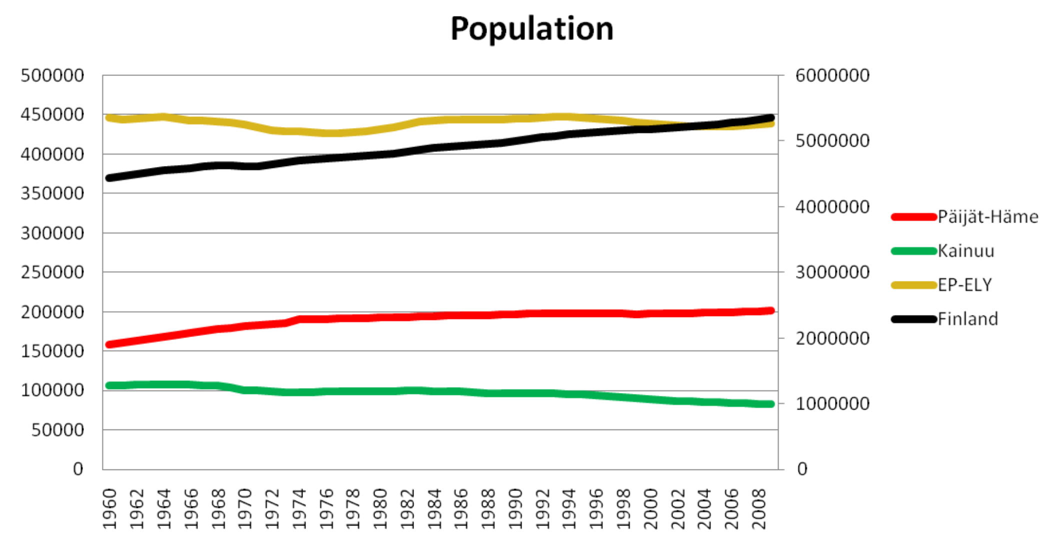
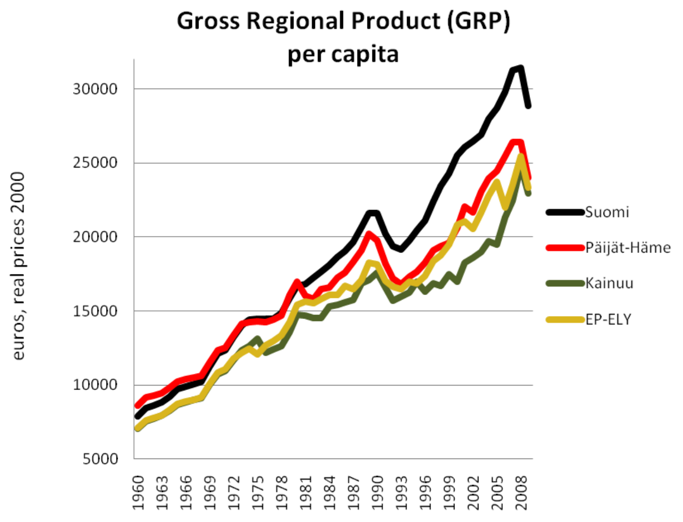


Figure 2: Population in Finland and in the three regions.

The economy of Päijät-Häme accounts for 2,9 per cent the Finnish GDP. Nevertheless in year 1960, the Gross Regional Product (GRP) of Päijät-Häme was 4,2 % of the Finnish GDP. Thus the economic importance of Päijät-Häme has reduced but the economic well-being of its inhabitant has not. In 1960 GRP of Kainuu was 2,9 % of the Finnish GDP, when in 2009 it is only 1,2 %. For the area of CEDESO the corresponding percentages are 9,0 (1960) and 6,7 (2009). This suggests that GDP production is everyday more centered in Helsinki metropolitan area and few other growth zones.



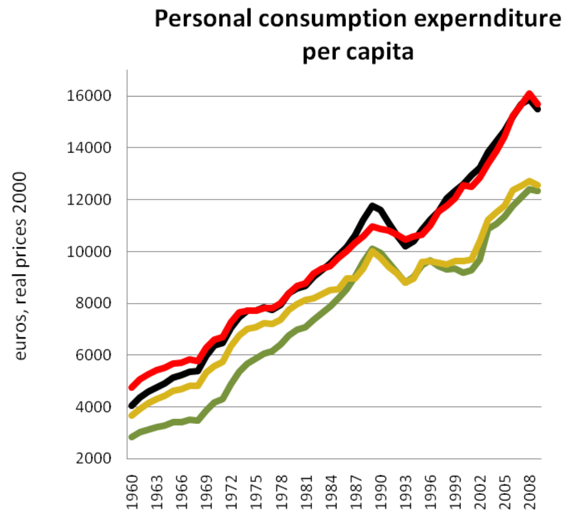


Figure 3: Gross Regional Product (GRP) and private consumption expenditures in the areas per capita. Source: Statistics Finland.

In Figure 3 the Gross Regional Product (GRP) and private consumption expenditures are presented in real prices of year 2000. The recession of 1990s can easily be pointed out in the graphs. The black graph represents the Finnish average. The influence of Helsinki, the metropolitan area in general and other cities like Tampere and Turku can be noticed, as the average Finnish GDP exceeds the GRP of every region. The consumption figures (graph on the right) are nevertheless more even. Here Päijät-Häme tops Kainuu and the area of CEDESO.

3.2 An Overview of the Results and Some Comparisons

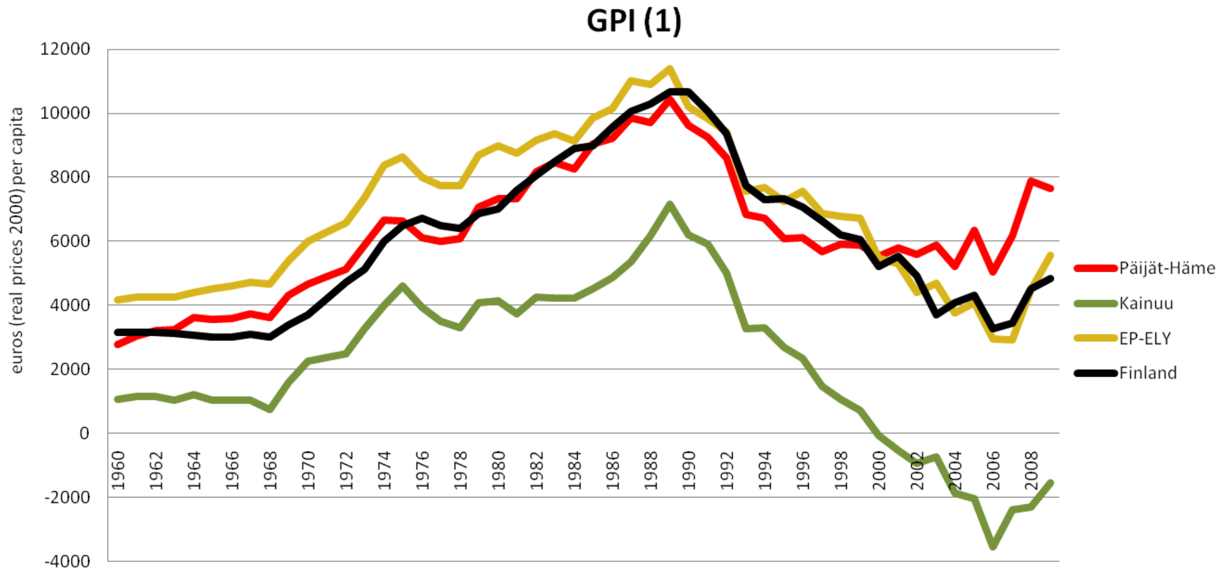


Figure 4: GPI calculated using Talberth (2006) methodology. GPI(1) includes all 23 components that were used in Finnish GPI study (Rättö 2008).

Figure 4 gives the overall result of the study when the methodology of Talberth et al. (2006) is followed. The black graph is the Finnish GPI, which can be interpreted as average of all areas. Year 1989 was the peak year in all graphs, after which a substantial decline can be noticed. When compared with other regions, Päijät-Häme has been showing steady and even upward development since 1995 as other regions continued the downward path until the year 2006. Since 2006 the development in each area seems positive once again. The most notable difference in Figure 4 is the location of Kainuu's graph as it lies well below the other graphs. This is due to the fact that the methodology Talberth et al. (2006) created gives a huge value to the cost for the loss of wetlands. As Kainuu, Päijät-Häme and the area of CEDESO all differ in geographical location and vegetation (this can be called "the natural resource endowments"), it can be considered somewhat unfair to compare these areas using the GPI(1). Swamps take some 40 % of Kainuu's land area and more than 70 % of the swamps were drained for agriculture and forestry in the 20th century. As Kainuu is geographically large and has relatively small population, this one component creates this major gap between the graphs in

Figure 4. It is also likely that the price per hectare of wetland used in the American study does not aptly describe the situation in a country like Finland. There was no similar study conducted specially for Finnish nature and the U.S. pricing per hectare had to be used.

As the GPI-components that are related to vegetation (loss of wetlands, Column T, and growth in forest area, Column V) get such a big significance in the Finnish sub-national study, the results are represented in this study also without these components. I call this the GPI(2). GPI(2) that consists of the rest 21 components and is presented below (Figure 5).

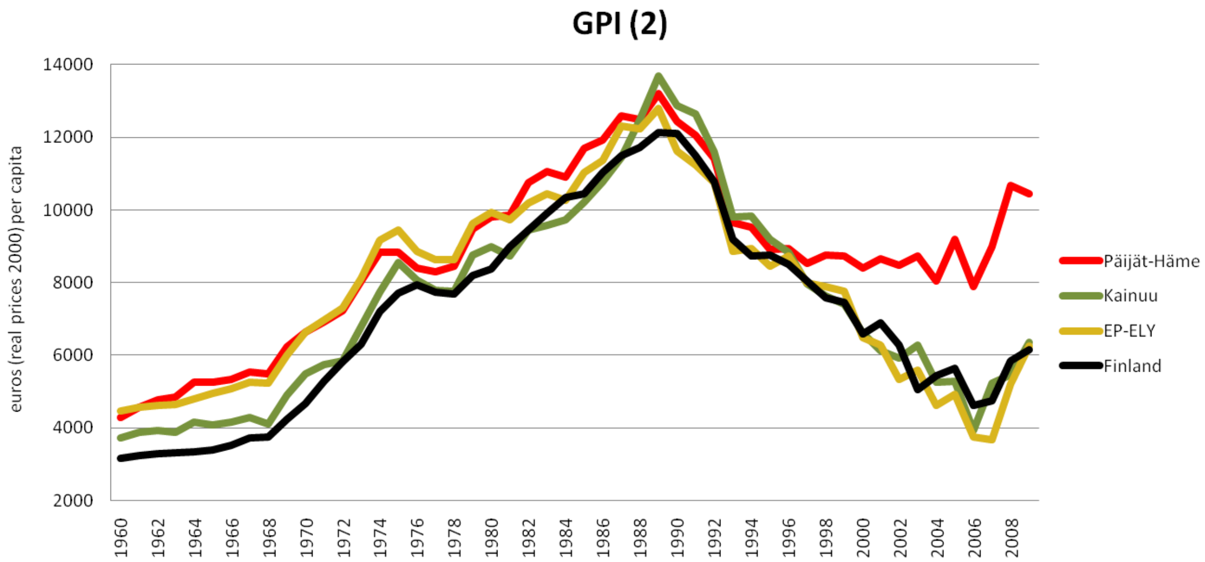


Figure 5: GPI when two components (drainage of wetlands and growth in forest area) are omitted.

By looking at Figure 5 one can conclude that despite the quite different compositions of the each sub-national GPI, the summed graphs for each area seems rather similar. Only Päijät-Häme stands out with a development that turned steady around year 1995 and looks quite positive since 2006. Thus when the biggest components reporting "the resource endowments" of each area are omitted, the trend for Kainuu and for the area of CEDESO seems very alike with the Finnish GPI, which is quite a coincidence. The characteristic of each regional GPI composition will be discussed in Chapters 3.3.

The largest plus signed components of the GPI (generally in this report "GPI" means the model constructed by Talberth et al. and comprises all 23 components) in each region are the personal consumption expenditures, non-market value of household work and growth in the forest area. The largest components to be subtracted are the loss of wetlands, the carbon dioxide emissions damage, depletion of nonrenewable energy resources and cost of unemployment.

All four graphs of GPI per capita (Figures 4 and 5) reach the top in 1989, right before the economic recession of the 1990s. One of the important factors contributing to the general slow recovery of the Finnish GPI to the level attained in 1989 is the growing economic inequality in the society. After the early 1990s the income inequality has been growing in Finland, which reduces the value of weighted personal consumption in GPI. Even more significant are the increasing costs of environmental degradation, which includes the values of both long-term and short-term environmental damage. Especially from 1990 onward the value of environmental degradation has been growing fast, mainly due to the cumulative impacts of several harmful factors. Since for example carbon dioxide stays in the atmosphere for many years, the impact of the gas is not restricted to the year it is emitted. Accumulating effects have an impact for several years, which is taken into account in the GPI by Talberth et al. (2006).

	Decline in GPI(2) from 1989 to 1995	Decline in GPI(2) from 1989 to 2008
Päijät-Häme	33 %	19 %
Kainuu	33 %	60 %
EP-ELY	34 %	59 %
Finland	28 %	52 %

Table 3: Percentage changes in GPI(2) from the peak year of 1989.

The percentage changes in GPI(2) (loss of wetlands and changes in forest area columns omitted) are presented in Table 3. The decline between 1989 and 1995 was very similar in all areas. The reason for this was the economic recession, increase in income inequality and unemployment, as well as the cumulating environmental damages. But when reaching year 2008, the changes in the GPI are quite different: Päijät-Häme is no longer more than 19 per cent behind the peak year of 1989, while Kainuu, the area of CEDESO and Finland in average show decline of 52–60 %. The positive development in Päijät-Häme since 2000 is due to several factors: the drainage of wetlands has been quit, emissions to water and air have been cut down and employment has recovered after the 1990s. The new economic downswing that started in 2008 has increased the unemployment once again, but it has cut down the emissions even to larger extent. What is bad for the economy and material standard of living is often good for the environment.

In this report the components of the GPI are divided into four groups following the division created by Rättö (2008). Next the different sub-groups are analyzed separately and some comparisons are made between the regions.

1) Personal Consumption and the Distribution of Economic Welfare

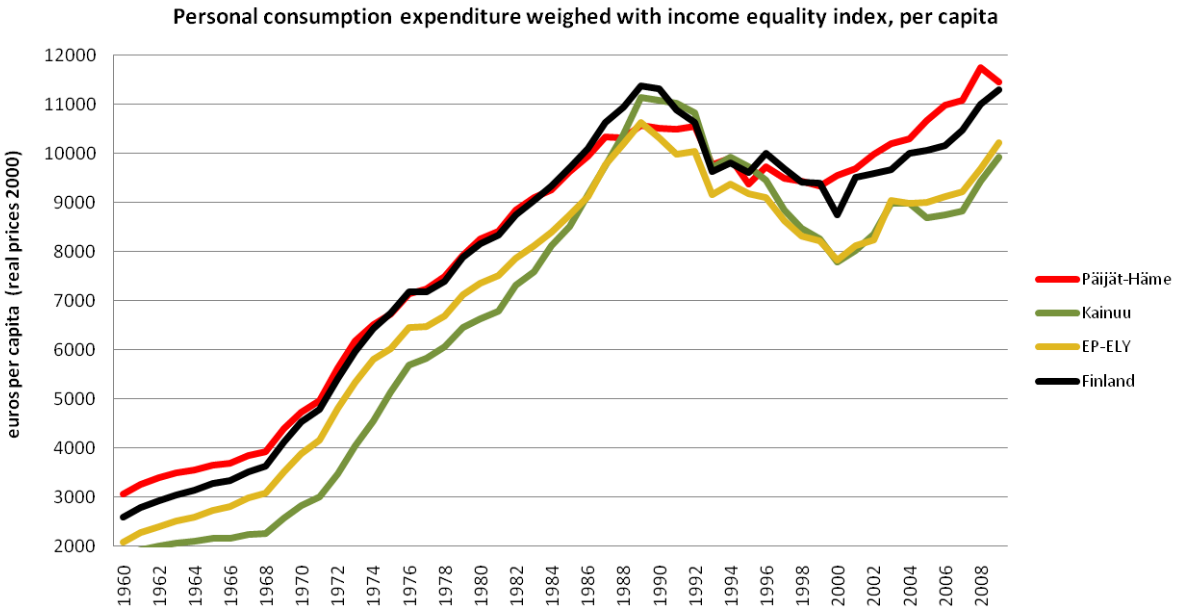


Figure 6: Source Statistics Finland

Group 1 combines personal consumption expenditures with Gini index so that more equal income distribution produces higher figure. This number then works as a basis for all the additions and subtractions. The Gini coefficient is a measure of the inequality of a distribution, value 0 expressing total equality and value 100 maximal inequality. The wealth and income differences among the Finnish population started to increase in 1995 and have been growing ever since (Figure 7). The increases in Gini-coefficient within the regions have followed the same development (Loikkanen et al. 2007). The Gini coefficient is the lowest in Kainuu and in the area of CEDESO (26 in 2005), and somewhat higher in Päijät-Häme (27). The Finnish average was 29 in year 2005 (Statistics Finland.)

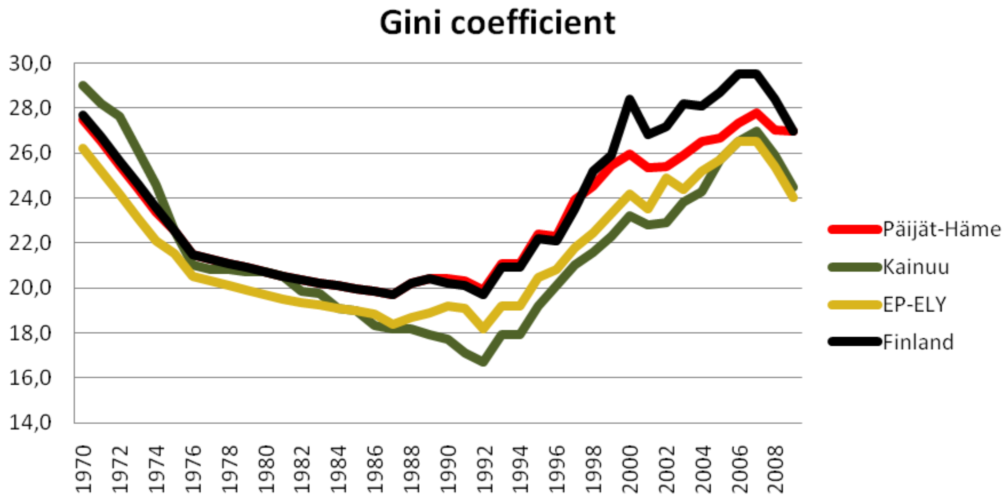


Figure 7: Gini coefficient measured from individuals' disposable income. Higher value means that income inequality is greater. Source: Statistics Finland. There was no data available before year 1965.

2) The Value of Non-Market Economic Activity and Benefits

Group 2 includes the following components: the value of household work and parenting, value of higher education, value of volunteer work and the service flow from consumer durables and public infrastructure (highways and roads).

Sub-national data was poorly available for the components of group 2 and thus several approximations had to be made. This is mainly due to the fact that time use survey taken by Statistics Finland is carried out only on national level. Therefore no big differences can be seen in Figure 8 (diagram of left). Nevertheless there is good data available on population's education level and the value of higher education is also presented in Figure 8 (diagram on right). The level of education is the highest in the area of CEDESO (South Ostrobothnia) where 38 % of working population (individuals aged 15-74 years) has a degree from an institution of higher education. In Finland the average is 31 %, in Päijät-Häme 26 % and Kainuu 20 %. Using the GPI methodology the value of higher education in Euros per capita was calculated to 1 670 Euros in Päijät-Häme, 1 480 in Kainuu and 2 470 in the area of CEDESO in year 2009.

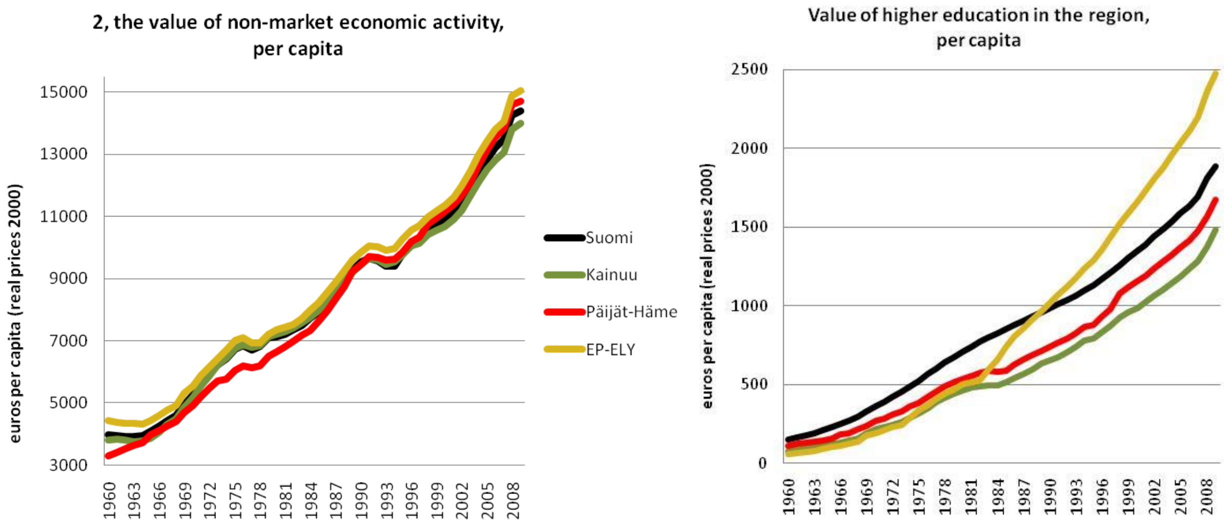


Figure 8: The components of group 2, the value of non-market economic activity (on left) and the social value of higher education (on right) Euros per capita.

3) Private Cost of the Negative Effects Related to Economic Activity

Sub-group 3 makes adjustments for different negative aspects of urbanization and economic activity. These comprise of costs from automobile accidents, cost of crime, commuting costs, value of lost leisure time and cost of underemployment. Some of these components can be called "defensive expenditure", that are in fact are rather costs than benefits, and should therefore be subtracted from the consumption expenditures that are in general all considered to be positive contributions to welfare. The cost of consumer durables is also deducted in group 3.

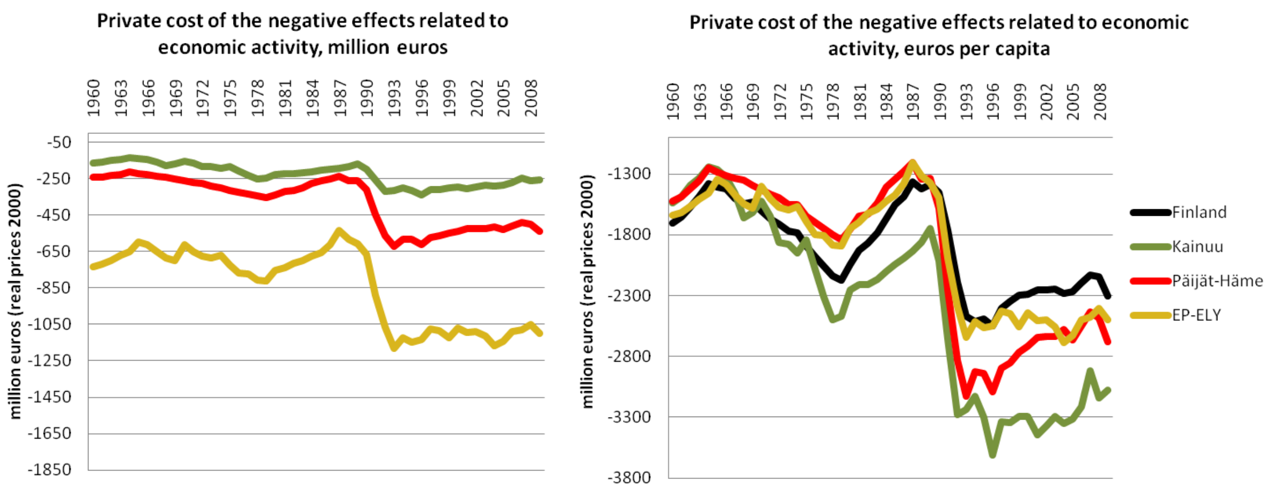


Figure 9: GPI components of group 3.

Figure 9 presents the components listed above as a summed graph. The diagram on the left shows the magnitude of these effects in each region in million Euros and the diagram on the right presents these costs divided by the population (i.e. per capita). The trend in each region has been the same, but the magnitudes are somewhat different. The area of CEDESO is doing best in this category on per capita basis, Päijät-Häme following close behind. In the area of CEDESO the costs of commuting are low, employment has remained relatively high and crime rate is low. In Päijät-Häme the situation turned worse in the 1990s and 2000s due to increased unemployment, increased cost of commuting and high crime rate. In Kainuu the cost of unemployment is the main reason pulling the graph down.

4) Costs of Environmental Degradation and the Depletion of Natural Resources

Group 4 consist of cost of water pollution, cost of air pollution, cost of noise pollution, loss of wetlands, loss (or increase) in forest area and damage from logging roads, depletion of nonrenewable energy resources and carbon dioxide emissions damage.

The components listed above account for the short- and long-term damages to the environment caused by human activity. If today's economic activity depletes the physical resource base available for tomorrow's, then it is not really creating well-being but rather just borrowing it from the future generations. While GDP counts such borrowing as current income, the GPI accounts for these factor as a cost. The GPI also subtracts the costs of air and water pollution measured by damage to human health, economy and the environment.

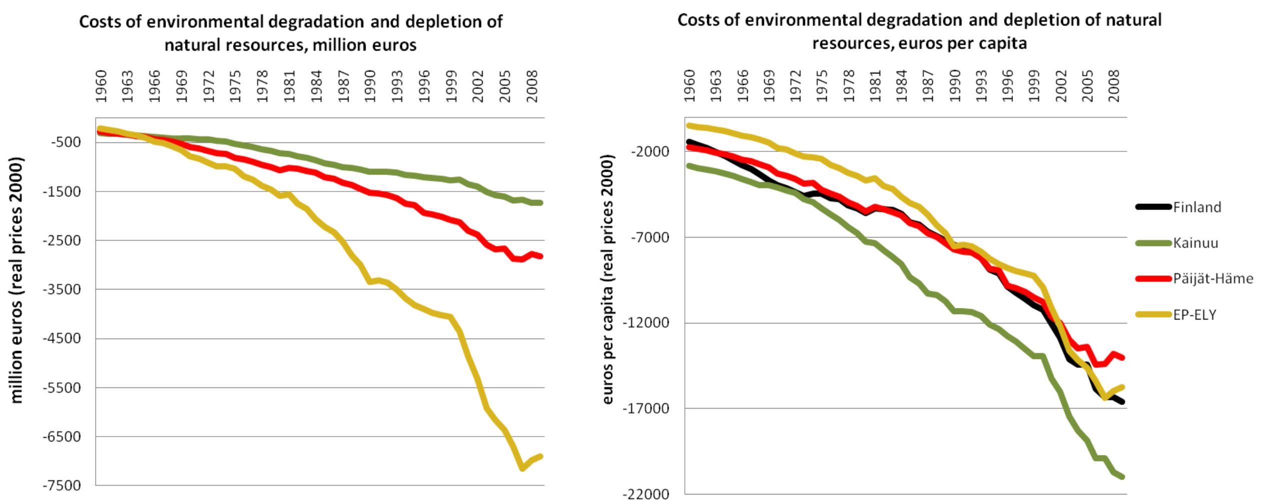


Figure 10: GPI components related to environmental degradation and depletion of natural capital.

All components in sub-group 4 are presented in Figure 10. In Finland the drainage of swamps (-), growth of forest area (+) and carbon dioxide emissions damage (-) are the biggest components. The environmental damage has been accumulating heavily in all areas since 1960s but has fortunately leveled off since 2005. It seems that the effort made for cutting down emissions has finally worked. The magnitude of environmental damage is largest in the area of CEDESO, but when this is put into proportion with population South Ostrobothnia is doing better, although the damage per capita is growing most rapidly. Kainuu is showing the weakest performance here, but this is once again due to the amount of loss of wetland (Column T) in the area. It is amazing how close to the Finnish average these per capita graphs for each area go. In Figure 11 the swamp and forest components are omitted (like in GPI(2)) and one can see how Kainuu now appears more environmentally sustainable. In Figure 11 Kainuu and Päijät-Häme show the greatest degree of environmental sustainability, although the costs are growing dramatically in all areas. Päijät-Häme seems to be doing rather well since 2005.

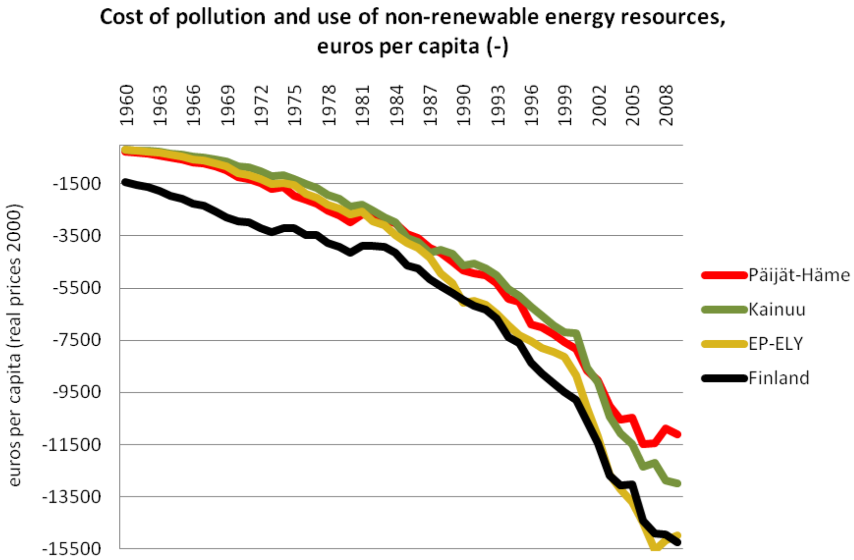
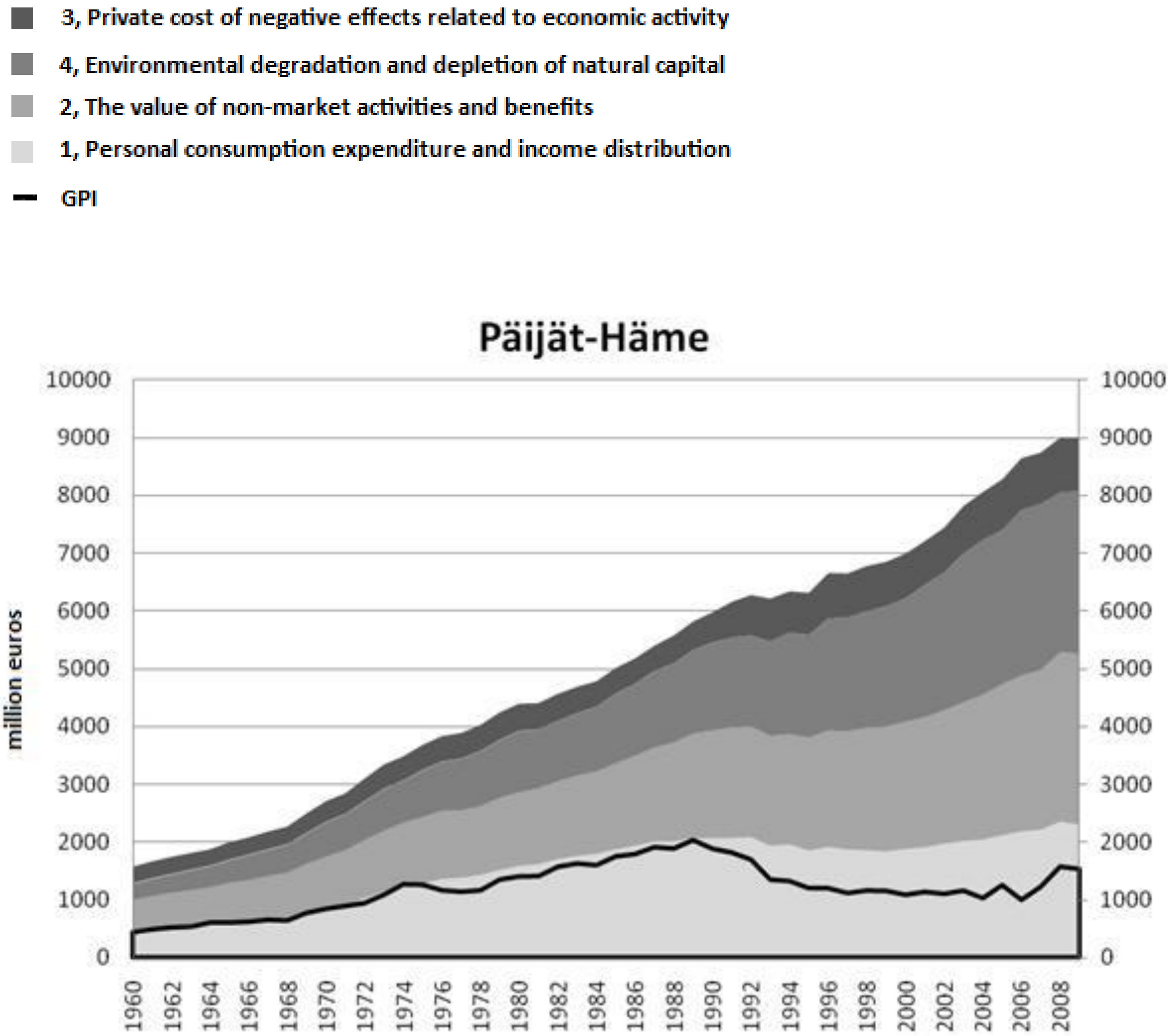


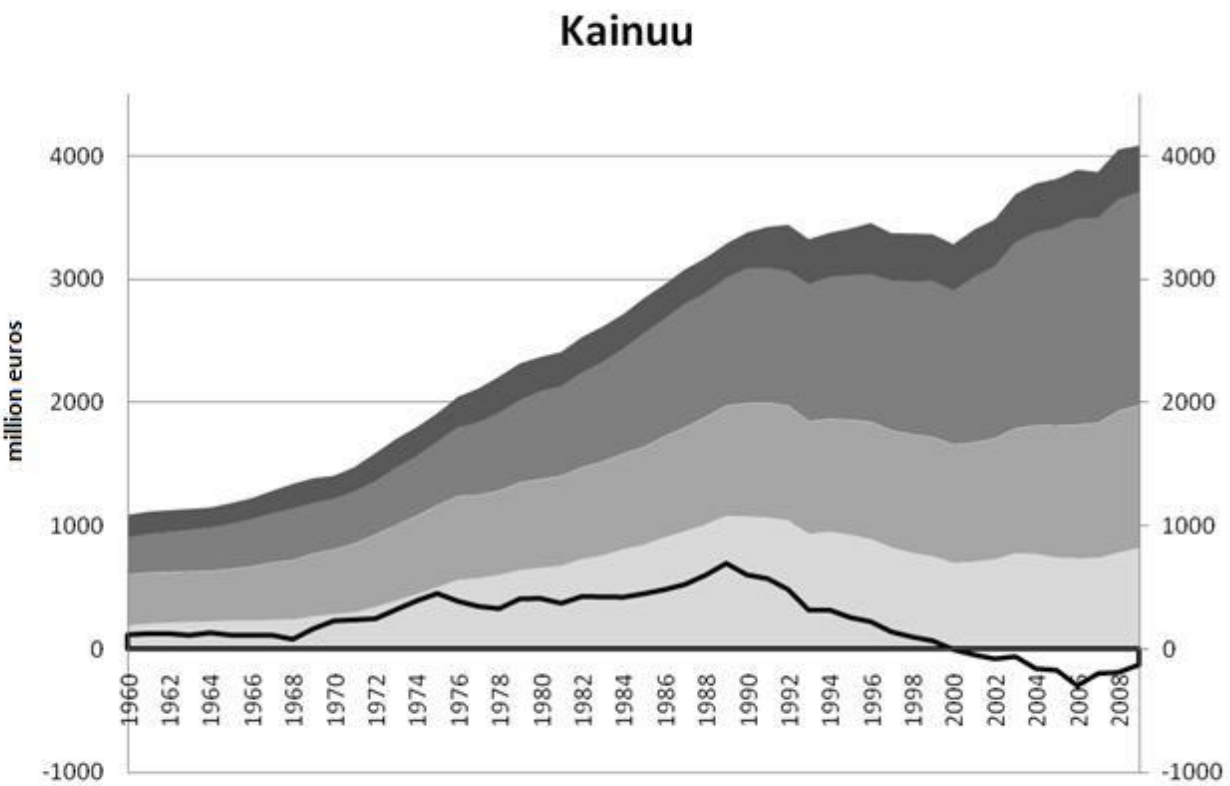
Figure 11: Cost of air pollutants (SO2, NOx, CO2), emissions to water and the use of nonrenewable energy resources, Euros per capita.

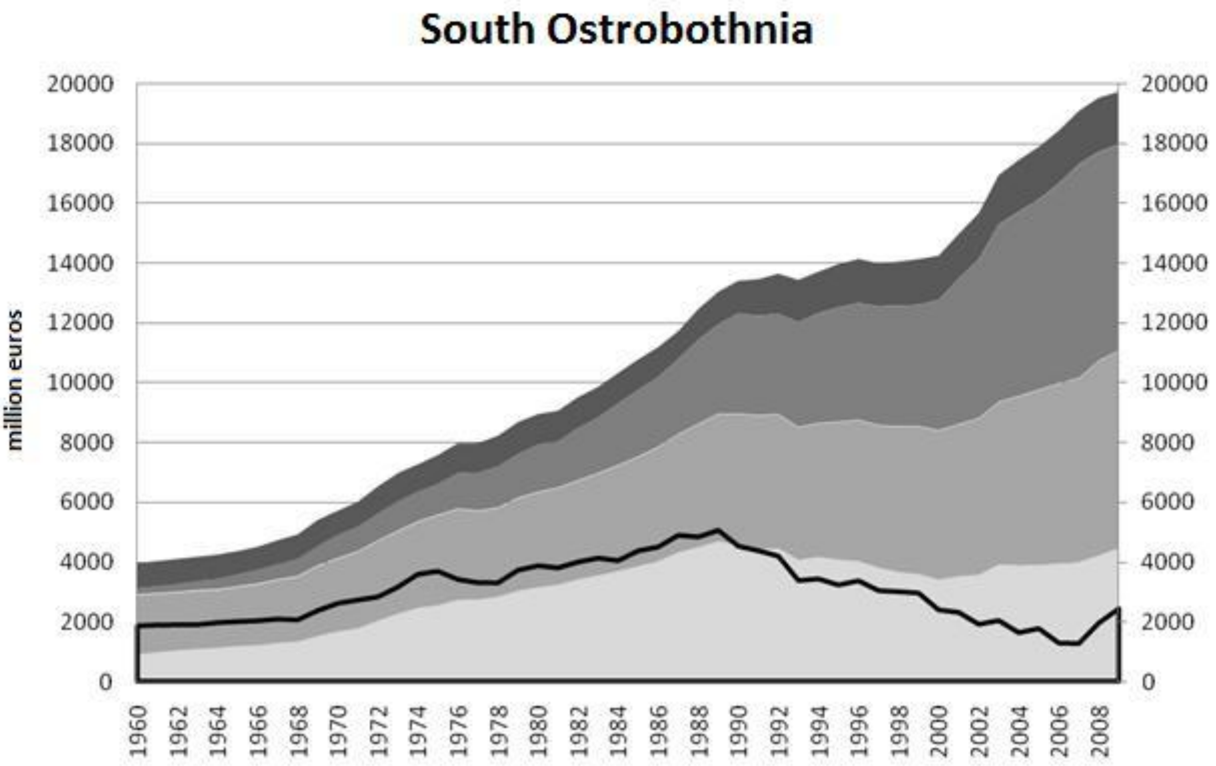
3.3 Results for Each Region

This Chapter analyses each region separately. In order to maintain comparability the results are analyzed using Talberth's (et al. 2006) methodology, i.e. GPI(1) that contains all 23 components.

In the following pictures the sub-groups 1-4 are presented as a summed diagram in order to show the magnitude of each. Both positive and negative components are piled. The GPI graph (summed + and –) is the black curve.



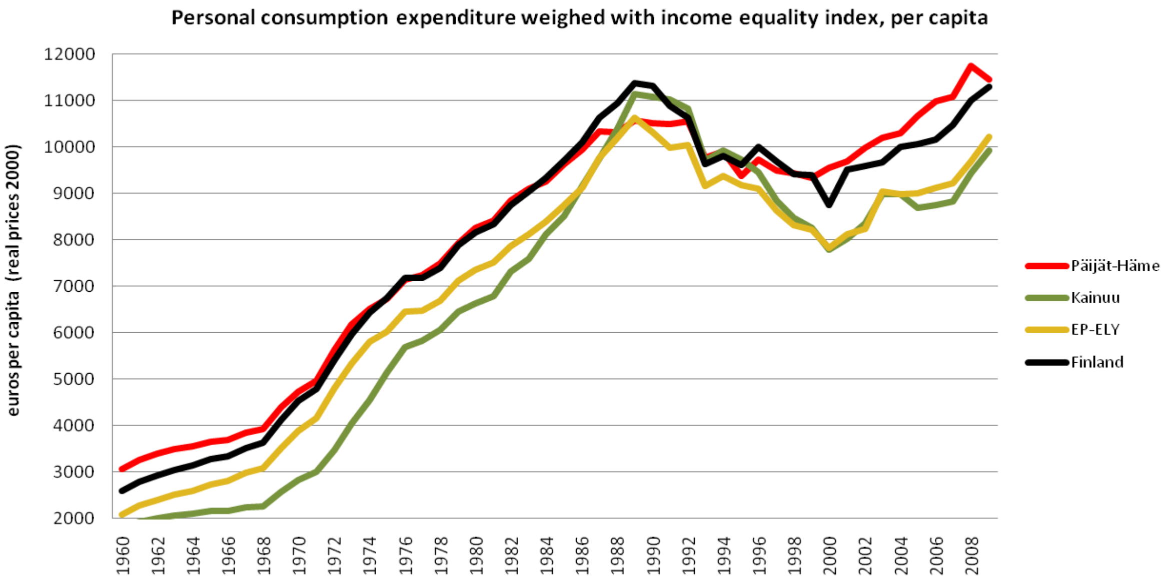

Kainuu
million euros
4000
3000
2000
1000
0
-1000
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2008


South Ostrobothnia
million euros
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008

3.3.1 Päijät-Häme

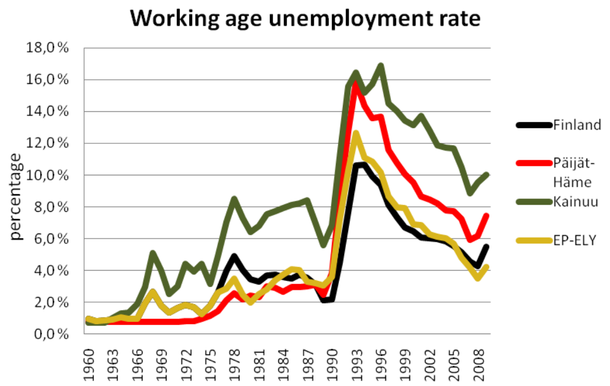
Päijät-Häme consists of 12 municipalities and it is a part of Centre for Economic Development, Transport and the Environment for Häme. Päijät-Häme's area is only 5 126 km^2 which makes it the geographically smallest of the regions in this study. Lahti, Heinola and Hollola are the biggest centers in the area. The population in Päijät-Häme grew rapidly in the 1960s but after 1975 the population declined for several years but started growing again in the 1990s.

In Päijät-Häme the average material well-being has been relatively high and followed the Finnish average closely since 1960. The level of personal consumption expenditure is higher than in any other region in this study. Weighted personal consumption expenditures are presented in the figure below. Also the income equality in the area is close to Finnish average. The Gini coefficient for Päijät-Häme in year 2005 was 27 and Finnish average 29.



The value of the non-market activity such as household work and volunteering has developed steadily during the time 1960-2009 in all areas, but the data gaps have made the regional application difficult. The education level in Päijät-Häme is close to Finnish average yet somewhat behind it. 26 per cent of the working-age population has a degree from an institute of higher education (Finnish average is 31 %). The good thing to notice is that the education differences have narrowed since 1990s and there are nowadays several units of higher education in the area.

When it comes to the defensive expenditures and private costs of urbanization and modernisation, the costs grew dramatically in the beginning of the 1990s but have now leveled off. This drastic change was mainly due to the explosive growth in unemployment (Figure 12). In Päijät-Häme the unemployment was low until the 1990s when it increased fast and has remained relatively high ever since. The cost of unemployment was calculated to 281 million Euros in 2009, which is equivalent to 6 % of GRP, 1 400 Euros per inhabitant a year.



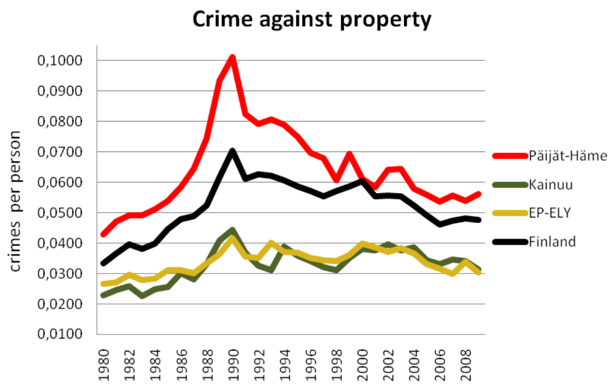


Figure 12: The unemployment rate among the working age population and crime rate in Päijät-Häme

The crime rate in Päijät-Häme (Figure12) is well above the Finnish average. This holds for all type of crimes, but the GPI only accounts for crimes against property due to lack of data. The damages due to automobile accidents in GPI account for the value of material losses as well as costs due to personal damages evaluated by Finnish insurance companies. In Päijät-Häme the frequency of traffic accidents is around the Finnish average. In 2009 the calculated total sum of material damages in Finland was 25 million Euros, which is equivalent to 125 Euros per person.

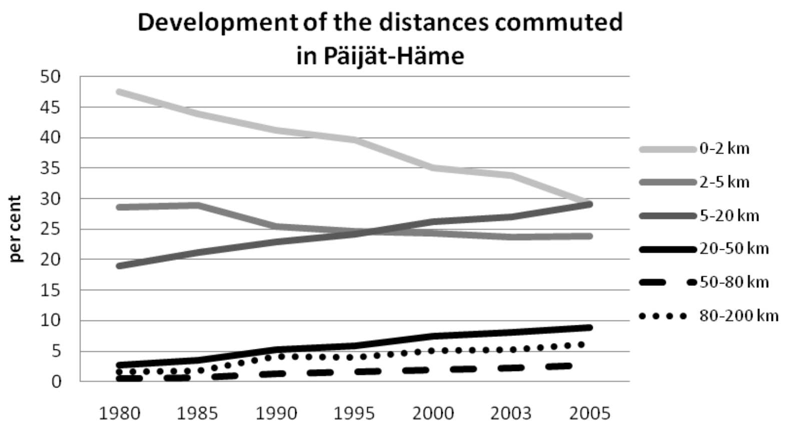


Figure 13: Development of commuting distances. This picture presents the proportion each distance (e.g. 0-2 kilometers) occupies of the total commutation traffic.

Inhabitants of Päijät-Häme work less hours that the Finnish people in average and significantly less than the ones in Kainuu and in the area of CEDESO. One important thing to notice is that in the 1990s and 2000s the time spent commuting has increased significantly in the area (see Figure 13). In Päijät-Häme the people are nowadays commuting notably longer distances than in any other area in this study and there is a clear trend towards longer and longer distances. In 1980s the average commuting distance in Päijät-Häme was only 56 % of the Finnish average, but in year 2008 the average has been surpassed (102 %). The development results mainly from the increased amount of commutation from Lahti to Helsinki. The improved train service between the two cities naturally shortens the time spent on road, but at the same time encourages making the decision of working and living far apart. This can be considered a good thing or a bad thing, but in the GPI longer commuting distances are considered as a disadvantage. According to Jallinoja (2010) only relatively small proportion of the distances in Päijät-Häme is travelled using public transport (Jallinoja, 2010). In the GPI the costs of commuting include the costs related to vehicles and purchased transport, as well as to the cost of the time lost. In this study mainly the lost time could be adjusted sub-nationally.

Päijät-Häme performs relatively well in category 4 (costs of environmental degradation and depletion of natural resources). Although these costs have been growing substantially also in this area, the costs per person are the lowest of all areas and the sum of all these effects has not grown since 2005. The importance of each component in GPI calculation is presented in Figure 14.

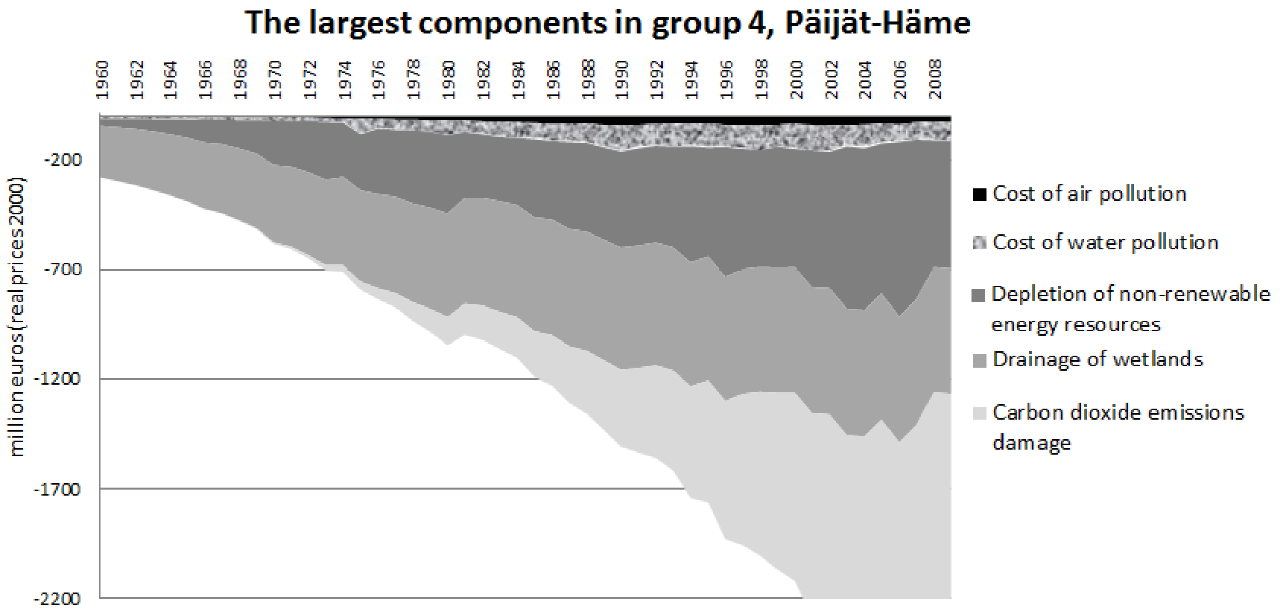


Figure 14: The largest components of the group 4 (costs of environmental degradation and depletion of natural resources) in Päijät-Häme.

The drainage of swamps and depletion of nonrenewable energy resources dominate, although the damage due to carbon dioxide emissions is growing. Only a relative small area of Päijät-Häme region is covered with wetlands (9 % of land area) and even then this component gets such weight. For Kainuu these costs are enormous. 74 per cent of wetlands have been drained in Päijät-Häme in the 2000th century which is close to the Finnish average (Metla). The growing stock in the region's forests is lively and also the forest area has grown slightly during the last decades.

The GPI accounts for several emissions to water and air. The discharges to water include nitrogen and phosphorous. The phosphorous load to water system has diminished substantially from the 1970s, but the nitrogen levels have remained almost unchanged. Only in the 2000s some reductions have been made. The emissions originate mostly from agriculture and industry. (Hämeen ympäristön tila –raportti; VEPS database.) The cost of water pollution was the highest in 1990. In 2009 the cost was estimated to 10 million Euros.

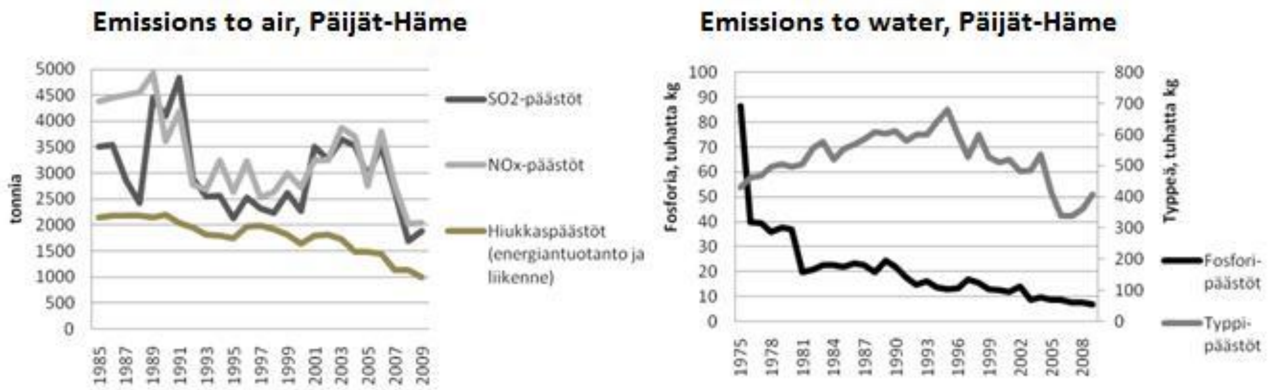


Figure 15: Emission to water and air in tons. Phosphorous (fostori) and nitrogen (typpi) to water and SO2-, NOx- and particles (hiukkaspäästöt) to air.

The emissions to air account for nitrogen oxides, sulphur dioxide and particle emissions. The trend in these emissions is descending. According to Center for Environment for Häme the reductions result mostly from increased regulation (Hämeen ympäristökeskus). Due to the lack of data only the emissions originating from industrial activity and energy production could be accounted for. There was not enough information available for estimating the remaining emissions. Therefore the real costs of air pollution can be regarded to be significantly larger.

There was no reliable and comprehensive data available for the use of renewable energy on sub-national level, but the share of nonrenewable energy could be estimate on the basis of the national figures, regional carbon dioxide emissions, industrial activity and energy use. Internet VAHTI-database gives the share of renewable energy of all fuel used since 1995 and this share has increased in Päijät-Häme. Using the GPI methodology, the cost of depletion nonrenewable energy resources in Päijät-Häme was 580 million Euros in 2009.

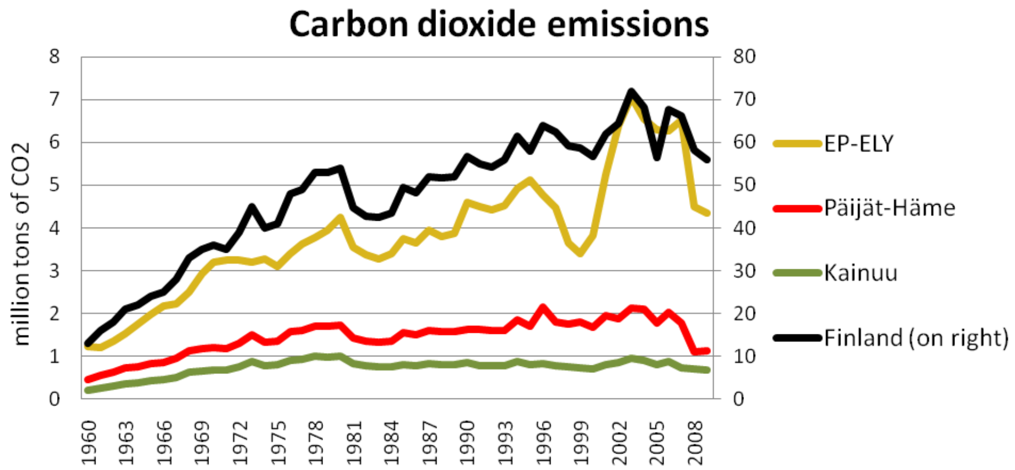


Figure 16: Carbon dioxide emissions in tons. Figures for Finland are on the right hand side axis.

The carbon dioxide emissions in Päijät-Häme have decreased significantly after 2005 (Figures 16 and 17) and the level of emissions per capita is lower than other regions, around same level that in Kainuu. The reason for the recent reduction in carbon dioxide emissions lies in economic fluctuations, closing of individual factories as well as improved technologies and filters. Generally all emissions have gone down in Päijät-Häme during the past decades so the area seems to be "greening".

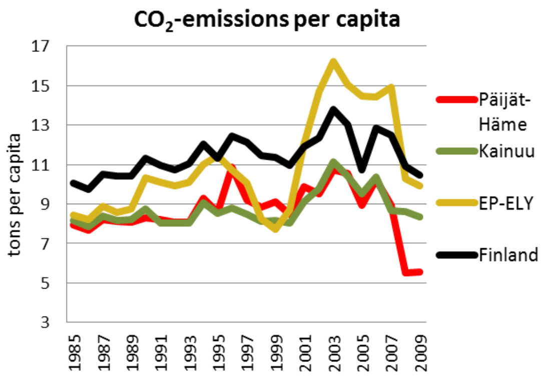


Figure 17: The national and sub-national CO_2 –emission per capita.

The overall picture of Päijät-Häme's development in after 1995 is positive. The sustainable well-being studies carried out using the GPI indicator in Finland and internationally have all given quite depressive results. In comparison to Finland, Kainuu and the area of CEDESO, Päijät-Häme stands out in a good way. It is the only one of the areas listed above where the development measured with the GPI becomes stable already in 1995 and a notable improvement can be seen after 2005.

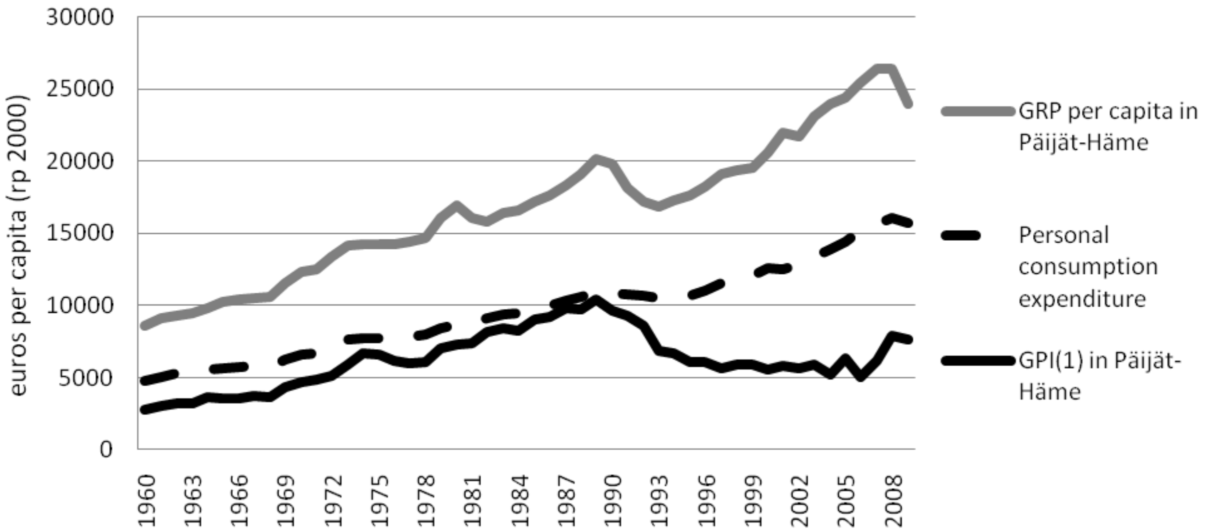


Figure 18: Gross Regional Product (GRP), personal consumption expenditure and GPI per capita for Päijät-Häme.

The general picture remains the same if all 23 GPI components are included in the summing up (GPI(1)) or if the two components relating closely geography and vegetation (Columns V and T) are left out (GPI(2)). The Figure 18 shows the development of different indicators commonly related with welfare and development. The Gross Regional Product (GRP) has developed quite steadily although the effect of economic downswings can easily be detected. Very similar development can be seen from personal consumption expenditure figures, although they develop more steadily. The GPI, which takes personal consumption figure as a basis, increases until 1989 after which it starts to come down.

The positive contributions that distinguish Päijät-Häme from the other regions in the GPI accounts are the following: Firstly, the material well-being measured with personal consumption expenditure is high, while income inequality has remained moderate. The residents in Päijät-Häme benefit from working less hours than the average Finns. Most importantly Päijät-Häme is not location for heavy industry (i.e. fewer emissions) and many improvements have been made in cutting down emissions in recent years. Emissions to air and water as well as the use of nonrenewable energy sources are in decline. Therefore the region’s ecological burden is now relatively small.

The most significant negative factors that cut the regional GPI figures down are that after the recession of the 1990s the unemployment rate has remained high. Also the crime rate in the region is high, even though it is now in decline. One factor affecting the quality of life of the residents is the continuing tendency to commute longer and longer distances. This can also be seen as a good thing as it is now feasible to work in the metropolitan area while living in Päijät-Häme.

According to this study Päijät-Häme has been able to keep its inhabitants' standard of living adequate while not causing too much burden on the environment. The development can therefore be considered sustainable. Lahti has lately identified itself as a "green city" and the whole region wants to develop towards being a centre for environmental business and research. It seems that the region is well on its way.

3.3.2 Kainuu

Kainuu has around 82 600 inhabitants (2009) and area of 21 504 km^2. The population density is around 3,8 people per square kilometer. Kainuu, as well as other northern regions, has lost inhabitants since 1980s. Only the administrative capital Kajaani is still increasing its population. Around one third of population of Kainuu lives in sparsely populated countryside.

The age structure in the area has changed during the study period. In the 1950s and 1960s a large proportion of the population was less than 15 years old. In 1968 only 60 % of the population was working-aged (15 to 74 years), while the Finnish average at that time was 70 %. Today the percentage of people aged 15-74 is 74 %, which is close to the Finnish average of 75 %. The challenge for Kainuu, as well as for the whole country, is the aging population.

The nature of Kainuu features forested hills, lakes and vast areas of uninhabited woods and wetlands. Around 45 per cent of land area in Kainuu is or was covered with different types of wetlands. There are nevertheless every day less intact wetlands as 70 per cent of the swamp area has been drained mostly in the 1960s and 1970s for the use of agriculture, forestry and peat industry. The drainage has mostly fallen on the most diverse areas and has therefore cut down the biodiversity (Schroderus-Härkönen & Markkanen 1999, p. 133).

Structural change in agriculture has been strong. The number of farms has gone down fast and the average size of a farm has increased significantly. The economy of Kainuu especially in the countryside is nowadays driven by the lumber industry, which employs 8 % of the workforce in the region. Mining industry causes the biggest chances to the region's landscape. The industry is growing and the changes can be seen in the mine area as well as in the processing of soil. The activity causes discharges to water and noise pollution, but also brings employment to the region. (Kainuu provincial strategy 2007–2013; Hänninen 2006.)

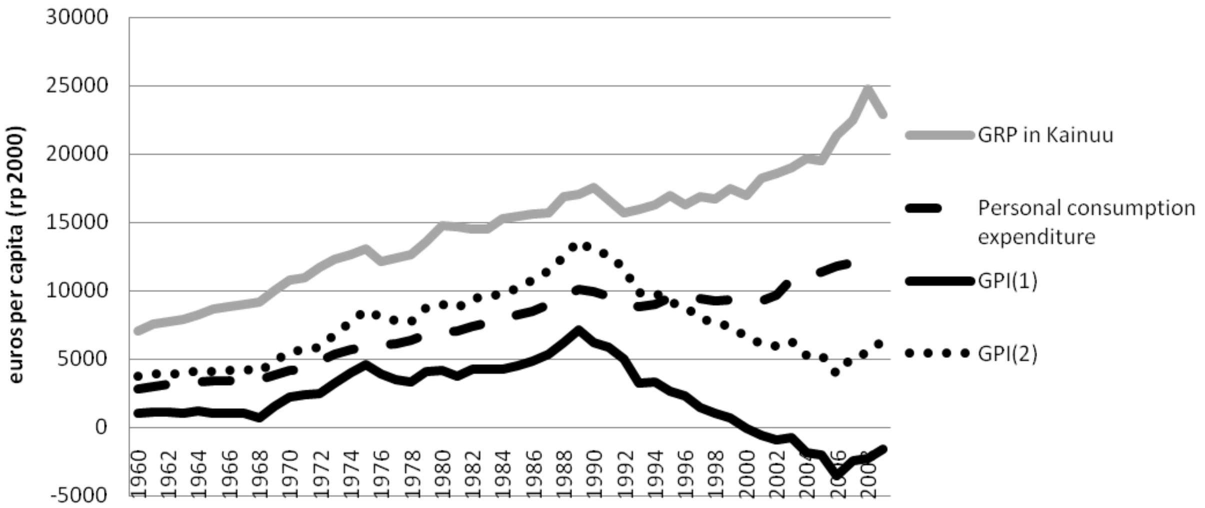


Figure 19: Gross Regional Product (GRP), personal consumption expenditure and GPI per capita in Kainuu.

Figure 19 shows the development of different indicators commonly related with well-being and development. Gross Regional Product (GRP) for Kainuu has developed quite steadily although not as strongly as the corresponding figure for the whole of Finland. Very similar development can be seen from personal consumption expenditure figures. What is interesting is that the effects of economic fluctuations on GRP and consumption are lighter in the area. The GPI, which takes personal consumption figures as a basis, increases until 1989 after which it starts to come down. In the case of Kainuu it is interesting to look at GPI(2) alongside with GPI(1). As explained earlier in Chapter 3, GPI(2) omits the impact of loss of wetlands (-) and growth of forest area (+) which make a huge gap between Kainuu and other areas. In order to maintain the comparability the results will be analysed here in more detail using GPI(1).

In Kainuu the average material well-being measured with consumption expenditure has been relatively low since 1960. The distribution of income among the population is more even than in Finland in average, which generally is taken as a sign of social equality and is believed to result in benefits (see Appendix 1, Column C). The Gini coefficient for Kainuu in year 2005 was 26 and the Finnish average 29. More equal income distribution shifts the GPI graph upward.

The value of the non-market activity such as household work and volunteering has developed steadily during the time 1960-2009 in all areas, but the lack of sub-national data has made regional application difficult. The education level in Kainuu is somewhat below the Finnish average. In 2009 only 20 per cent of working aged population had a degree from an institute of higher education, when the Finnish average was 31 %. The social value of higher education in Kainuu was calculated to 1 480 Euros per inhabitant in 2009.

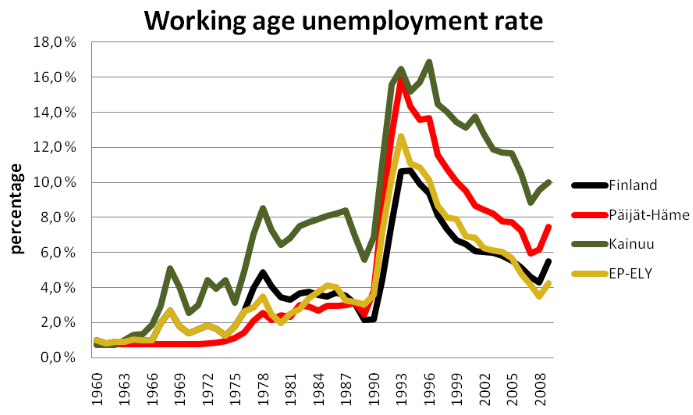


Figure 20: Working age unemployment rate.

When it comes to the defensive expenditures and private costs of urbanisation and modernisation, the costs grew in the beginning 1970s again in 1990s because of the poor state of employment. In Kainuu the unemployment started to become a problem already in 1968 (see Figure 20). Using GPI methodology, the cost of unemployment was highest in 1996 when it corresponded to 17 per cent of Gross Regional Product (GRP). In 2009 it was only 9 % of GRP, still remaining well above Finnish average.

In Kainuu people work more hours a year than the average Finns. The difference is around 5-10 %, depending on the year. The residents of Kainuu do not commute such long distances than those of Päijät-Häme, but the trend is similar (Figure 21). The drop in really short distances commuted (0 to 2 kilometers) is probably due to the shutdown of a number of farms.

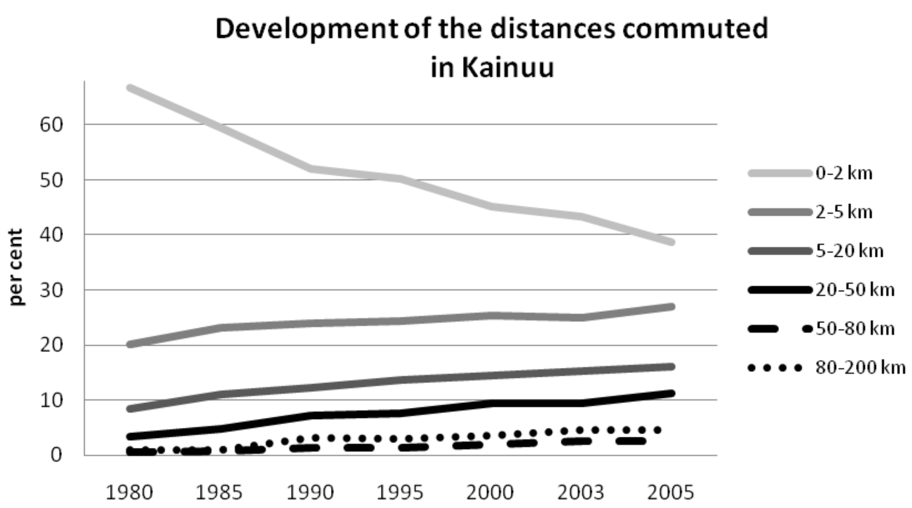


Figure 21: Development of commuting distances. This picture presents the proportion each distance (e.g. 0-2 kilometers) occupies of the total commutation traffic.

The category 4, costs of environmental degradation and depletion of natural resources, makes the biggest difference in GPI(1) graphs between Kainuu and the other areas. This is due to the drainage of wetlands that has been vast in the region.

The costs related to the environment have been growing substantially in all areas. Figure 22 shows the importance of the different components. The area in green color stands for the positive net growth in the forest area and is therefore added (+) to the negative components. One can see that damages dues to carbon dioxide damage is the fastest growing factor, though this component has a bigger significance in other areas of this study. The value of wetland drained is partially left outside the picture due to its size in comparison to other factors. It was calculated that around 530 000 hectares of wetlands were drained before 1990 and since then two per cent of this was restored (Metla). The related cost was at top level in 2000 when the component was equivalent to 22 % of GRP of that year. In 2009 the corresponding figure was 16 %.

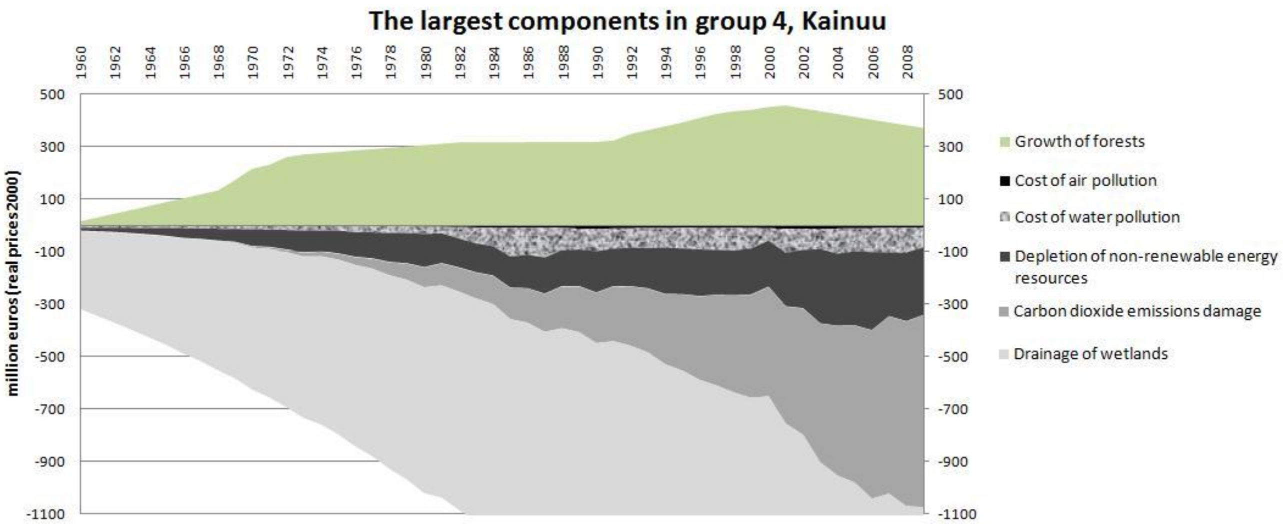


Figure 22: Components of group 4 that get the largest numerable value (+ or -)

Emissions to air in the GPI accounting include nitrogen oxides, sulphur dioxide and particle emissions. The trend in these emissions is clearly descending, at least for sulphur dioxide (Figure 23). In Kainuu the nitrogen levels increased in 1980s and have remained almost unchanged ever since. The phosphorous load to water system has fluctuated more and is not on relatively low level. The data is derived from VAHTI-database. Due to the lack of data only the emissions originating from industrial activity and energy production could be accounted for. There was not enough information available for estimating the remaining emissions. Hertta-database estimates also the remaining emissions, but the figures are available only from year 2000. The particle emissions contain also those from traffic. The real costs of air pollution can be regarded significantly larger.

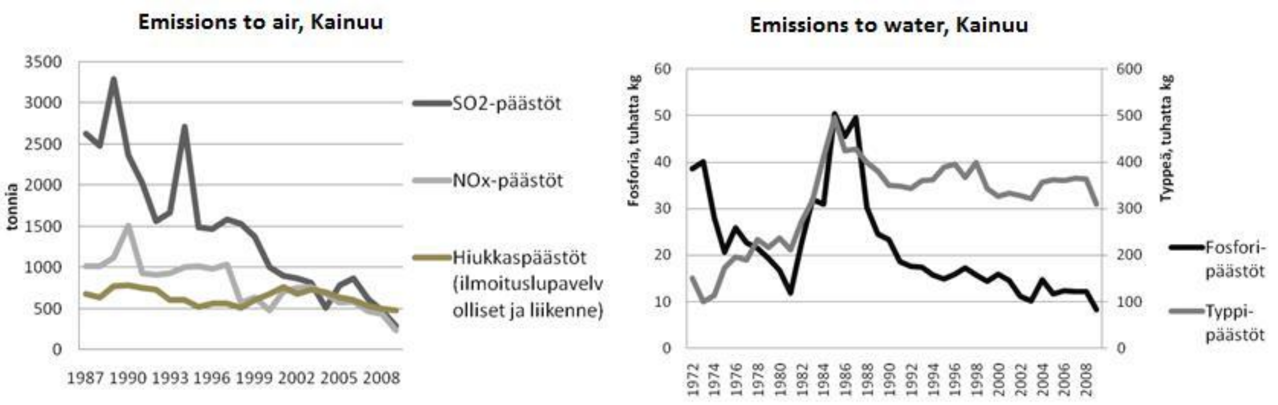


Figure 23: Emission to water and air. Phosphorous (fostori) and nitrogen (typpi) to water and SO2-, NOx- and particles (hiukkaspäästöt) to air.

The discharges to water include nitrogen and phosphorous. In the past the paper mills caused lots of emissions, but shutting down factories, improving technologies and filters and reducing the amount of water in the processes made the situation better. In the past forest industry caused the biggest load for the environment but the processes have been improved significantly. The same progress has unfortunately not been seen in agriculture. Nowadays the biggest causes of environmental burden alongside with agriculture and industry are the peat production and scattered loading from unspecified sources. Only 20 per cent of the total load can be traced back to its origin (Hänninen 2006; Center for Environmental Administration in Kainuu 1999.)

Kainuu is sparsely populated and sources of noise pollution are scarce. Mainly traffic and industrial units create noise, but this disadvantage could be increasing due to increased mining activity (Hänninen 2006). It is likely that the effects of mining industry do not yet appear in the GPI figures produced in this project.

In Kainuu vast part of electricity is generated by hydropower. In the GPI accounting this means that the use of nonrenewable energy resources is lower. There was no reliable data available for the use of renewable energy at sub-national level, but for Kainuu the share of nonrenewable energy could be estimated on the basis of carbon dioxide emissions and information found in publications of local administration (Kainuun Seutukaavaliitto). For example, in 1970 the region required 2,2 % of the total energy used in Finland while the use of fuels was only 1,5 %. At this point of time Kainuu accounted for 2 % of the national GDP. In Kainuu the energy production is greener than in other areas.

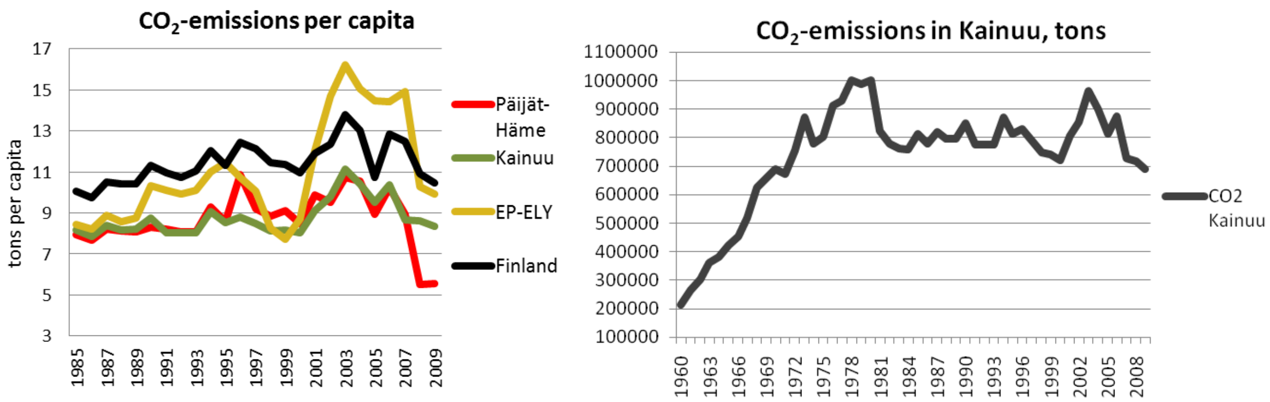


Figure 24: The national and sub-national CO_2 –emission per capita and emissions in Kainuu in tons of CO_2

The carbon dioxide emissions in Kainuu have remained at approximately same level since 1970 (Figure 24) and the level of emissions per capita is below the Finnish average, around same level than in Päijät-Häme. The relatively low level is probably resulting of hydropower use.

Figure 25 depicts pollution and energy resource depletion. Here the graph of Kainuu runs above all other graphs until the year 2002 after which Päijät-Häme performs better. It can therefore be concluded that Kainuu is not doing any worse than the rest of the country when it comes to environmental sustainably, only the loss of wetlands is causing its poor performance when using GPI(1).

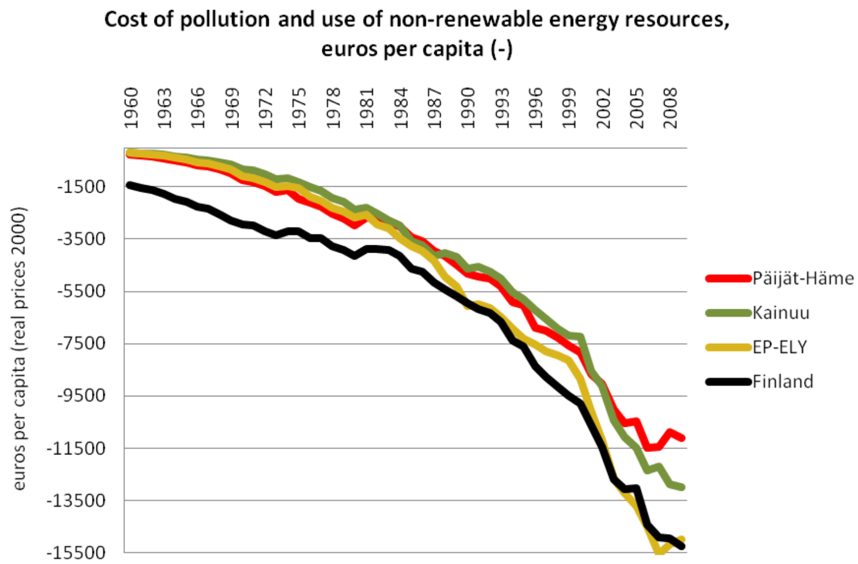


Figure 25: Part of the components in group 4, pollution and use of nonrenewable energy sources.

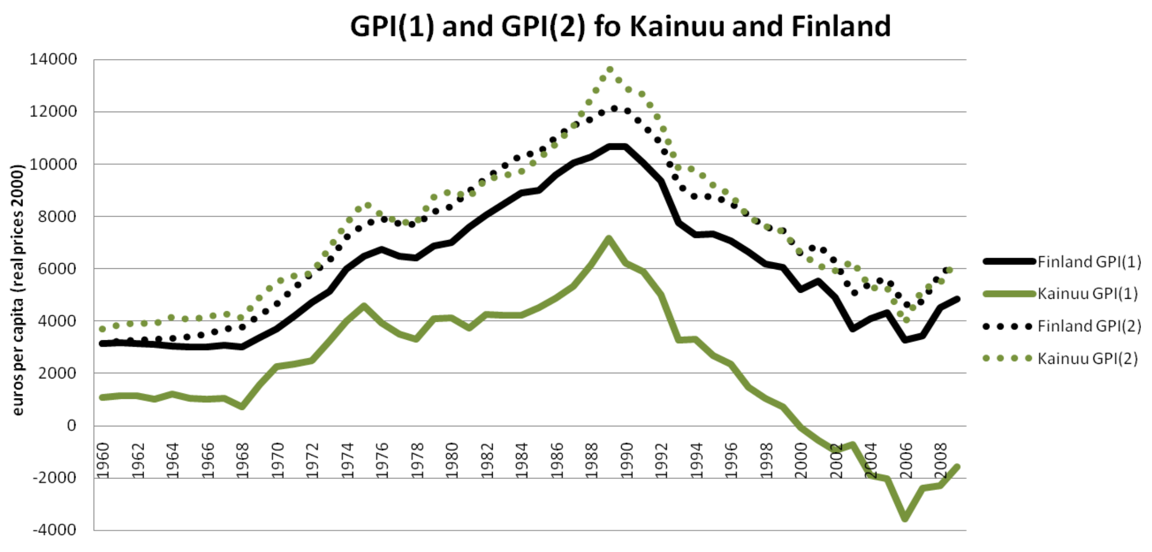


Figure 26: GPI(1) and GPI(2) for Kainuu compared with the Finnish (average).

Figure 26 once again shows the huge weight the value of wetlands drained (Column T) obtains when using the U.S. methodology created by Talbert et al. (2006). It is true that the wetlands are an important part of the Finnish nature. In addition to the economic and recreational values, wetlands contribute to preserving biodiversity and controlling water and carbon cycles. Therefore it is important to protect the remaining wetlands in order to look after not only the regional, but national and global biodiversity. Today majority of the most diverse and therefore valuable wetlands in Kainuu are included in Natura 2000 sites.

Most of the facts listed above are also valid in the case of forest. Efficient forestry results in loss of primeval forests and reduced biodiversity. Unfortunately, the GPI only accounts for the changes in forest area and all qualitative changes are left unacknowledged. The forest component (Column V) therefore creates a positive contribution to GPI(1) in all areas.

When we look at GPI(2) the overall picture of Kainuu looks very close to the Finnish average (Figure 27). As a region Kainuu does not perform as well as Päijät-Häme, but has its own strengths. The components that affect positively in Kainuu's GPI figures are a rather equal income distribution and low level of negative externalities due to commuting, noise pollution and crime, for example. The CO_2- and other emissions to air, as well as water pollution are on a low level. The use of renewable energy (hydropower) is a plus. Kainuu can be considered a relatively sustainable area when it comes to environmental factors, although the differences to the Finnish per capita average are small.

The most important weak points for Kainuu are the low level of material well-being measured with private consumption expenditure. Almost as important are the facts that the unemployment has stayed elevated since

1970s and the educational level of residents is quite low. All factors together situate Kainuu close to Finnish average, despite its unique strength and weaknesses.

4. Conclusions

There is clear need to establish links between natural capital components and the quality of life. Today the mainstream business, corporate and technological approaches to sustainability focus on individual, visible, known and local environmental problems, as well as short-term solutions to them. Long-term preventative strategies for global environmental challenges, which include currently unknown environmental impacts, are largely ignored. Sustainability, well-being and quality of life are complex phenomena which require a multidimensional approach. The global sustainability cannot be reached when constantly increasing the extraction, production and use of nonrenewable resources. The way the GPI puts monetary value on the natural environment makes it possible to take environmental issues better into decision-making. (Hoffrén & Rättö 2010.) Monetisation cannot capture the reality and qualitative diversity of ecosystems, but helps in putting some value on these crucial issues.

The GPI is an indicator that tries to capture the economic, social and environmental dimensions of welfare to one single measure by artificially pricing the environmental and natural resource degradation. The GPI appreciates the factors of ecological sustainability that tell about the long-range future possibilities for sustainable economic development. However, the GPI fails to acknowledge the growth of the human capital and its future potential. (Hoffrén & Rättö 2010.) The "investments" made today in education, health and other social services contribute to welfare in the future (this is accounted for in Genuine Savings, for example). When Daly and Cobb started to develop indicators preceding Genuine Progress Indicator (GPI), their idea was to raise questions and show the weaknesses of GDP as a welfare measure and the goal seems to be accomplished.

The strength of Genuine Progress Indicator is the way it combines information about several factors making new kind of comparisons possible. The comparisons can be made between different points in time and between different geographical areas. In order to carry out this study a vast amount of data was collected. Some of it had to be approximated because there was not enough data available on sub-national level. Some of the data from the 1960s and 1970s was picked by hand from printed publications found in regional governments' archives. Those documents can be the last place this information is stored as the digitalisation only stretches to 1980 or so. The situation has improved little by little from the 1960s and every day the data is becoming more available and reliable. Nevertheless, in order to refine the results and use the GPI in the future, Finland needs better compilation of statistics in the field of social (e.g. time use) and environmental indicators. For sub-national studies, naturally, the data has to be collected on regional level.

As suggested in the earlier chapters, the GPI may not be a perfect measure of sustainable well-being for the Finnish society in its current form. Nevertheless the results point out many interesting things for the regions under study and for the whole country. The growth of GDP no more contributes to the growth of well-being of individuals like it used to. The growth happens partly on the expense of social equality as well as state of environment. The Finnish GPI graph peaked in 1989 and has since decreased till recent years. In 2000's the Finnish GPI has been on about the level than in the 1970's.

It is important to recognise and discuss also the weaknesses of the GPI in both national and sub-national level. Criticisms have been expressed at its theoretical foundations, components and calculation methods. One criticism concerns the way the GPI sums up factors that are inconsummerable, for example time and consumption expenditure. The common measure is money and the non-monetary components are valuated in money-terms. While some find this way of creating prices that describe the average appreciations of different factors (such as free time) deficient, the proponents of the GPI argue that also in real life one gives monetary value to non-monetary factors. One example is the way insurance companies value human-life or health when addressing insurance fees. Most of the prices (valuation methods) used in the GPI are based on opportunity costs or defensive expenditures that can actually be monetised. A wage rate can be used to represent the opportunity cost of free time, and the health consequences the value of pollution damages.

Some critics are against the theoretical concept of combining an indicator of current welfare with an indicator of sustainability because costs associated with depletion of nonrenewable resources and other forms of natural capital make little difference to current welfare. This is what the GPI intends to do by pricing the depletion and therefore giving an "accounting cost" for the actions

Some find it hard to understand how the trend in the GPI can be descending while people are getting wealthier and wealthier in average. It is true that while we can (in average) buy every day higher standard of living for ourselves, more and more people are also already suffering from some of the negative externalities of modern life. Increasing income inequality in the society causes a number of discomforts, so do the working longer and longer hours and living in cities and having to wait in traffic jams. The long-term environmental damages, instead, are not yet seen in everyday life and do not affect our current well-being to same extent. The GPI dries to address them. Thus the perceived trend in well-being can differ from the picture given by the GPI.

While some dispute the GPI's methodological soundness and its ability to measure sustainable welfare it has been used by government and nongovernmental organisations throughout the world as a tool for promoting sustainable policies and for demonstrating the fallacy of relying on gross domestic product (GDP) as a welfare measure. If a society is able to reduce the use of fossil fuels, cut down emissions and makes the life of its citizens more pleasurable, it is important that the changes are shown by the measure used. Therefore it does matter which measure is used to evaluate the society's performance. The GDP does not account for any other changes than increased production and ignores where it originates: whether it is the reparation after accidents or environmental hazards, or something positive as building new roads and taking care of people.

There are still many details in Genuine Progress Indicator that need refining. The GPI accounts would be well served by a new set of valuation studies addressing time use, natural capital depletion, and costs associated with disservices such as air and water pollution, since many of the sources underlying the current GPI Columns are somewhat outdated. (Talberth et al. 2006.) In addition to this, because of national, societal and geographical differences the prices used in the U.S. study may not be the best for Finnish conditions. For example in the case of loss of wetlands and the growth in forest area the valuation methods may not be optimal. Taken together, these changes would make the GPI a more accurate and robust tool for promoting sustainable development in the future.

If the GPI is to describe the different aspect of sustainable well-being broadly, some additional components should be included. The national applications naturally decrease the meaningfulness of international comparisons, but at the same time give a more solid picture of the level of well-being. Some of these factors could already be included in a Finnish composite indicator of well-being with only a little effort. One example is the public spending on health care and other services. In Finland the welfare services form an important service flow for individuals. A study from year 2006 reports that in average, these services form a part that is equivalent to 18 % of the size of individual's disposable income (Kulutustutkimus 2006; Lindqvist 2009). This is one of the features that distinguish Finnish society from the American. The data on public spending is available at National Accounts by Statistics Finland.

Also the following components could be included, with some more research:

- Public welfare services
- Health and/or costs due to illnesses
- Research and development, innovations
- More extensive sample of crime and accidents
- Cost of alcohol abuse
- Cost of soil degradation

Links to international applications using GPI can be found in Appendix 2. Some of these studies integrate some 5-20 more components in what they call the Genuine Progress Indicator. "Genuine progress indicator" is used here as a general expression for indicators following the idea based on personal consumption expenditure of ISEW and GPI. These indicators measure the progress in a broader, more genuine way. It is worth emphasising that the methodologies of these GPIs are not the same and comparing the results between different studies makes little sense. This is one reason why this study sticks close to one, well-defined methodology.

To make comparisons, the GPI could and should be applied to more provinces or regions in Finland. For example the influence of Helsinki and other big cities to the Finnish average should be distinguished. If one wants to create long time series like in this study, changes in the administrative borders will make the data complication challenging. Because GPI is best in describing the trends in long term, long time series make sense.

As many acknowledge that using GDP growth as a policy target is a fundamentally flawed approach, and that "even an approximation" of welfare would do a better job as a policy guide, Talberth et al. (2006) list several examples where the GPI has had an impact on the decision making. For example, in Alberta (Canada), the Pembina Institute has been publishing the GPI accounts since 2001 as a way to persuade the provincial government to adopt a more comprehensive accounting framework that is "capable of assessing the full benefits and full costs of all forms of capital in Alberta —human, social, natural and built." In Nova Scotia, the organisation GPI Atlantic reported that the provincial government had created an Office of Health Promotion responsible for all matters relating to health promotion, wellness and addiction services in part based on GPI sub-accounts documenting the enormous toll ($3 billion) of largely preventable chronic diseases. As a result, they conclude that GPI Atlantic is having an impact on public policy. In the San Francisco Bay Area, the quasi-governmental Bay Area Alliance for Sustainable Communities adopted a local variant of the U.S. GPI as a means for tracking progress in achieving the policy objective of a "diversified, sustainable, and competitive economy". Talberth et al. also analyse how several economic and political tools and phenomena, including degree of economic openness, tax cuts and growth in urbanisation, affect the GPI accounts. (Talberth et al. 2006.) The GPI serves for building an overall picture of the development in the country or area. The local authorities need in addition more specific measures but on the basis of twenty different indicators it is difficult to form a complete picture of the development. The components of GPI can work as separate indicators and can be used to set goals (Hoffrén, 2010.)

According to Lawn (2008) it is clear that sub-national governments (state, county or city) are limited in their capacity to increase their own GPI because a great deal of impacts remain the policy domain of national governments. Lawn list several policy imperatives can be implemented in order to improve GPI figures: (1) the introduction of tax incentives and/or subsidies to promote research and development into 'green' technologies; (2) better targeted infrastructural investment to assist in the emergence and development of tomorrow's key industries (i.e., industries that will significantly raise productivity, increase a state's rate of energy efficiency, and elevate standards of production excellence to new heights), (3) import-replacement policies centered on a competitive industry base and the facilitation of high-tech, value adding, and resource-saving industries; (5) industrial relations reform involving the establishment of genuinely flexible labour markets that provide workers with greater work-leisure-family options while simultaneously protecting full-time work entitlements; (6) ecological tax reform that would initially involve the manipulation of the tax system to: (a) reward 'welfare-increasing' business behavior (e.g., activities that add greater value in production); (b) encourage the development and uptake of resource-saving technologies; (c) reduce the proportion of private sector investment being directed into non-productive, 'rent-seeking' ventures; and (d) penalize environmentally-destructive behaviour (e.g. highly energy-intensive and polluting activities).

Maryland (see Appendix 2) has made use of its GPI-framework be creating projections for several future development paths. According to Maryland GPI "the model is a dynamic tool for use by policymakers and citizens alike that demonstrates how the GPI indicators are interrelated". The calculations are projected to 2060 and identify three statewide priority policies: Smart Growth, Clean Energy and Green Jobs. The Model allows the user to adjust State investment in one or more of the priority policies to see how sustainability and long-term prosperity are likely to change over time. (Maryland GPI.)

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6. Appendices

Appendix 1: GPI Methodology

The Finnish GPI is derived from 23 separate time series data columns spanning the years 1960-2009. The methodology follows the updated GPI methodology introduced by Talberth et al. (2006), but three columns are omitted (rationing below). In this section each column is reviewed. A brief rationale is given, and data sources and general calculation methodology are briefly described. The columns are denoted by letters following the alphabet from B to Z and to the last one, AA.

B – Personal Consumption

Personal consumption expenditures on goods and services are the initial starting point for the GPI. Personal consumption expenditures are a valid starting point for the GPI since we are ultimately interested in the welfare associated with this consumption rather than the monetary value of production. Personal consumption expenditure data were taken from the National Accounts by Statistics Finland. The sub-national data is from Regional Accounts.

C – Income Distribution Index

"A rising tide does not necessarily lift all boats", if the gap between the very rich and everyone else increases. Both economic theory and common sense tell us that the poor benefit more from a given increase in their income than do the rich. Accordingly, the GPI rises when the poor receive a larger percentage of national income, and falls when their share decreases.

There is strong empirical evidence that rising income inequality also hinders growth in economic welfare. A highly unequal distribution of income can be detrimental to economic welfare by increasing crime, reducing worker productivity, and reducing investment. Moreover, when growth is concentrated in the wealthiest income brackets it counts less towards improving overall economic welfare because the social benefits of increases in conspicuous consumption by the wealthy are less beneficial than increases in spending by those least well off (Lawn, 2005).

If we look at the *average* income of a nation we ignore the fact that the income can be concentrated in the hands of a very small proportion of the population. Therefore the level of material well-being in general may be very low. This is why in GPI the average consumption expenditures are weighted with and Gini coefficient -based index that indicates the distribution of wealth. The Gini index expresses the difference between actual distribution and totally equal distribution by income quintiles. The Gini index ranges from 0, when every household has the same income, to 100, when one household gets all the income. Thus the higher the Gini index the greater the income inequality, or the greater the portion of aggregate income earned by the top household income bracket (Talberth et al. 2006).

The Gini index is published regularly by Statistics Finland (Income distribution statistics). Gini index used in this study is based on the statistical variable “Disposable income”. In GPI calculation the income distribution index is set at a value of 100 in year 1987 and 1992, when the Gini index was at its lowest value in Finland (19,7). The regional income inequalities are compared with the lowest value of Finnish average Gini (1987 and 1992). A study by Loikkanen, Riihelä and Sullström (2007) was used to estimate the sub-national income distribution before 1994. The income distribution in the regions has followed the national trend.

D – Weighted Personal Consumption

Weighted personal consumption is Column B (personal consumption expenditures) divided by Column C (income distribution index) multiplied by 100. The reason for dividing rather than multiplying is that larger numbers in Column B indicate greater inequality. Column D becomes the base number from which the remaining columns in the GPI are either added or subtracted.

E - Value of Household Work and Parenting

Much of the most important work in society is done in household and community settings: childcare, home repairs, volunteer work etc. These contributions are ignored in the GDP because no money changes hands. To correct this omission, the GPI includes the value of household work figured at the approximate cost of hiring someone to do it. Work performed in households is in many ways more essential than much of the work done in offices, factories and stores. Yet most of this goes unaccounted for in the national income accounts. While the housework and parenting of the stay-at-home mom or dad counts for nothing in the GDP, commercial childcare in the monetized service sector adds to the GDP. Other unpaid household labor, such as the physical maintenance of the housing stock (from cleaning to light repairs), also constitutes valuable economic activity. (Talberth et al. 2006, p. 11).

The estimate of time used in these activities is derived from the Finnish GPI study (Rättö 2008) what was based on Time use survey statistics of Statistics Finland. No sub-national data on time use was available so the figures are adjusted by using the head count of working aged population. The time used for household work per person has diminished in households of one person and small families with children. But at the same time the number of these household types has increased. This results in a situation where the total time used in household work has remained practically unchanged. (Säntti et al. 1982; Aalto & Varjonen 2005.) The corresponding opportunity cost (average wage) is derived from the work of Rättö, although updated by using a newer study by Varjonen and Aalto (2010) who also estimated the value of household work in Finland.

F - Value of Higher Education

According to Talberth et al. (2006), there has been considerable debate over whether to include this column at all. Previous editions of the GPI have omitted the cost of higher education, considering it an investment. Other studies have considered higher education to be consumption, while still others have asserted that the primary value of higher education is as a signaling effect and it should be considered a defensive expenditure. While it is clear that the long-term earnings of university graduates are much higher than those without a degree, the GPI sidesteps over the debate how to address these individual benefits by focusing instead on the benefits to society.

The valuation method used by Talbert et al. (2006) are based on a study by Hill et al. (2005) that provides an exhaustive list of such benefits, which are both monetary and non-monetary and in the form of increases in the stock of knowledge, productivity of workers and capital, civic participation, job market efficiency, savings rates, research and development activities, charitable giving, and health. They estimate the total value of this social spillover effect to be $16,000 per year per college-educated worker. This translates to 17 777 Euros (Rättö 2008). This value is multiplied by the number of people that have graduated from a unit of higher education. In Finland any university degree as well as higher level vocational degree is included. Each graduate is expected to produce a service flow of 40 years.

For the regional application one need to know the educational level of population living in the area. The Finnish GPI component for value of higher education is adjusted to regions by using the percentage figures (% of 15-74 year old population with a degree). The data was available at Statistics Finland until year 1975 before which the data was based on estimation made by Rättö (2008) and regional data was found provincial publications from 1960s and 1970s.

G – Value of Volunteer Work

Some of the most important work in is not done for pay. Such work is not only performed at home, but also in the broader realm of our neighborhoods and communities. Work done here is the nation's informal safety net, the invisible social matrix on which a market economy depends.

Volunteer work is usually defined as work done voluntarily via an organization or by helping neighbours without getting paid. Despite its crucial contribution the value of this work is left ignored in national accounts. The GPI corrects this omission at least partially. (Talberth et al. 2006, p. 11) In the Finnish GPI, the value of participatory and organizational activities is used instead on volunteer work based on the data available (Statistics Finland).

First the total number of hours spent in participatory and organizational activities each year is estimated based on the time use survey by Statistics Finland. The estimations used here are derived from the work Rättö carried out for Finland (see Rättö 2008). Because volunteer work is not usually something people do every day and not all people commit to it, the daily average amount of work done daily is small, only around 15 minutes. The value of voluntary work is based on hourly wage. The wage level used here is somewhat larger than in household work (14 Euros in 2007, using real prices 2000). Unfortunately there were no sub-national time use studies available to make better estimations, so the figures were only adjusted by using the head count of working age population in each area. The value of volunteer work was 471 Euros per capita based on the national data.

H – Services of Consumer Durables

The GDP expresses the value provided by major consumer purchases (e.g., home appliances) with the amounts people spend to buy them. This hides the loss in well-being that results when products are made to wear out quickly. To overcome this, the GPI treats the money spent on capital items as a cost, and the value of the service they provide year after year as a benefit. This applies both to private capital items and to public infrastructure, such as highways. The GPI treats the services of household capital as a benefit and the initial purchase price as a cost. This column adds the annual services derived from consumer durables, which economic theory defines as the sum of the depreciation rate and the interest rate. If a product lasts eight years, it depreciates at 12.5 percent per year and thus provides that much of its service each year. At the same time, if the interest rate is 5 percent, the purchaser of the product could have received that much interest by putting the money into the bank instead. Economists therefore regard the interest rate as part of the monetary value of the product to the consumer. (Talberth et al. 2006, p. 12.)

Based on an assumed depreciation rate of 15 percent and an average interest rate of 7.5 percent, the value of services from household capital is estimated at 22.5 percent of the value of the net stock of cars, appliances, and furniture at the end of each year as estimated by Statistics Finland. To avoid double counting, we make an adjustment (Column M) by subtracting out actual expenditures on consumer durables. Focusing on annual services that household appliances and equipment provide rather than on the purchase price corrects the way the GDP treats money spent on durables.

The figures used in this study are from National Accounts (Personal consumption expenditure, Durable goods) and are depreciated as described above. Unfortunately there was no sub-national data available or it could not be acquired within this project. Therefore the services of consumer durables only correct the level of GPI (per capita), do not make differences between areas.

I - Services of Highways and Streets

According to Talberth (et al. 2006) the GPI does not include most government expenditures since they are largely defensive in nature as they protect against erosions in the quality of life, rather than enhance it. This is true for example in the case of military spending. Some government activities, nevertheless, do provide free services that can be counted as a plus.

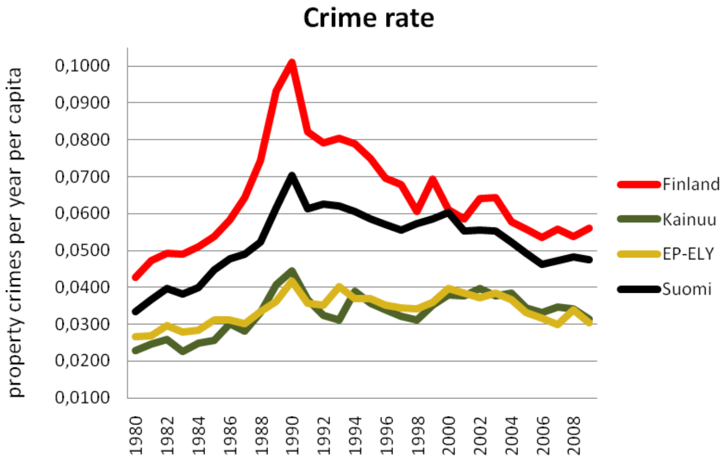
The annual value of services from highways and streets is derived from National accounts figures of the net stock of federal, state, and local government streets and highways. The annual value of services from streets and highways is estimated by taking 7.5 percent of the net stock value. This value estimated by Talberth et al. is based on the logic that around 10 percent of the net stock (2.5 percent for depreciation and 7.5 percent for average interest rates) is the estimated annual value of all services from streets and highways. However, since around 25 percent of all vehicle miles is assumed to be for commuting (a defensive expenditure), only 75 percent as net benefits. Thus the GPI assumes the net service value of streets and highways is 75 percent of 10 percent, or 7.5 percent of net stock. (Talberth et al. 2006, p. 12.)

Unfortunately there was no sub-national data on the value of net stock of highways and roads available or it could not be acquired within this project. Therefore the services of consumer durables only correct the level of GPI (per capita), do not make differences between areas. The estimates based on kilometers share of roads does not serve for this purpose. The services provided by highways and roads were calculated to 56 Euros per capita each year.

J - Cost of Crime

Crime takes a large economic toll on society. Some of these costs are obvious, such as medical expenses and lost property. But others are more indirect, such as the trauma of being violated, or are incurred in the form of lost opportunities, such as activities foregone because people fear the possibility of theft or violence.

Some GPI applications try to account for damages due to all criminal activity, also the psychological damage (see GPI Maryland, Appendix 2). The Finnish (and the American) GPI relies only on the year to year estimates of the cost of crime to victims in terms of their out-of-pocket expenditures or the value of stolen property. Undoubtedly the full cost of crime is underestimated.



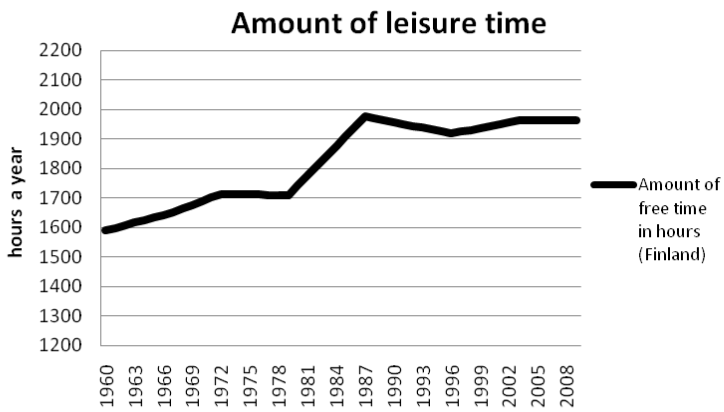
The U.S. methodology also accounts for the defensive expenditures on locks, burglar alarms, security devices, and security services and thus subtracts these expenditures on crime prevention as it is consumption that does not add to the well-being of our households but merely prevents its deterioration or violation (Talberth et al. 2006, p. 12). There was no data available on this for Finland.

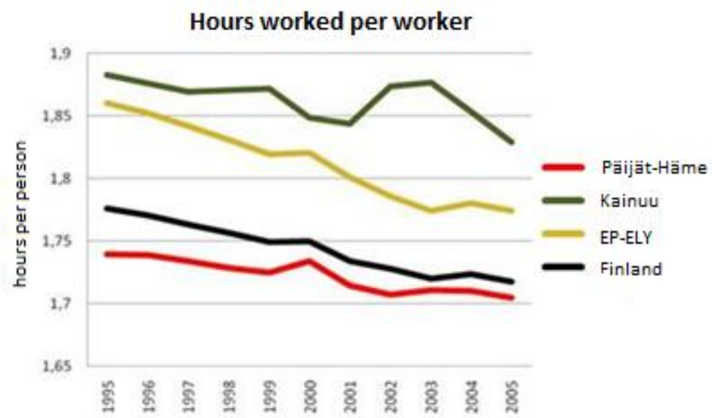
The figures used here are from the Finnish GPI (Rättö 2008) and are adjusted to sub-national level by using the corresponding probabilities of property crime in each area (derived from Statistics Finland's Crime statistics). Sub-national data is available until year 1980. Before this year the figures are estimated that the proportion of property crime (of the Finnish total figure) remained the same. Some solitary data spots were collected form Regional Administrations' publications from 1960s and 1970s.

K - Loss of Leisure Time

As a nation increases in wealth, people should have increasing latitude to choose between more work and more free time for family or other activities. In recent years, however, the opposite has occurred. As the nation is getting richer, people are working harder to produce and buy more and to pay interest on mounting personal indebtedness. The GDP ignores this loss of free time, but the GPI treats leisure as most people do - as something of value. When leisure time increases, the GPI goes up (Talberth et al. 2006, p. 13).

In order to provide a reasonable estimate, the GPI includes only the value of leisure lost in relation to the year with the greatest leisure since 1960. In the case of Finland this was in 1987 (in United States the year was 1969). The number of annual national leisure hours is taken from the Finnish GPI (see Rättö 2008) which derives the figures from a study by Kiander (1999). The data was updated since according to the newest studies the amount of leisure time is again increasing in Finland.





The sub-national adjustments were made by using the Regional Accounts data by Statistics Finland and compared with the Finnish average. Sub-national data was not available before 1995, but before that the progress was assumed to follow the Finnish average.

It is impossible to find a single value for free time, but the valuation is done following methodology by Talberth et al. (2006). The loss of leisure time was value at constant Euros, using a wage level per hour which was approximately the average real wage rate for the period 1960 to 2008 (Rättö 2008).

L - Cost of Unemployment

The U.S. methodology used the concept of *underemployment* instead of unemployment. Underemployment is a more inclusive concept than unemployment. It refers to persons who are either unemployed or involuntary part-time.

The costs of unemployment mostly fall on the workers and their families. But according to Talberth et al. (2006, p. 14) the community and society also pays a price when limited work opportunities may lead to frustration, suicide, violence, crime, mental illness, or alcoholism and other substance abuse. The GPI treats each hour of unemployment (the number of unprovided hours for constrained workers) as a cost, just as leisure time is considered a benefit. An hour of leisure time is a desirable objective whereas an hour of underemployment is a burden.

The cost of unemployment was calculated like in the Finnish GPI study by Rättö (2008). The cost is equivalent to the amount of unemployed times the average wage times the average working hours. The working hours are based on a study by Kiander (1999) and Statistics Finland (2005). The sub-national data is acquired like in the case of loss of leisure time. The unemployment rates are from Statistics Finland until year 1975. Some single data spots were collected from local Administrations' publications from 1960s and 1970s.

M - Cost of Consumer Durables

The actual expenditures on consumer durables are a negative adjustment in the GPI to avoid double counting the value of their services (Column H).

N – Cost of Commuting

While commuting is for most people an unsatisfying and sometimes frustrating experience, the GDP treats it as a benefit to consumers as it is part of consumption expenditures. Moreover, GDP does not account for the opportunity costs of time spent commuting; time that could be spent freely with family, at leisure, sleeping, or at work. The GPI therefore subtracts the cost of commuting. There are two distinct types of costs incurred in commuting. The first is the money spent to pay for the vehicle or for bus or train fare; the second is the time lost that might have been spent on other, more enjoyable or productive activities. The figures related to vehicles and the prices of purchased transportation are from the study carried out by Hoffrén in 2001 and updated by Rättö in 2008. The time used for transportation and furthermore the value of the time lost are calculated as the total number of people employed each year times the estimated annual number of hours per worker spent commuting times a constant value for the time. The value of time lost is approximated to 65 % of average hourly earnings (Talberth et al. 2006). The number of hours per year used commuting was derived from Statistics Finland's time use surveys 1987-1988 and 1999-2000. Sub-national data on commuting in hours was not available, but in the regional adjustments were mainly based on commuting distances derived from VAHTI-database (see Figure 27). The figures were further adjusted with careful estimates of development of commuting time and fares, but the figures need more refining.

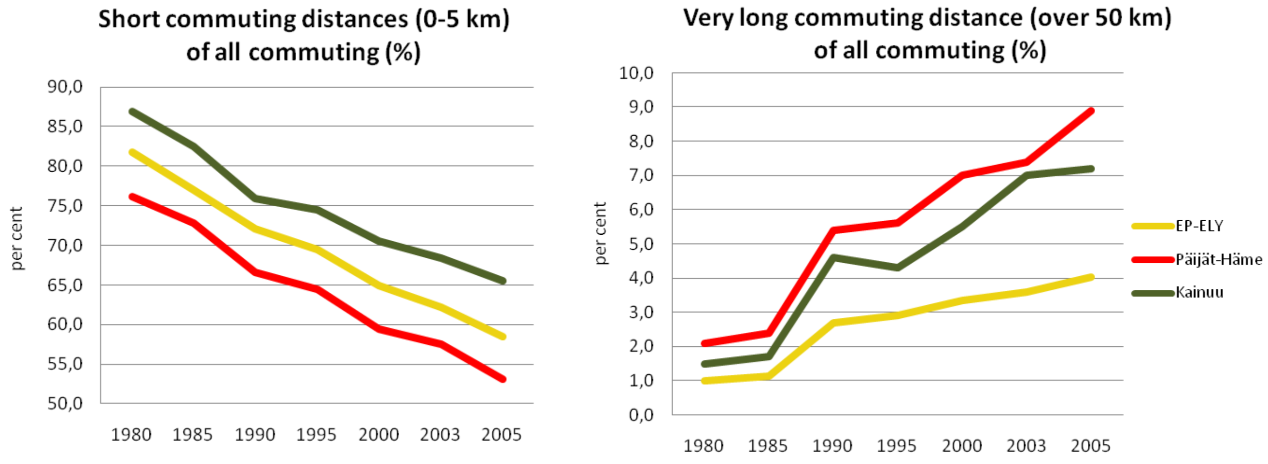


Figure 27: The development of commuting distances (very short and very long) 1980-2009

P – Cost of Automobile Accidents

The damage and economic loss due to automobile accidents represents a real cost of industrialization and increasing traffic densities. In Finland, this is not a problem of same scale than in many parts of the world, though traffic jams start to be a problem in the biggest cities of Finland as well. Nevertheless, economic costs resulting from accidents cannot be considered as an increase in well-being and can therefore be subtracted from expenditures in order to better describe well-being.

The costs in the Finnish GPI include injuries and loss of lives as well as material damages. The figures are derived from the Finnish GPI (Rättö 2008) and ISEW (Hoffrén 2001) and adjusted to sub-national level by the frequency of each type of damage in each region. The data on accidents was available on national level until the year 1970 and on sub-national until 1990. The calculations are the extrapolated backwards assuming the proportions have remained unchanged (adjusted with population). The data is derived from Statistics Finland PX-Web database (Traffic and tourism, Accidents and Regional Accounts, Traffic).

Q - Cost of Water Pollution

Water resources are a valuable asset but no economic account accounts for the cost of damage to water quality. In the GPI framework, the costs of water pollution arise from (1) damage to water quality and (2) damage from siltation which reduces the life span of water impoundments or channels. The latter had to be omitted from the Finnish GPI due to data gaps. Damage to water quality here means acidification and eutrophication due to nitrogen and phosphorous discharges.

The prices used are derived from studies that estimate the economical and health cost due to pollution. The actual prices should be replaced with new ones since the Finnish studies can be considered outdated (source:

ISEW by Hoffrén 2001; Tiehallinto, Liiketaloustieteellinen tutkimuslaitos 1998). The prices and deflated over the years using GDP-deflator (from National Accounts). This method is used by Talberth et al. (2008) and recommended also by Stiglitz commission (Stiglitz et al. 2010, s. 292).

The regional pollution figures are from VAHTI database by SYKE that reports point source pollution. The emissions originating from scattered sources were estimated using information about the proportions of each pollutant source and the data acquired from VEPS database covering years 2000-2009. The cost of water pollution was in general the highest in 1990s and has been cut down since.

R – Cost of Air Pollution

The annual economic cost of air pollution to households, infrastructure, the environment, and human health is a typical example of environmental costs that lie outside the boundary of the traditional national accounts. In the Finnish GPI accounts emissions to air include for nitrogen oxides, sulphur dioxide and particle emissions. (Carbon dioxide emissions are accounted for separately, in Column X.) The trend in these emissions is descending. Due to the lack of data only the emissions originating from industrial activity and energy production could be accounted for. There was not enough information available for estimating the remaining emissions. Therefore the real costs of air pollution can be regarded significantly larger.

The prices used are derived from studies that estimate the economical and health costs due to pollution. The actual prices should be replaced with new ones since the Finnish studies can be considered outdated (source: ISEW by Hoffrén 2001; Tiehallinto, Liiketaloustieteellinen tutkimuslaitos 1998). The prices are deflated over the years using GDP-deflator (from National Accounts). This method is used by Talberth et al. (2006) and also recommended by Stiglitz commission (Stiglitz et al. 2010, s. 292). The importance of this column in the resulting GPI is not very big and newer, national studies on the effect of air pollutants for health and infrastructure are needed.

S - Cost of Noise Pollution

Cost of noise pollution has been estimated for Finland in several studies, for example Tiehallinto 2005 and Liikonen & Leppänen 2005. The values used in the Finnish GPI are derived from ISEW (Hoffrén, 2001) and updated here. The cost of noise pollution is estimated by multiplying the amount of people exposed to noise by a cost factor created for the Finnish ISEW and GPI (Hoffrén 2001; Rättö 2008). The cost factor was based on several studies by e.g. Lampinen, 1991 and Tiehallinto. The sub-national figures include noise from ground traffic, air traffic, waterborne traffic, shootings and motor sport.

T - Loss of Wetlands

Wetlands contain some of the most productive habitat in the world produce other benefits such as regulating and purifying water and providing habitat for different species. Yet their value is not represented in economic accounts because the benefits. When a wetland id drained, the GDP rises by the increased output of the farm or value of stock of wood. However, the loss of services from wetlands goes uncounted. The GPI estimates the value of the services that are given up when wetlands are converted to other purposes. To do this, the area of wetland loss in each year is multiplied by $914 (per acreage, around 2 500 Euros per hectare), the value of an acre of wetland as estimated by a meta-analysis of wetland valuation studies reviewed by Woodward and Wui (2000, in Talberth et al. 2006, p. 16). The values of wetland lost before 1960 was also taken into account, but the price used here was lower based on the study by Costanza et al. (2004), around 396 Euros per acreage. Talberth et al. and Costanza set the price per hectare constant to account for the increasing scarcity of the resource.

The way the loss of wetland is estimated in the GPI may not describe the Finnish circumstances in the best way. Our soil is exceptionally swampy and the value may be overestimated, or just as well underestimated. This is why the results are also presented without Column T and Column V.

The original area of wetlands in Finland was around 10,4 million hectares. According to Metsäntutkimuslaitos (Metla), there are now around 4,1 million hectares of untreated wetland left in Finland. In 1950s, the figure was 8,8 million hectares. A part of the swamps have been restored since 1989, around 20 000 hectares in total. In Finland Metla provides good data on wetlands lost in each Forestry Centre area. Jouni Penttinen in Metsähallitus (Etelä-Suomen luontopalvelut) provided additional information for this project. For Kainuu and South Ostrobothnia these figures were easy to acquire, but for Päijät-Häme the area was estimated by a percentage share from Häme Forestry Centre figures. Nevertheless, in Päijät-Häme these figures have the smallest significance.

V - Loss of Forests and Damage from Logging Roads

In the methodology created by Talberth et al. (2006) the idea is to take into account the loss of *primary* forests. Nevertheless, according to many, there are hardly any forests left in Finland that can be considered to be in their natural state. One could look at the area of protected forests, but as in the Finnish GPI (Rättö 2008), the changes in the overall forest area is included here. Other possibility would be to account for the changes in the amount of wood (kilograms) in the Finnish forests and consider this as an economic investment as well as something that hinders the global warming. This method is used in Finnish Genuine Savings (GS) study (Lemmetyinen, 2010).

The cost per acre was derived from Talberth et al. (2006) that use the figure 134 dollars by Costanza et al. (1997). This translates to 1 5000 Euros per hectare and includes ecosystem services and passive use values as estimated by numerous studies including Vincent, et al. (1995, in Talberth et al. 2006, p. 17). The value does not include raw materials and climate regulation.

According to Talberth et al. (2006) the GPI accounts measure this loss by assigning a price tag to year by year estimates of forest losses and adding such losses to the cumulative damage from previous years. It also incorporates costs associated with national forest logging roads, which are continuing sources of sedimentation, landslides, fires, and habitat fragmentation. It is doubtful whether the methodology used here is the best to describe Finnish nature. As better studies have not been available this methodology used by Rättö (2008) was followed also in this sub-national study. Column V is also omitted in GPI(2) because of this concern, and also because it was concluded that in addition to loss of wetlands this column is greatly determined by regions geography and vegetation.

In Finland the forest area has not diminished but increased. The growth of forests can be taken as an investment, a contribution. Only in Päijät-Häme the forest area decreased in 1960s and 1970s but has increased ever since. In Kainuu and area of CEDESO the contribution of Column V is significant (+). The calculation of effect caused due to forest logging roads is based on the total stock of roads in any given year. Estimates of total miles of forest roads are estimated by Hoffrén and Andersson (2010) and were not updated here. Value per kilometer is around 8 000 Euros per kilometer.

W - Depletion of Nonrenewable Energy Resources

The depletion of nonrenewable resources is a cost shifted to future generations that should be somehow made a cost for the present generation. Nonrenewable natural capital cannot be increased, it can only be diminished. Our current accounting system counts this liquidation of natural capital wealth as income which can be considered misleading, because it is not a permanent or sustainable source of consumption. (Talberth et al. 2006, p. 18.)

The GPI uses estimates of renewable energy replacement costs as an approximation for the costs of depleting nonrenewable energy reserves. To calculate replacement costs, Talberth et al. (2006) rely on the costs of biomass fuel production. They admit that while the approach is debatable, it is both intuitive and reasonable, since biomass fuel was the largest share (47%) of the renewable energy market in 2004.

The replacement cost is assumed to be of 110 Euros per barrel based on a U.S. study that took into account the effects of subsidies and increasing marginal costs as biomass demand and production increase. To account for scarcity the cost was decreased by 3% per year prior to 1988 and increased by the same rate in subsequent years. The Finnish nonrenewable energy consumption was converted to equivalent barrels of oil, and then multiplied by the adjusted annual replacement cost figure by Rättö in 2008. The data was derived from Energy Statistics (2007) by Statistics Finland. For this study the sub-national adjustments were made on the basis of information from several sources as there was no regional nonrenewable fuel consumption data available even in the 2000s.

It is of common knowledge that both GDP growth and carbon dioxide emissions follow the use of nonrenewable energy resources regionally, nationally and internationally. Therefore the GDP- and CO_2-shares of the region were taken as a basis of the estimation. Additional information has defined the figures for Kainuu and Päijät-Häme. For Kainuu the share of nonrenewable energy was defined on the basis of information found in publications of local administration (Kainuun Seutukaavaliitto). For example, in 1970 the region required 2,2 % of the total energy used in Finland while the use of fuels was only 1,5 %. At this point of time Kainuu accounted for 2 % of the national GDP. For Päijät-Häme the figures were somewhat adjusted as the VAHTI-database provided the share of renewable energy of total fuels used since 1995 and this share has increased in Päijät-Häme.

X – Carbon Dioxide Emissions Damage

Few scientists dispute the link between carbon dioxide emissions and global warming or the link between global warming and increasing incidence and severity of damaging storms, floods, and droughts. As the extreme weather phenomena have demostrated, climate change also causes enormous economic costs to households, infrastructure, business and natural capital. The severe weather events escalate the costs in insurance payouts and replacing lost or damaged homes, buildings, livestock, and other household resources. (Talberth et al. 2006, p.19.) Ironically the cost of repairing the damages only increase the GDP, although for example the lost of wood also produces economic losses.

The GPI attempts to address these damages by assigning costs to carbon emissions. There are many ongoing studies that attempt to calculate economic damages per ton of carbon emitted into the atmosphere through burning of fossil fuels. The approximated costs vary in different analyses. Talberth et al. (2006) rely on a recent meta-analysis of 103 separate studies carried out in 2005 (see Tol 2005, references in Talberth et al. 2005) that found a mean of $93 per metric ton which is around 100 Euros per tonne in year 2000 dollars. Other indicators have adopted other prices (e.g. Genuine Savings index by World Bank uses $20 in 2000 and the cost in deflated over the years by using GDP deflator as suggested by Stiglitz et al. 2010). In the GPI it is assumed that only excess emissions are contributing to global warming and deduct the portion of these emissions sequestered by the world's terrestrial and aquatic ecosystems. Globally, the Intergovernmental Panel on Climate Change estimates the Earth's carbon sequestration capacity to be 3 gigatonnes (Gt) carbon per year (Talberth et al. 2006, p. 19). Worldwide, overshoot of this sequestration capacity began in 1964 (not counting natural sources of carbon dioxide). In the GPI accounts the global overshoot is taken as the basis but since the global emissions are nowadays growing significantly faster than the Finnish, only the Finnish overshoot percentage is acknowledged since 1964. Talbert et al. (2006) also assumed that marginal damage due to carbon dioxide omissions increases over time. To account for this the marginal damage costs are run down from $89.57 in 2004 to just over zero in 1964, the first year of carbon overshoot (Talberth et al. 2006, p. 19). The marginal damage is calculated to be cumulative so that costs incurred one year continue to be incurred the next year. The methodology is used in the Finnish GPI by Rättö (2008). The calculation methodology of Column X differs significantly between different GPI applications. (See for example Appendix 2; Stiglitz et al. 2010, p. 278; GPI Atlantic).

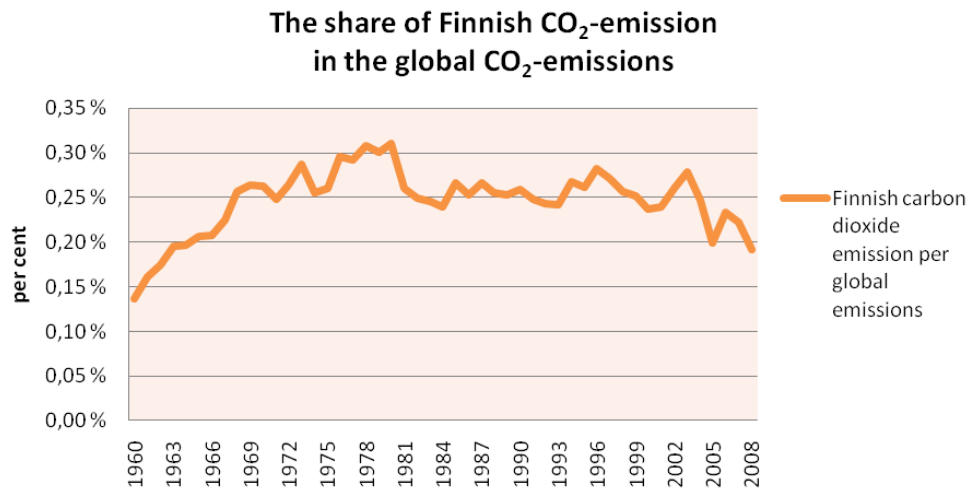


Figure 28: Share of Finnish CO_2-emissions in the global emissions.

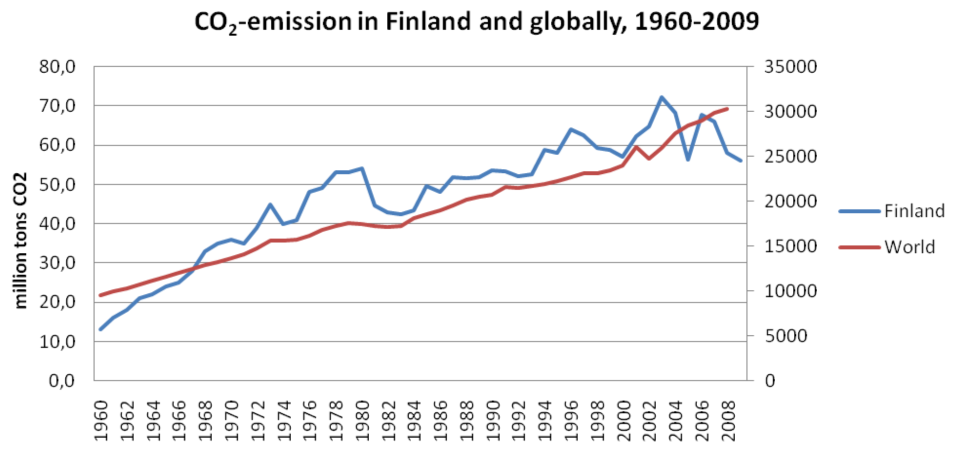
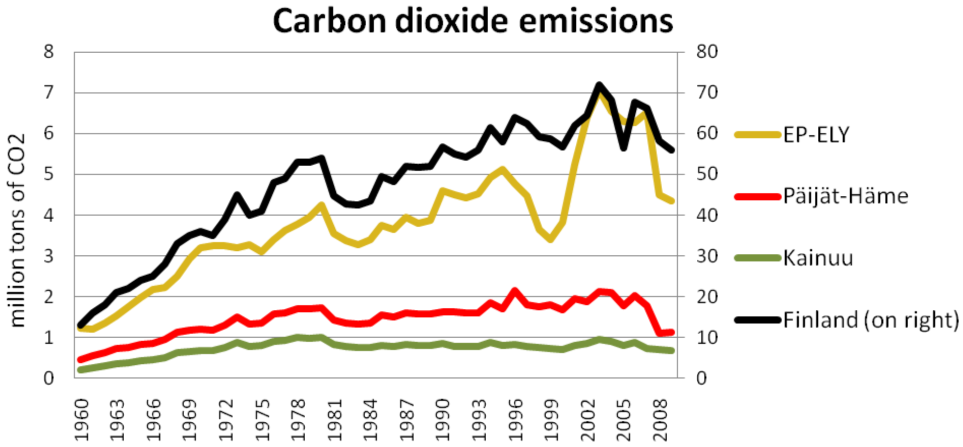


Figure 29: CO_2-emission million tons. Figures for Finland on the left hand side axis, global emission on the right hand side axis. Sources: Statistics Finland and Oak Ridge Laboratory

Weight of carbon is 12/44 per each ton of carbon dioxide. The national data is available at Statistics Finland's database but sub-national data had to be acquired from different sources. The data provided here are reliable until back to year 1980 and before that the margin of error increases.



Z - Net Capital Investment

For an economy to prosper over time, the supply of capital (buildings, machinery, and other infrastructure) must be maintained and increased to meet the demands of increased population. If this does not occur, the society is consuming its capital as income. Thus, one element of economic sustainability is constant or increasing quantities of capital available for each worker. The GPI calculates changes in the stock of capital (or net capital growth) by adding the amount of new capital stock (increases in net stock of private nonresidential fixed reproducible capital) and subtracting the capital requirement, which is the amount necessary to maintain the same level of capital per worker. The aim of this column is to estimate increases in the stock of capital available per worker. (Talberth et al. 2006, p. 20.)

The capital requirement is estimated by multiplying the percent change in the labor force by the stock of capital from the previous year. Column Z was calculated for the Finnish GPI in 2008 (from ISEW by Hoffrén 2001 and updated by Rättö 2008). For this study the column has not been updated due to lack of data. Thus the GRP-share of each area was used. This causes no big error since the significance of Column Z is very small, less than 1 %.

AA - Net Foreign Borrowing

The economic sustainability of a nation is also affected by the extent to which it relies on foreign funding to finance its current consumption. A nation that borrows from abroad to pay for a spending spree will feel rich for a short time. But the illusion of wealth will vanish when the debt comes due or when the value of the currency drops as foreign investors lose confidence in that nation's ability to repay its loans. The GPI counts net additions to the capital stock as contributions to well-being, and treats money borrowed from abroad as reductions. If the borrowed money is used for investment, the negative effects are canceled out. But if the borrowed money is used to finance consumption, the GPI declines. (Talberth et al. 2006, p. 20.)

Column AA could be further developed for sub-national applications as it is now measuring the national (foreign) borrowing. The numerical value of the column is small in the current form and it is adjusted to sub-national level by using the GRP–share of each area.

The components included in the U.S. GPI methodology but omitted in the Finnish GPI (2008) and in this study:

O - Cost of Household Pollution Abatement

One of the costs that pollution imposes on the households of the nation is the expenditures made for equipment such as air and water filters. These defensive expenditures do not improve the well-being of households, but merely compensate for the externalities (pollution) imposed upon them as a result of economic activity. (Talberth et al. 2006.) This column was omitted in the Finnish GPI because such data was not available and could not be estimated properly.

U - Loss of Farmland

Talberth et al. (2006) treat farmland as a part of natural capital. By destroying farmland, we are losing a vital ecosystem service - sustainable food supply. Farmland losses also generate costs in the form of lost scenic, aesthetic, and historic values, increased flooding, deterioration in water quality, and degradation of wildlife habitat. In the U.S. GPI accounts the farmland losses resulting from urbanization and lost productivity are acknowledged.

The column was calculated in the Finnish GPI in 2008 by Rättö but the significance of the component was less than 1 per cent in the accounting. In Finland the farmland is not generally *lost,* rather it is generated by draining wetlands and this should not be taken as a positive contribution. Thus the sub-national level adjustment for Column U was ignored.

Y - Cost of Ozone Depletion

While the production of CFCs has declined dramatically, the cumulative impacts on the depletion of the earth's ozone layer continues. Despite the fact that this still is a significant problem globally, the use of CFC in Finland is minor and there was no data available neither for the amounts of for the health and ecological consequences of ozone depletion.

Appendix 2: Recent National and Sub-national Application Using Genuine Progress Indicator

Few application, national and sub-national, using GPI are listed below. These studies use somewhat different methodologies. Several other work can be found by using internet search engines and journal databases.

- Germany 2010: New Welfare Index http://www.polsoz.fu-berlin.de/en/polwiss/forschung/systeme/ffu/aktuell/10_nwi.html
- Maryland, USA http://www.green.maryland.gov/mdgpi/index.asp
- Vermont, USA http://www.uvm.edu/giee/?Page=genuine/index.html
- Alberta, Kanada http://www.pembina.org/economics/gpi/alberta
- GPI Atlantic http://www.gpiatlantic.org/

The components of each application are presented in a table below.

	GPI Finland	Maryland	Vermont	NWI Germany	Alberta
	2008 ja 2010	2009	Chittenden county	2010	2005
			Burlington (2006)		
Light blue fill: The methodology used for this component differs signicantly from the one used in the Finnish GPIs					
Component					
Personal consumption weighted by income income distribution	**x**	x	x	x	x
+ Value of household work and parenting	**x**	x	x	x	x
+ Value of higher education	**x**	x		x	
+ Value of volunteer work	**x**	x	x	x	x
+ Services of consumer durables	**x**	x	x	x	x
+ Services of highways and streets	**x**	x	x	x	x
- Cost of crime	**x**	x	x		x
- Loss of leisure time	**x**	x	x	x	x
- Cost of unemployment	**x**	x	x		x
- Cost of consumer durables	**x**	x	x		x
- Cost of commuting	**x**	x	x	x	x
- Cost of household pollution abatement		x	x		
- Cost of automobile accidents	**x**	x	x	x	x
- Cost of water pollution	**x**	x	x	x	x
- Cost of air pollution	**x**	x	x	x	x
- Cost of noise pollution	**x**	x	x	x	
- Loss of wetlands	**x**	x	x	x	x
- Loss of farmland	**x**	x	x	x	
-/+ Loss of forest area and damage from roads	**x**	x	x		x
- Depletion of nonrenewable energy resources	**x**	x	x	x	x
- Carbon dioxide emissions damage	**x**	x	x	x	x
- Cost of ozone depletion		x	x		
+/- Net capital investment	**x**	x	x	x	
+/- Net foreign borrowing	**x**		x	x	
Breakdown of families, divorses		x	x		x
Public spending on healt and education				x	
Cost of alcohol and drug abuse				x	
Cost of environmental hazards				x	
Cost of soil degradation				x	
Economic diversity					x
Economic growth (GDP)					x
Trade					x
Salaries					x
Taxes					x
Savings					x
Household dept					x
Poverty					x
Transportation costs					x
Life expectancy and health					x
Premature mortality					x
Infant mortality					x
Obesity					x
Suicide					x
Drug use					x
Gambling problem					x
Voter participation					x
Educational attainment					x
Oilsands reserve use sustainability					x
Energy use					x
Agricultural sustainability					x
Fish and wildlife					x
Parks and wilderness					x
Hazardous waste					x
Landfill waste					x
Ecological footprint					x

Appendix 3: Maps

Figure 30: Municipalities in Päijät-Häme

Figure 31: Municipalities in Kainuu

Appendix 4: Genuine Progress Indicator components (Columns) data for Päijät-Häme, Kainuu and the area of CEDESO

Päijät-Häme

Päijät-Häme	(million euros, rp 2000)									
Column A	Column B (+)	Column C (+/-)	Column D (+)	Column E (+)	Column F (+)	Column G (+)	Column H (+)	Column I (+)	Column J (-)	Column K (-)
	Personal	Income	Weighted	Value of	Value of	Value of	Services of	Services	Costs	Loss of
Year	Consumption	Distribution	personal	housework	higher	volunteer	consumer	of	of	leisure
		Index	consumption	and parenting	education	work	durables	highways	crime	time
1960	750,0	155,4	482,8	409,8	18,0	35,6	55,3	3,4	1,5	185,0
1961	810,5	155,4	521,7	430,7	19,8	35,4	60,0	3,6	1,6	180,5
1962	855,9	155,4	550,9	450,6	21,8	34,5	66,2	3,9	1,8	172,5
1963	893,9	155,4	575,4	469,5	22,6	33,5	72,0	4,3	1,9	163,9
1964	924,7	155,4	595,2	487,6	24,7	30,8	79,4	4,9	2,0	147,6
1965	965,6	155,4	621,6	525,3	27,3	32,4	87,7	5,7	2,2	152,1
1966	985,8	155,4	634,6	548,9	30,4	34,2	93,0	6,9	2,3	155,7
1967	1016,7	151,3	672,0	573,4	33,6	35,7	97,2	7,8	2,5	159,4
1968	1020,4	147,2	693,1	599,0	37,1	36,9	98,7	8,7	2,6	159,5
1969	1125,3	143,2	786,0	645,5	44,6	39,2	104,3	9,5	2,7	163,5
1970	1195,4	139,6	856,3	681,0	48,8	41,8	111,5	10,6	2,9	168,3
1971	1218,6	134,5	905,8	728,7	52,4	44,8	116,3	11,1	3,0	172,4
1972	1333,5	129,3	1031,7	765,4	57,4	47,2	125,6	12,0	3,1	173,0
1973	1414,6	124,0	1141,1	796,3	61,8	49,3	137,1	12,6	3,3	181,0
1974	1466,0	118,7	1235,1	819,4	69,1	52,2	145,2	13,6	3,3	186,5
1975	1472,5	114,4	1286,9	855,6	73,8	54,1	152,1	19,8	3,2	195,7
1976	1490,1	109,1	1365,4	872,6	81,4	54,6	155,5	20,3	3,2	196,6
1977	1497,7	108,1	1385,2	853,3	87,2	52,8	160,5	20,7	3,2	189,6
1978	1539,3	107,1	1437,2	861,2	93,4	52,8	163,0	21,0	3,2	189,6
1979	1614,9	106,1	1522,2	909,4	99,0	55,1	165,9	21,5	3,2	197,8
1980	1671,8	105,1	1591,0	926,4	103,3	55,4	171,6	21,7	3,1	173,7
1981	1689,8	104,1	1623,9	954,1	107,6	56,0	176,2	21,8	4,2	150,3
1982	1766,6	103,4	1708,7	977,4	111,5	56,8	185,4	21,5	5,0	127,0
1983	1813,4	102,7	1765,6	1006,3	114,7	57,9	193,5	21,5	6,2	103,5
1984	1839,4	102,0	1802,8	1042,7	103,0	59,5	200,4	21,4	7,3	79,6
1985	1905,7	101,4	1880,3	1080,0	111,6	61,0	214,2	21,4	7,8	54,4
1986	1954,3	100,7	1941,1	1126,8	119,0	62,9	226,4	21,4	8,9	28,4
1987	2017,3	100,0	2017,3	1178,7	125,2	64,9	238,5	21,5	10,7	0,0
1988	2068,6	102,5	2017,4	1239,9	131,1	67,4	250,2	21,5	12,7	6,1
1989	2150,1	103,6	2076,4	1313,1	140,0	69,0	266,0	21,9	13,2	12,4
1990	2144,3	103,5	2071,1	1355,4	145,7	71,3	280,2	13,6	12,2	18,9
1991	2137,4	103,0	2074,5	1392,5	151,7	73,1	289,8	12,8	11,0	24,4
1992	2112,0	101,0	2091,1	1391,0	157,8	72,8	286,9	11,9	10,1	28,6
1993	2078,5	107,1	1940,8	1379,9	164,1	71,8	276,8	11,0	10,0	31,8
1994	2103,9	107,1	1964,6	1397,8	171,9	72,3	260,7	10,6	9,7	35,1
1995	2112,8	113,7	1858,2	1454,4	174,1	74,7	242,8	10,8	9,2	43,1
1996	2174,1	113,1	1922,5	1508,2	179,8	76,9	238,8	10,9	8,4	49,4
1997	2280,4	121,5	1876,2	1526,2	187,3	77,7	244,6	11,1	8,2	46,0
1998	2322,0	124,7	1862,8	1569,7	213,4	79,5	248,9	11,3	6,9	42,6
1999	2379,1	129,1	1843,2	1593,7	221,0	80,3	259,1	11,6	7,6	37,0
2000	2482,5	131,7	1885,0	1606,0	228,5	80,7	279,1	11,6	6,4	32,3
2001	2468,5	128,8	1916,7	1637,7	235,9	82,3	283,5	11,6	6,5	27,3
2002	2548,7	128,9	1977,1	1667,5	245,4	83,9	305,3	11,6	7,0	21,9
2003	2660,3	131,4	2024,8	1718,4	254,5	86,5	330,3	11,8	6,9	15,9
2004	2754,9	134,6	2046,5	1787,4	263,3	89,5	358,8	12,1	6,6	16,4
2005	2872,5	135,3	2122,9	1847,5	272,4	92,2	391,8	12,2	6,7	16,7
2006	3035,9	138,6	2190,2	1878,9	282,3	93,4	431,3	12,0	6,8	15,9
2007	3131,0	141,1	2218,7	1899,9	295,0	94,7	463,5	11,7	6,9	15,0
2008	3235,2	137,1	2359,3	1998,3	315,2	100,0	506,7	11,5	6,6	16,1
2009	3160,8	137,1	2306,2	1997,3	336,5	100,4	518,8	11,3	6,9	15,8

Päijät-Häme	(million euros, rp 2000)									
	Column L (-)	Column M (-)	Column N (-)	P (-)	Q (-)	R (-)	S (-)	T (-)	V (-)	W (-)
	Costs of	Costs of	Costs	Costs of	Costs of	Costs of	Costs of	Loss	Loss	Resource
Year	under-	consumer	of	auto	water	air	noise	of	of	depletion
	employment	durables	commuting	accidents	pollution	pollution	pollution	wetlands	forests	
1960	11,8	46,8	39,2	2,9	7,0	2,8	1,7	235,7	0,3	29,5
1961	11,8	54,6	41,4	3,5	7,4	2,9	2,4	246,4	0,3	35,2
1962	11,6	64,4	42,4	3,8	7,8	3,1	3,1	257,2	0,3	41,7
1963	11,2	65,1	43,6	4,7	8,2	3,3	3,9	268,0	0,3	51,8
1964	10,4	75,3	44,5	5,7	8,9	3,5	4,7	278,7	0,3	63,5
1965	10,9	83,6	48,3	7,0	9,3	3,7	5,6	289,5	0,3	77,3
1966	11,3	74,0	50,4	7,6	9,8	3,9	6,5	302,2	1,4	98,2
1967	11,8	73,0	53,4	7,6	10,6	4,2	7,2	314,8	2,4	104,3
1968	12,1	65,2	57,6	8,2	11,9	4,8	7,6	327,5	3,4	121,1
1969	12,8	87,2	62,9	8,7	12,5	5,0	8,6	340,2	4,4	142,9
1970	13,6	98,2	65,7	9,7	14,9	5,3	9,6	352,9	5,5	188,2
1971	14,5	90,7	67,2	11,3	16,1	5,7	10,2	365,5	6,5	194,3
1972	15,9	115,4	71,0	12,3	15,4	6,2	10,6	378,2	7,6	218,2
1973	17,2	130,3	73,9	12,8	17,6	7,2	10,4	390,9	7,1	247,7
1974	20,5	119,6	73,9	12,7	18,1	8,8	9,7	403,5	6,5	233,5
1975	25,4	120,9	74,7	15,3	68,7	10,5	9,3	416,2	6,0	241,8
1976	32,3	111,6	77,1	15,5	42,4	11,9	9,6	428,9	5,4	281,5
1977	45,4	111,0	80,7	15,5	46,5	13,2	10,1	439,6	4,9	289,6
1978	53,8	109,0	84,5	14,3	47,6	14,3	10,4	450,4	4,3	317,5
1979	47,3	124,2	89,7	16,7	53,3	15,6	10,9	461,2	3,8	334,3
1980	52,6	130,0	92,9	16,2	66,7	17,5	11,7	472,0	3,2	348,2
1981	51,3	137,8	93,5	18,9	50,3	19,8	12,3	482,7	2,6	281,1
1982	66,7	158,7	95,6	20,9	58,9	21,9	12,7	493,5	2,1	263,5
1983	66,3	161,8	97,9	24,0	67,6	24,0	13,0	504,3	1,5	271,6
1984	62,8	167,9	100,2	24,5	70,4	26,4	13,2	511,9	1,0	281,7
1985	70,1	187,3	102,8	26,6	74,6	28,2	13,4	519,5	0,4	330,2
1986	72,7	193,8	108,2	31,3	81,9	30,0	13,4	527,1	-0,1	331,2
1987	75,2	202,9	116,8	31,9	85,4	30,8	13,4	534,7	-0,7	368,4
1988	81,3	223,5	124,3	38,2	87,2	32,9	13,2	542,3	-1,2	376,7
1989	64,9	232,3	125,9	45,3	104,0	36,7	13,5	549,9	-1,8	392,8
1990	105,1	212,6	129,9	45,5	121,9	38,0	13,9	557,5	-2,3	406,2
1991	242,0	174,5	125,2	43,8	107,4	37,5	14,6	559,0	-2,9	407,7
1992	361,3	140,9	121,7	40,6	100,6	33,5	14,8	560,6	-3,4	399,7
1993	429,3	126,9	116,5	33,7	106,5	31,5	14,9	562,1	-3,9	415,7
1994	393,4	137,9	108,5	33,5	104,0	32,1	15,3	563,6	-4,5	471,1
1995	386,1	150,1	110,9	34,4	110,2	31,9	15,5	565,2	-4,0	495,3
1996	402,8	175,3	120,2	30,6	103,4	36,3	16,2	566,7	-4,9	590,4
1997	352,5	192,9	133,0	33,2	111,4	36,5	16,4	568,2	-5,1	547,7
1998	331,0	221,1	151,0	31,4	116,5	36,8	16,7	569,8	-6,3	531,2
1999	312,2	226,0	156,6	33,2	102,2	36,0	17,3	571,3	-6,9	549,1
2000	296,4	242,7	171,1	30,3	114,8	33,3	17,8	572,9	-7,4	538,0
2001	274,4	230,5	181,3	32,4	115,8	38,9	18,2	574,4	-8,1	623,5
2002	272,5	256,9	189,4	30,9	121,2	39,4	18,1	575,9	-8,7	622,3
2003	273,0	296,4	195,2	32,8	98,6	38,5	18,9	577,5	-9,3	738,4
2004	265,4	312,6	203,1	21,3	110,3	34,2	19,4	576,3	-9,4	737,5
2005	271,0	345,6	203,1	32,8	90,1	32,8	20,0	575,1	-9,3	684,0
2006	255,5	385,2	207,0	22,0	81,1	34,0	20,4	573,9	-9,4	797,7
2007	212,0	401,6	211,5	42,0	78,9	27,0	20,5	572,7	-9,4	728,2
2008	231,4	443,3	222,0	22,6	82,9	25,6	21,1	571,5	-9,3	577,5
2009	280,7	378,2	210,7	25,1	86,8	23,6	19,6	570,3	-9,3	582,9

Päijät-Häme	(million euros, rp 2000)									
	X (-)	Z (+/-)	AA (+/-)	GPI(1)	GPI(1)	GPI(2)	GPI(2)			
	Carbon dioxide	Net	Net	Genuine	GPI	Genuine	GPI	GDP	population	GDP
Year	emissions	capital	borrowing	Progress	euros per	Progress	euros per	euros per		million
	damage	investment		Indicator	capita	Indicator	capita	capita		euros
1960	0,0	0,1	0,0	441	2787	677	4278	8553	158179	1353
1961	0,0	0,1	5,7	489	3040	736	4575	9075	160757	1459
1962	0,0	0,0	4,2	523	3200	780	4777	9217	163335	1506
1963	0,0	0,0	-15,4	536	3230	804	4847	9390	165913	1558
1964	0,0	0,0	31,5	609	3614	888	5270	9756	168491	1644
1965	0,1	-0,1	-0,2	610	3566	900	5260	10154	171068	1737
1966	0,2	-0,1	0,1	624	3604	928	5356	10286	173274	1782
1967	0,7	-0,1	-8,7	659	3755	976	5563	10392	175480	1824
1968	2,1	-0,1	-40,6	649	3653	980	5515	10519	177686	1869
1969	4,1	-0,2	8,8	782	4348	1127	6264	11435	179892	2057
1970	6,7	-0,2	48,0	856	4704	1215	6673	12214	182050	2224
1971	9,4	-0,2	14,1	906	4946	1278	6977	12398	183176	2271
1972	13,8	-0,3	-40,9	957	5195	1343	7288	13237	184302	2440
1973	21,3	-0,3	27,2	1105	5957	1503	8103	13995	185428	2595
1974	27,0	-0,3	75,3	1286	6734	1696	8880	14144	191000	2702
1975	33,7	-0,3	66,7	1287	6736	1709	8946	14035	191050	2681
1976	45,3	-0,4	-94,4	1194	6246	1628	8519	14002	191100	2676
1977	58,7	-0,4	-82,8	1169	6102	1613	8423	14170	191519	2714
1978	76,5	-0,5	-57,1	1196	6228	1650	8597	14460	191973	2776
1979	96,1	-0,5	61,4	1380	7178	1845	9596	15883	192257	3054
1980	118,1	-0,6	70,5	1433	7443	1908	9910	16770	192582	3230
1981	130,6	-0,7	-55,1	1448	7506	1934	10021	15877	192956	3064
1982	141,5	-0,8	26,5	1619	8382	2115	10947	15647	193170	3022
1983	152,9	-0,9	12,9	1677	8653	2183	11263	16289	193793	3157
1984	165,5	-1,0	-63,8	1653	8493	2166	11128	16451	194626	3202
1985	184,9	-1,0	44,5	1812	9289	2332	11954	17089	195041	3333
1986	203,6	-1,0	-11,8	1855	9503	2382	12202	17451	195171	3406
1987	227,8	-1,0	33,5	1981	10154	2515	12891	18130	195118	3538
1988	252,4	-1,1	24,5	1961	10034	2502	12802	18944	195467	3703
1989	278,7	-1,2	95,4	2113	10763	2661	13555	19956	196291	3917
1990	307,9	-1,4	3,2	1972	10009	2527	12827	19626	197012	3867
1991	337,1	-1,6	2,6	1914	9679	2470	12492	18104	197753	3580
1992	365,0	-1,7	-32,8	1803	9091	2360	11900	17185	198329	3408
1993	393,8	-1,8	-110,5	1463	7371	2021	10183	16809	198503	3337
1994	433,4	-1,8	-76,6	1466	7388	2025	10205	17305	198456	3434
1995	481,6	-1,9	-100,9	1283	6470	1844	9300	17620	198286	3494
1996	554,5	-2,0	-2,8	1283	6489	1845	9331	18251	197707	3608
1997	616,1	-2,1	-65,8	1198	6059	1761	8908	19086	197710	3774
1998	672,2	-2,0	-18,7	1244	6301	1808	9155	19298	197443	3810
1999	730,9	-1,9	2,3	1237	6266	1801	9126	19506	197347	3850
2000	784,1	-1,6	-89,3	1167	5914	1733	8779	20581	197378	4062
2001	857,3	-1,2	25,0	1219	6167	1785	9032	22026	197656	4223
2002	934,3	-0,8	-23,7	1185	5983	1752	8847	21679	198088	4112
2003	1039,4	-0,6	137,6	1241	6254	1809	9117	23073	198434	4415
2004	1136,8	-0,5	-17,3	1109	5582	1676	8436	23958	198685	4569
2005	1199,8	-0,6	66,5	1337	6718	1903	9562	24447	198975	4647
2006	1298,4	-0,7	-118,2	1081	5424	1645	8257	25450	199235	4803
2007	1383,4	-2,2	17,3	1308	6539	1872	9355	26385	200061	4848
2008	1427,6	-2,6	10,4	1660	8265	2222	11064	26400	200847	4891
2009	1470,6	-3,1	10,4	1616	8029	2177	10816	24000	201270	4498

Kainuu

Kainuu	(million euros, rp 2000)									
Column A	Column B (+)	Column C (+/-)	Column D (+)	Column E (+)	Column F (+)	Column G (+)	Column H (+)	Column I (+)	Column J (-)	Column K (-)
	Personal	Income	Weighted	Value of	Value of	Value of	Services of	Services	Costs	Loss of
Year	Consumption	Distribution	personal	housework	higher	volunteer	consumer	of	of	leisure
		Index	consumption	and parenting	education	work	durables	highways	crime	time
1960	303,7	156,9	193,6	355,0	8,8	19,8	22,4	2,3	0,4	127,2
1961	323,9	156,9	206,5	354,8	9,8	20,8	24,0	2,4	0,5	120,9
1962	337,5	156,9	215,2	349,3	10,6	20,4	26,1	2,6	0,5	112,1
1963	347,8	156,9	221,7	343,7	11,4	19,7	28,0	2,8	0,6	103,3
1964	354,8	156,9	226,2	341,1	12,2	19,0	30,5	3,2	0,6	91,0
1965	365,4	156,9	232,9	348,0	13,2	17,2	33,2	3,6	0,6	90,6
1966	367,7	158,4	232,2	363,6	14,4	18,0	34,7	4,2	0,7	90,9
1967	373,7	156,3	239,0	385,3	15,7	19,1	35,7	4,7	0,7	92,4
1968	369,6	153,8	240,3	400,8	17,0	19,9	35,7	5,2	0,7	90,1
1969	401,4	150,8	266,3	423,7	20,2	20,2	37,2	5,5	0,8	88,8
1970	420,1	147,2	285,3	433,1	21,8	20,8	39,2	5,9	0,8	86,7
1971	429,0	143,1	299,7	461,9	23,0	22,0	40,9	6,1	0,8	89,1
1972	482,0	140,4	343,3	483,7	24,3	23,5	45,4	6,4	0,8	89,0
1973	524,5	132,6	395,6	501,7	26,2	24,6	50,9	6,7	0,8	91,4
1974	557,4	124,8	446,7	514,8	28,7	25,5	55,2	7,0	0,9	92,5
1975	575,2	114,4	502,7	535,9	31,4	26,1	59,4	10,2	0,8	94,4
1976	599,0	106,6	561,9	542,1	34,4	27,3	62,5	10,5	0,8	95,8
1977	608,1	105,6	576,0	530,5	38,5	27,8	65,2	10,7	0,8	94,2
1978	635,6	105,6	602,0	533,3	41,5	27,1	67,3	10,9	0,8	95,4
1979	673,3	105,1	640,8	557,2	44,1	27,0	69,2	11,1	0,8	100,1
1980	691,9	105,1	658,5	560,4	46,2	28,1	71,0	11,2	0,8	88,3
1981	703,2	104,1	675,8	567,0	47,8	28,4	73,3	11,2	1,1	76,6
1982	736,7	100,8	730,5	575,8	48,9	28,7	77,3	11,1	1,4	64,8
1983	761,0	100,2	759,8	586,1	49,9	29,0	81,2	11,1	1,5	52,8
1984	785,4	97,0	810,1	598,0	49,8	29,4	85,6	11,0	1,8	40,3
1985	814,3	96,3	845,8	608,2	51,3	29,9	91,5	10,9	1,9	27,4
1986	843,5	93,1	906,3	624,2	53,8	30,4	97,7	10,9	2,3	13,8
1987	883,6	92,4	956,4	638,0	55,9	31,0	104,5	10,8	2,3	0,0
1988	935,4	92,4	1012,5	656,1	57,9	31,7	113,1	10,7	2,8	2,8
1989	981,2	90,9	1079,9	666,5	61,5	32,7	121,4	10,8	2,8	5,6
1990	965,7	89,8	1074,9	686,6	63,4	33,4	126,2	6,7	2,6	8,6
1991	925,2	86,8	1065,9	701,7	65,5	34,4	125,4	6,2	2,4	10,7
1992	885,1	84,8	1044,1	697,2	68,3	35,1	120,2	5,8	2,0	12,0
1993	848,9	90,9	934,3	687,5	71,3	34,9	113,1	5,3	1,9	13,4
1994	864,7	90,9	951,7	691,9	74,9	34,3	107,1	5,1	2,3	16,0
1995	903,1	97,5	926,6	712,2	75,7	34,4	103,8	5,2	2,1	18,4
1996	910,5	102,0	892,4	729,7	78,4	35,3	100,0	5,2	2,0	20,8
1997	879,2	106,6	824,8	729,2	81,4	36,1	94,3	5,2	1,8	19,4
1998	856,1	109,6	780,8	740,5	85,3	36,1	91,8	5,3	1,7	18,1
1999	852,2	113,2	752,8	741,3	87,6	36,6	92,8	5,3	1,8	15,8
2000	823,2	117,8	699,0	735,1	88,7	36,4	92,6	5,3	1,8	13,4
2001	820,7	115,7	709,1	738,0	90,7	36,1	94,3	5,2	1,9	10,8
2002	847,8	116,2	729,4	742,0	93,2	36,3	101,6	5,1	1,9	8,6
2003	940,0	120,8	778,1	756,7	95,5	36,6	116,7	5,1	1,8	6,4
2004	951,7	123,4	771,6	776,2	98,3	37,3	123,9	5,2	1,9	6,5
2005	967,9	130,5	741,9	791,0	101,3	38,2	132,0	5,2	1,8	6,4
2006	992,8	134,5	738,0	790,9	104,2	38,8	141,0	5,1	1,8	6,1
2007	1013,3	137,1	739,4	792,2	107,7	39,0	150,0	4,9	1,8	5,9
2008	1031,1	131,5	784,3	827,2	114,7	39,0	161,5	4,8	1,7	5,7
2009	1020,5	124,4	820,6	822,2	122,4	40,8	167,5	4,6	1,6	5,6

Kainuu	(million euros, rp 2000)									
	Column L (-)	Column M (-)	Column N (-)	P (-)	Q (-)	R (-)	S (-)	T (-)	V (-)	W (-)
	Costs of	Costs of	Costs	Costs of	Costs of	Costs of	Costs of	Loss	Loss	Resource
Year	under-	consumer	of	auto	water	air	noise	of	of	depletion
	employment	durables	commuting	accidents	pollution	pollution	pollution	wetlands	forests	
1960	7	18,9	28,1	8,4	1,0	0,6	296,7	-14,2	0,3	29,5
1961	7	21,8	28,7	8,7	1,1	0,8	320,1	-28,9	0,3	35,2
1962	7	25,4	28,3	8,9	1,2	1,0	343,6	-43,6	0,3	41,7
1963	9	25,3	28,1	9,2	1,2	1,3	367,1	-58,3	0,3	51,8
1964	11	28,9	27,8	9,7	1,3	1,5	390,5	-73,0	0,3	63,5
1965	11	31,6	29,1	9,9	1,4	1,7	414,0	-87,7	0,3	77,3
1966	17	27,6	29,8	10,2	1,5	2,0	439,1	-102,4	1,4	98,2
1967	27	26,8	31,3	11,9	1,6	2,2	464,2	-117,2	2,4	104,3
1968	48	23,6	33,1	12,0	1,8	2,3	491,8	-131,9	3,4	121,1
1969	39	31,1	34,7	12,9	1,9	2,5	516,9	-171,2	4,4	142,9
1970	25	34,5	34,4	13,7	2,0	2,7	541,9	-215,4	5,5	188,2
1971	32	31,9	35,5	14,4	2,1	2,8	567,0	-230,1	6,5	194,3
1972	49	41,7	37,3	16,2	2,3	2,8	592,1	-259,5	7,6	218,2
1973	45	48,3	37,8	18,2	2,7	2,7	617,2	-269,8	7,1	247,7
1974	52	45,5	37,1	16,5	3,3	2,5	642,3	-274,9	6,5	233,5
1975	38	47,2	36,6	16,5	4,0	2,4	667,4	-279,9	6,0	241,8
1976	60	44,9	38,1	22,8	4,5	2,5	692,5	-285,0	5,4	281,5
1977	83	45,1	40,7	22,5	5,0	2,6	715,9	-290,1	4,9	289,6
1978	100	45,0	43,0	24,7	5,4	2,7	739,4	-295,1	4,3	317,5
1979	88	51,8	45,8	24,2	5,9	2,8	762,9	-300,2	3,8	334,3
1980	77	53,8	47,5	27,2	6,5	3,0	786,3	-305,5	3,2	348,2
1981	83	57,4	48,2	23,6	7,4	3,2	809,8	-310,6	2,6	281,1
1982	93	66,2	49,7	42,4	8,1	3,3	833,2	-315,6	2,1	263,5
1983	97	67,9	51,2	60,7	8,9	3,4	849,8	-315,9	1,5	271,6
1984	101	71,7	52,5	70,4	9,7	3,4	866,4	-316,2	1,0	281,7
1985	105	80,0	54,1	109,2	10,4	3,4	882,9	-316,5	0,4	330,2
1986	109	83,6	55,3	101,8	11,0	3,4	899,5	-316,8	-0,1	331,2
1987	113	88,9	57,8	112,9	10,6	3,4	916,0	-317,1	-0,7	368,4
1988	96	101,0	60,3	85,2	10,8	3,5	932,6	-317,4	-1,2	376,7
1989	77	106,0	60,6	78,1	14,2	3,4	949,2	-317,7	-1,8	392,8
1990	99	95,7	63,2	85,4	14,6	3,3	965,7	-318,0	-2,3	406,2
1991	165	75,5	57,6	76,0	13,5	3,4	975,0	-323,0	-2,9	407,7
1992	230	59,1	51,8	73,6	12,8	3,4	984,3	-348,0	-3,4	399,7
1993	232	51,8	48,1	76,6	11,3	3,1	993,6	-362,7	-3,9	415,7
1994	216	56,7	47,8	73,9	12,5	3,2	1002,8	-377,4	-4,5	471,1
1995	231	64,1	45,0	78,1	10,6	3,6	1012,1	-392,1	-4,0	495,3
1996	256	73,4	46,3	81,2	11,2	3,6	1021,4	-409,2	-4,9	590,4
1997	222	74,4	50,0	82,9	11,5	3,7	1030,7	-424,9	-5,1	547,7
1998	215	81,5	56,6	85,9	10,6	3,6	1040,0	-434,4	-6,3	531,2
1999	206	80,9	59,7	76,7	12,2	3,8	1049,3	-439,7	-6,9	549,1
2000	199	80,5	66,7	45,7	12,8	3,9	1049,3	-450,7	-7,4	538,0
2001	209	76,6	67,1	90,3	15,1	3,9	1046,6	-456,5	-8,1	623,5
2002	199	85,5	69,8	80,6	13,8	3,8	1043,9	-445,5	-8,7	622,3
2003	189	104,7	73,7	76,3	14,6	4,2	1041,3	-435,0	-9,3	738,4
2004	188	108,0	76,5	95,0	13,7	4,3	1038,6	-424,1	-9,4	737,5
2005	187	116,4	74,5	87,3	12,8	4,5	1036,0	-413,1	-9,3	684,0
2006	167	126,0	75,4	89,9	12,5	4,7	1033,3	-402,5	-9,4	797,7
2007	140	130,0	77,3	92,8	11,1	4,8	1030,6	-391,9	-9,4	728,2
2008	158	141,3	78,1	94,2	10,4	5,0	1028,0	-381,2	-9,3	577,5
2009	164	122,1	75,7	74,5	9,8	4,6	1025,3	-371,2	-9,3	582,9

Kainuu	(million euros, rp 2000)									
	X (-)	Z (+/-)	AA (+/-)	GPI(1)	GPI(1)	GPI(2)	GPI(2)			
	Carbon dioxide	Net	Net	Genuine	GPI	Genuine	GPI	GDP	population	GDP
Year	emissions	capital	borrowing	Progress	euros per	Progress	euros per	euros per		million
	damage	investment		Indicator	capita	Indicator	capita	capita		euros
1960	0,0	0,0	0,0	115	1072	397	3715	7072	106880	756
1961	0,0	0,0	2,7	125	1162	416	3879	7552	107178	809
1962	0,0	0,0	2,0	124	1149	424	3937	7722	107622	831
1963	0,0	0,0	-7,2	111	1024	419	3882	7917	108036	855
1964	0,0	0,0	14,7	130	1212	448	4163	8276	107606	891
1965	0,0	0,0	-0,1	112	1041	438	4073	8682	107603	934
1966	0,1	0,0	0,1	110	1024	447	4160	8849	107335	950
1967	0,4	0,0	-4,0	111	1035	458	4278	8982	106996	961
1968	1,3	-0,1	-18,9	78	734	438	4119	9136	106334	971
1969	2,5	-0,1	4,1	164	1574	510	4894	9993	104116	1040
1970	4,2	-0,1	22,4	228	2258	554	5495	10743	100899	1084
1971	5,9	-0,1	6,6	236	2361	573	5733	10938	99922	1093
1972	8,8	-0,1	-19,1	245	2478	578	5838	11679	98998	1156
1973	13,7	-0,1	12,7	319	3254	666	6800	12327	97976	1208
1974	17,5	-0,2	35,1	390	3981	758	7729	12629	98039	1238
1975	22,0	-0,2	31,0	450	4595	838	8548	13105	98007	1284
1976	29,6	-0,2	-41,5	388	3932	795	8062	12177	98652	1201
1977	38,2	-0,2	-36,4	346	3490	771	7791	12394	99008	1227
1978	49,6	-0,2	-25,2	327	3294	772	7765	12612	99382	1253
1979	61,6	-0,2	26,6	407	4095	870	8751	13575	99373	1349
1980	75,0	-0,3	31,3	410	4135	891	8980	14729	99247	1462
1981	83,3	-0,4	-25,6	370	3722	870	8738	14681	99531	1461
1982	90,9	-0,4	12,3	425	4258	943	9441	14505	99883	1449
1983	98,5	-0,4	5,8	423	4232	957	9570	14531	100024	1453
1984	106,9	-0,4	-29,6	421	4219	971	9736	15303	99709	1526
1985	119,0	-0,4	19,9	448	4515	1015	10219	15417	99288	1531
1986	130,4	-0,4	-5,2	482	4873	1064	10768	15606	98842	1543
1987	144,9	-0,4	14,1	524	5346	1123	11453	15736	98078	1543
1988	159,4	-0,5	10,6	600	6166	1215	12488	16868	97316	1641
1989	174,6	-0,5	39,1	695	7169	1327	13681	17073	96973	1656
1990	192,4	-0,6	1,4	602	6206	1249	12886	17565	96957	1703
1991	209,2	-0,7	1,1	571	5907	1223	12651	16596	96689	1605
1992	225,9	-0,8	-14,5	482	4998	1119	11591	15675	96507	1513
1993	243,3	-0,8	-50,9	314	3261	945	9812	15987	96298	1540
1994	267,6	-0,8	-34,9	316	3293	941	9821	16253	95814	1557
1995	290,5	-0,9	-46,9	255	2681	875	9193	17005	95201	1619
1996	318,8	-0,9	-1,2	221	2342	833	8829	16281	94386	1537
1997	345,6	-0,9	-27,5	138	1480	744	7979	16867	93218	1572
1998	369,6	-0,8	-7,6	97	1052	702	7629	16711	92071	1539
1999	393,8	-0,8	0,9	66	722	675	7415	17469	91081	1591
2000	416,7	-0,6	-33,5	-6	-66	593	6601	16966	89777	1523
2001	447,0	-0,5	9,5	-48	-547	542	6123	18278	88473	1617
2002	481,9	-0,3	-9,4	-82	-934	517	5916	18607	87371	1626
2003	529,5	-0,2	51,3	-63	-725	544	6278	18977	86573	1643
2004	571,1	-0,2	-6,4	-162	-1884	453	5264	19691	85965	1693
2005	599,9	-0,2	23,9	-173	-2032	449	5269	19475	85303	1661
2006	642,2	-0,3	-44,7	-300	-3560	331	3918	21345	84350	1800
2007	676,9	-0,4	6,8	-201	-2396	438	5228	22445	83779	1880
2008	705,5	-0,5	1,9	-192	-2305	455	5473	24777	83160	2060
2009	732,1	-0,6	1,9	-129	-1563	525	6353	22935	82634	1895

The area of Center for Economic Development, Transport and the Environment for South Ostrobothnia (CEDESO)

Etelä-Pohj. ELY	(million euros, rp 2000)									
Column A	Column B (+)	Column C (+/-)	Column D (+)	Column E (+)	Column F (+)	Column G (+)	Column H (+)	Column I (+)	Column J (-)	Column K (-)
	Personal	Income	Weighted	Value of	Value of	Value of	Services of	Services	Costs	Loss of
Year	Consumption	Distribution	personal	housework	higher	volunteer	consumer	of	of	leisure
		Index	consumption	and parenting	education	work	durables	highways	crime	time
1960	1637,9	149,2	930,4	1727,1	26,4	99,3	120,8	9,6	2,0	561,3
1961	1748,9	149,2	1007,4	1683,9	29,3	96,6	129,4	10,1	2,2	549,1
1962	1840,6	149,2	1066,0	1654,1	32,5	92,8	142,4	10,7	2,4	526,7
1963	1915,2	149,2	1115,6	1647,6	36,1	89,9	154,2	11,6	2,6	499,0
1964	1978,7	149,2	1156,2	1619,7	40,8	81,6	169,8	13,1	2,8	471,4
1965	2051,8	149,2	1209,9	1644,8	45,8	84,2	186,4	14,9	2,9	408,5
1966	2074,2	149,2	1237,7	1684,0	50,3	86,3	195,7	17,5	3,1	417,9
1967	2130,5	145,2	1314,8	1736,1	55,2	89,0	203,6	19,6	3,3	419,6
1968	2130,5	141,1	1360,2	1788,8	60,9	90,8	206,1	21,6	3,5	418,5
1969	2345,9	137,1	1547,6	1922,2	77,9	96,2	217,4	23,3	3,7	445,2
1970	2433,7	133,0	1697,7	1988,6	84,9	100,7	227,1	25,4	3,8	370,9
1971	2485,8	127,9	1802,8	2095,3	92,2	106,1	237,2	26,3	4,0	390,0
1972	2725,7	122,6	2061,9	2162,4	98,9	109,4	256,8	27,9	4,2	397,9
1973	2897,3	117,4	2290,2	2225,9	106,1	112,6	280,9	29,1	4,3	407,8
1974	3008,5	112,1	2490,2	2302,8	125,1	116,4	298,0	30,6	4,5	411,4
1975	3035,5	109,3	2575,5	2379,3	145,0	120,2	313,5	44,5	4,5	430,5
1976	3092,1	104,1	2756,6	2382,2	159,3	120,3	322,6	45,5	4,4	430,4
1977	3072,2	103,0	2765,9	2292,8	173,8	115,7	329,3	46,2	4,4	418,1
1978	3143,9	102,0	2858,6	2279,1	188,6	115,0	332,8	46,8	4,4	419,4
1979	3330,3	101,0	3058,5	2380,7	202,9	120,0	342,1	48,0	4,3	446,9
1980	3445,0	100,0	3174,9	2434,1	215,7	122,7	353,5	48,5	4,3	400,0
1981	3525,9	99,0	3260,0	2467,3	223,5	124,3	367,7	49,0	5,4	347,5
1982	3587,1	98,3	3438,9	2514,1	231,3	126,6	376,5	48,7	6,9	295,1
1983	3678,7	97,6	3577,0	2574,6	262,9	129,5	392,5	48,9	8,1	238,0
1984	3770,4	97,0	3717,4	2648,3	294,1	133,2	410,9	48,7	9,2	183,6
1985	3800,6	96,3	3881,3	2717,2	327,6	136,6	427,1	48,7	10,3	125,6
1986	3983,3	95,6	4048,6	2806,6	357,0	141,0	461,4	48,8	10,9	64,9
1987	3977,1	93,4	4341,2	2898,3	380,9	145,5	470,2	48,8	11,4	0,0
1988	4140,8	94,9	4522,0	3007,4	405,3	150,9	500,7	48,7	12,9	13,6
1989	4439,1	95,9	4715,7	3073,7	430,1	154,2	549,1	49,4	11,6	27,4
1990	4344,7	97,5	4590,8	3170,9	453,4	159,0	567,7	30,6	11,3	41,5
1991	4194,6	97,0	4442,4	3245,1	477,0	162,6	568,7	28,8	10,7	52,4
1992	4083,2	92,4	4481,9	3231,2	501,8	161,8	554,7	26,7	10,1	60,8
1993	3938,4	97,5	4094,7	3192,9	526,7	159,8	524,6	24,7	11,2	67,3
1994	4007,3	97,5	4191,1	3227,9	552,7	161,5	496,5	23,8	10,3	81,3
1995	4285,1	104,0	4103,7	3336,8	575,6	166,8	492,4	24,3	10,2	96,1
1996	4294,8	105,7	4054,9	3436,2	604,6	171,7	471,8	24,5	9,6	113,3
1997	4252,3	110,7	3832,3	3462,3	637,3	172,9	456,2	24,8	9,3	131,5
1998	4201,5	113,9	3683,5	3541,2	672,8	176,8	450,4	25,4	8,8	154,2
1999	4245,9	118,4	3619,1	3566,1	699,4	177,9	462,4	25,8	8,8	170,2
2000	4217,9	122,8	3435,7	3571,3	729,3	178,1	474,3	25,7	9,2	174,9
2001	4238,1	119,5	3548,6	3626,1	756,9	180,7	486,8	25,7	9,5	177,8
2002	4535,3	126,3	3592,0	3684,7	788,3	183,5	543,3	25,6	8,9	182,6
2003	4884,4	123,7	3939,1	3793,1	818,8	188,8	606,4	25,9	9,0	189,2
2004	5014,3	127,8	3909,8	3926,7	852,0	195,4	653,0	26,4	9,1	197,0
2005	5128,6	130,5	3917,5	4043,8	884,9	201,1	699,5	26,6	8,7	202,9
2006	5389,5	134,5	3973,3	4096,1	918,3	203,6	765,7	26,1	8,8	210,2
2007	5470,8	134,5	4023,9	4145,4	958,4	205,9	809,9	25,5	8,1	216,7
2008	5566,9	128,9	4241,1	4372,2	1032,4	206,3	871,9	25,0	9,0	227,3
2009	5509,5	121,8	4480,7	4385,6	1084,7	207,0	904,3	24,7	8,2	227,3

Etelä-Pohj. ELY	(million euros, rp 2000)									
	Column L (-)	Column M (-)	Column N (-)	P (-)	Q (-)	R (-)	S (-)	T (-)	V (-)	W (-)
Year	Costs of under-employment	Costs of consumer durables	Costs of commuting	Costs of auto accidents	Costs of water pollution	Costs of air pollution	Costs of noise pollution	Loss of wetlands	Loss of forests	Resource depletion
1960	37,4	102,2	122,0	9,2	4,4	6,2	5,5	287,3	-158,6	70,0
1961	30,3	117,8	125,6	10,5	5,3	6,6	6,8	322,9	-181,4	82,7
1962	31,1	138,4	125,5	11,0	6,1	7,0	8,2	358,5	-204,1	97,8
1963	31,7	139,5	125,3	13,1	7,1	7,4	9,5	394,1	-226,8	121,4
1964	32,5	161,1	130,0	15,4	8,2	8,0	10,6	429,7	-249,5	149,1
1965	31,5	177,6	137,3	18,2	9,4	8,5	11,9	465,3	-272,2	180,6
1966	32,1	155,6	139,4	19,8	10,6	9,0	13,3	505,5	-294,9	227,5
1967	67,0	153,0	141,7	19,4	12,2	9,8	14,2	547,4	-317,6	241,3
1968	93,3	136,1	147,2	20,9	14,6	11,1	14,5	589,3	-340,3	279,7
1969	66,0	181,9	159,9	22,3	16,1	11,7	15,7	631,2	-367,0	330,3
1970	53,2	200,0	160,2	24,7	17,7	12,3	17,0	673,1	-393,7	435,6
1971	66,6	185,0	161,5	28,6	20,4	13,4	17,7	715,0	-420,4	447,6
1972	77,1	235,8	165,7	31,0	23,0	14,7	18,1	756,6	-447,2	496,1
1973	72,5	266,9	168,1	32,2	19,8	17,0	17,5	798,3	-473,9	544,5
1974	56,9	245,4	164,8	33,2	29,2	21,0	15,7	839,9	-500,6	512,6
1975	82,5	249,2	165,7	41,1	36,8	25,1	15,0	881,6	-526,5	508,2
1976	122,2	231,7	170,0	40,8	34,6	28,7	15,3	923,2	-552,4	624,3
1977	128,2	227,8	179,3	40,0	34,6	31,8	16,2	958,9	-578,2	645,3
1978	154,5	222,6	189,7	36,6	34,0	34,6	16,5	994,5	-604,1	713,5
1979	114,0	256,1	204,1	42,2	37,0	37,8	17,2	1030,1	-630,0	731,4
1980	94,1	267,9	214,6	40,0	27,6	43,0	18,3	1065,7	-655,9	783,7
1981	121,2	287,6	217,0	45,5	39,1	49,0	18,9	1101,3	-681,8	686,3
1982	137,1	322,2	223,4	49,8	199,8	54,4	19,3	1136,9	-684,4	655,9
1983	170,0	328,3	226,2	56,7	234,0	59,9	19,6	1162,1	-686,9	660,4
1984	194,1	344,2	232,7	56,6	338,6	66,3	19,6	1187,2	-689,4	693,2
1985	217,4	373,5	239,2	60,4	330,0	71,4	20,1	1212,3	-692,0	782,3
1986	220,1	395,0	246,5	70,3	340,6	76,0	20,3	1237,5	-694,4	798,3
1987	185,9	400,1	266,4	70,2	364,5	78,8	20,7	1262,6	-697,0	864,4
1988	187,1	447,3	284,8	83,6	496,9	137,4	20,7	1287,8	-699,5	874,5
1989	182,2	479,7	289,4	97,0	515,8	159,7	21,3	1312,9	-702,0	920,2
1990	222,6	430,7	296,9	92,0	579,7	230,9	21,8	1338,1	-704,6	1025,2
1991	455,5	342,4	277,5	90,7	506,3	164,3	22,5	1327,0	-707,1	1048,2
1992	647,5	272,4	261,8	85,8	504,9	127,3	22,6	1316,0	-716,2	1051,9
1993	788,8	240,5	244,4	70,9	508,2	133,5	22,4	1304,9	-725,3	1105,8
1994	697,5	262,7	247,2	86,9	464,7	90,3	22,5	1293,9	-734,4	1253,9
1995	707,9	304,4	241,1	90,3	485,4	74,8	22,3	1282,9	-743,5	1267,9
1996	680,9	346,2	260,2	70,9	393,1	76,1	22,9	1271,8	-752,0	1293,7
1997	586,4	359,8	278,5	71,0	372,1	75,0	22,9	1260,8	-760,9	1262,6
1998	552,2	400,1	313,6	55,0	416,3	81,5	22,9	1249,7	-769,6	1155,8
1999	551,3	403,3	327,9	67,3	379,8	77,8	23,4	1238,7	-777,2	1143,2
2000	481,6	412,4	355,2	50,6	474,9	73,9	23,6	1231,2	-786,1	1242,2
2001	484,7	395,8	368,7	55,1	482,6	80,2	23,8	1223,6	-794,4	1553,7
2002	451,4	457,2	384,6	60,7	456,2	84,5	23,3	1216,1	-801,9	1778,4
2003	454,7	544,1	398,5	62,7	451,1	91,5	24,3	1208,6	-810,8	2057,7
2004	461,2	569,1	416,8	85,2	463,1	75,5	24,9	1201,1	-819,0	2004,0
2005	447,4	617,0	414,4	71,3	442,9	61,5	25,6	1193,5	-827,1	2037,2
2006	382,8	683,8	425,9	59,0	426,7	71,3	26,2	1186,0	-835,1	2079,2
2007	336,2	701,7	438,3	81,2	523,3	68,6	26,4	1178,5	-843,2	2153,3
2008	297,6	762,8	449,4	68,5	538,9	63,3	27,1	1171,0	-851,3	1809,5
2009	362,4	659,2	437,7	61,0	367,9	55,9	25,2	1163,4	-859,2	1755,6

Etelä-Pohj. ELY	(million euros, rp 2000)									
	X (-)	Z (+/-)	AA (+/-)	GPI(1)	GPI(1)	GPI(2)	GPI(2)			
	Carbon dioxide	Net	Net	Genuine	GPI	Genuine	GPI	GDP	population	GDP
Year	emissions	capital	borrowing	Progress	euros per	Progress	euros per	euros per		million
	damage	investment		Indicator	capita	Indicator	capita	capita		euros
1960	0,0	0,1	0	1865	4175	1993	4463	7107	446650	3174
1961	0,0	0,1	10	1889	4252	2030	4570	7583	444200	3368
1962	0,0	0,0	8	1897	4263	2052	4610	7752	445050	3450
1963	0,0	0,0	-28	1903	4269	2071	4644	7945	445900	3543
1964	0,0	0,0	57	1968	4403	2149	4806	8312	447100	3717
1965	0,2	-0,1	0	2006	4508	2199	4942	8716	444950	3878
1966	0,7	-0,1	0	2032	4598	2242	5074	8879	441900	3923
1967	2,0	-0,1	-16	2089	4728	2319	5248	9017	441900	3984
1968	5,4	-0,1	-73	2061	4668	2310	5231	9177	441650	4053
1969	11,0	-0,2	16	2372	5392	2636	5992	10060	440000	4426
1970	18,7	-0,2	86	2617	5988	2896	6627	10849	437000	4741
1971	26,9	-0,2	25	2728	6287	3023	6965	11051	434000	4796
1972	39,2	-0,3	-73	2831	6584	3141	7304	11802	430000	5075
1973	57,3	-0,3	49	3161	7368	3485	8124	12167	429000	5219
1974	73,2	-0,3	135	3591	8370	3930	9161	12463	429000	5346
1975	90,6	-0,3	120	3693	8628	4048	9458	12055	428000	5160
1976	118,9	-0,4	-178	3416	8000	3787	8869	12696	427000	5421
1977	152,6	-0,4	-155	3310	7751	3690	8642	12951	427000	5530
1978	195,8	-0,5	-106	3302	7729	3692	8642	13344	427200	5701
1979	243,8	-0,5	112	3729	8689	4129	9621	14271	429150	6125
1980	300,5	-0,6	132	3877	8984	4286	9934	15437	431500	6661
1981	336,2	-0,7	-111	3807	8764	4226	9730	15642	434350	6794
1982	368,9	-0,8	54	4003	9148	4455	10183	15538	437550	6799
1983	401,7	-0,9	26	4131	9376	4606	10454	15779	440650	6953
1984	439,2	-1,0	-127	4048	9141	4546	10265	16076	442900	7120
1985	494,7	-1,0	85	4377	9856	4897	11028	16104	444050	7151
1986	548,3	-1,0	-23	4505	10143	5048	11366	16723	444100	7427
1987	617,9	-1,0	61	4898	11030	5464	12304	16495	444100	7325
1988	687,1	-1,1	43	4842	10911	5430	12237	17082	443750	7580
1989	761,1	-1,2	170	5064	11409	5675	12785	18249	443850	8100
1990	857,6	-1,4	6	4532	10192	5165	11617	18124	444650	8059
1991	954,6	-1,6	5	4381	9837	5001	11229	17057	445350	7596
1992	1049,8	-1,7	-63	4198	9407	4797	10751	16637	446200	7423
1993	1151,3	-1,8	-214	3382	7568	3961	8866	16493	446841	7370
1994	1288,5	-1,8	-149	3436	7681	3995	8932	16970	447324	7591
1995	1433,4	-1,9	-191	3232	7236	3771	8444	16889	446633	7543
1996	1596,1	-2,0	-5	3372	7572	3891	8740	17341	445258	7721
1997	1747,4	-2,1	-123	3043	6855	3543	7981	18378	443912	8158
1998	1864,8	-2,0	-35	3006	6792	3486	7877	18755	442552	8300
1999	1975,5	-1,9	4	2961	6722	3423	7770	19463	440535	8574
2000	2097,2	-1,6	-175	2396	5462	2841	6476	20837	438655	9140
2001	2294,3	-1,2	48	2315	5298	2744	6280	21074	436904	9207
2002	2555,7	-0,8	-45	1913	4391	2327	5342	20551	435729	8955
2003	2904,4	-0,6	254	2040	4687	2438	5601	21687	435317	9441
2004	3208,6	-0,5	-33	1633	3751	2015	4629	22750	435405	9905
2005	3431,9	-0,6	128	1773	4071	2139	4913	23715	435413	10326
2006	3734,6	-0,7	-236	1287	2955	1638	3761	21981	435428	9571
2007	4044,6	-2,2	37	1270	2907	1605	3675	23501	436700	10263
2008	4224,3	-2,6	10	1959	4479	2279	5209	25432	437487	11126
2009	4391,1	-3,1	10	2439	5559	2743	6252	23329	438693	10234