Linking change in happiness, time-use, sustainable consumption, and environmental impacts;

An attempt to understand time-rebound effects

Final Report

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This report may or may not reflect the policy and opinion of the commissioners.

"The whole economy of human society is based on one general and simple principle: I want to be happy…."

French Encyclopedist Denis Diderot (1713-1784) cited in Elchardus (1991)

Abstract

One important goal of sustainable consumption must be to complement the efficiency driven direction of sustainable production in a way that avoids the efficiency trap, i.e., the observation that despite large efficiency gains in production absolute resource consumption and CO2 emissions are increasing. This report aims to shed light on the underlying processes that cause this trap and to propose a new modeling approach to assess sustainable consumption. Knowledge on how consumption is linked to happiness and satisfaction, time-use, and environmental impacts is summarized using the insights from a large array of different disciplines. Evidence for the link between happiness and consumption activities suggest that this may be seen as a starting point to promote consumption activities that are both sustainable and correlated with high happiness. This is potentially one of the key factors for the acceptability of consumption activities. One study also suggests that activities with low energy consumption can well be correlated with high happiness. Although promising, few of these studies allow the conclusion that a change in consumption activities can be steered in a new direction that *makes* people happier. Further, the report suggests a new way of modeling behavioral consequences of adopting new consumption habits. It is shown how time elasticities can be calculated based on time use surveys that allow tracing substitution processes in a way that makes them quantifiable. The combination of these two major results lead to a new assessment framework for quantifying the environmental impacts of consumption including the possibilities to compare any consumption activities on the highest level of ultimate utility (happiness), consider behavioral consequences of adopting new consumption habits, and explicitly accounting for rebound effects. In a next step, available time use data can be used to calculate time-elasticities for a set of promising examples of sustainable consumption and the environmental implications of all changes in consumption activities assessed. Further, related changes in happiness or satisfaction need to be evaluated.

Table of contents

1. INTRODUCTION 5
Definition of sustainable consumption 5
Eco-efficiency and rebound effect 5
Needs and quality of life 8
The focus on time 8
This working paper 9

2. THE WHY OF CONSUMPTION 11

2.1 Drivers of consumption 11

2.2 Indicators for the measurement of ultimate utility 13

3. LIMITATIONS TO CONSUMPTION AND THE EFFICIENCY TRAP 16

3.1 Our framework 16

3.2 Limiting consumption factors 17

4. TIME USE AND HAPPINESS – INSIGHTS FROM THE LITERATURE 19

4.1 Introduction 19
4.1.1 Quality of life or happiness measurement 19
4.1.2 Relativity and cultural differences 21

4.2 Relationship between economic aspects and happiness 24

4.3 Activities and changes in happiness 25

4.4 Causal relationship between activity and happiness 31

4.5 What have we learned? 33

5. TIME USE, CONSUMPTION, AND ENVIRONMENTAL IMPACTS – INSIGHTS FROM THE LITERATURE 37

5.1 Overview 37

5.2 Time use surveys 37
5.2.1 Purpose and history of time use surveys 37
5.2.2 Our requirements for time-use data 38
5.2.3 Results from the literature 39
5.2.4 Sources for time use data 43

5.3 Linking Time use, consumption, and resource use 44
5.3.1 Consumption and environmental impacts 44
5.3.2 Results from the literature on energy use per time unit 44
5.3.3 Change in material intensity due to changes in time use 47

5.4 Required steps to quantify time-rebound effects 48

6. INSIGHTS ON TIME USE AND SUSTAINABLE CONSUMPTION 51

6.1 Is there a causal link along time use – consumption – environmental impacts – happiness? 51

6.2 What additional criteria need sustainable consumption to fulfill? 52

6.3 What does this mean for IPP? 52

7. REMAINING RESEARCH AND DATA NEEDS 54

REFERENCES 55

1. Introduction

Definition of sustainable consumption

The "Oslo Symposium" (Norwegian Ministry of Environment 1994) suggested a working definition of sustainable consumption which is used by many researchers and organizations including OECD (1997/2002a):

Sustainable consumption is *the use of services and related products which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardise the needs of future generations."*

This definition is somewhat in line with the Brundtland definition on sustainable development but does heavily focus on environmental factors neglecting the social and economic dimensions and intra-generational equity. Further, the definition is kept ambiguous about what the minimization relates to: is it related to one unit of service or one product, or is it related on all consumption per capita or even total global consumption? We assume here that the later is meant since only on this level one can control for jeopardizing the needs of future generations.

A shorter, less specific but more comprehensive definition that relies on the Brundtland definition on sustainable development is suggested here:

Sustainable consumption meets the needs of the present without compromising the ability of future generations to meet their own needs.

In Section 6 we will suggest concrete additional criteria that can be used to define and promote sustainable consumption. In the reminder of this working paper we will narrow the focus by just considering energy use and the related greenhouse gas emissions and not investigate how providing goods and services affects other sustainability dimensions along the life cycle.

Eco-efficiency and rebound effect

Product and production related policies that aim to reduce environmental impacts often include cleaner production, energy- and eco-efficiency, and integrated product policies. Although these policies helped to reduce energy consumption and environmental impacts of single production processes and over whole life cycles of products, total energy use, emission of greenhouse gases and other environmental impacts increased rather than decreased[1]. Why this? Among other reasons like, e.g., population growth, the major factor is efficiency. The efficiency in using capital, labor and resources has been increased, this has improved productivity and reduced unit costs. The reduction in unit costs allows – assuming at least constant real disposable income – an increase in the number of consumption units. If the increase in consumption units is larger than the reduction of energy use and emissions per unit then this is called the "efficiency trap".

In welfare economics the increase in productivity and the following increase in consumption is intended and considered to increase national welfare[2]. However, in energy and environmental economics, reduction of energy use and pollution per production unit are the

[1] It is important to note that many environmental impacts have been reduced during the last decades. However, these achievements are often caused by traditional policy measures like bans and emission thresholds.
[2] Whether these increases in national welfare also include global welfare and whether productivity increase due to lower labour costs in third countries produces similar welfare effects is at least questionable.

goal and an increase in production units hampers the eco-efficiency improvements. Therefore, these effects are often called *back fire*, *take-back, offsetting behavior* or as we shall call them *rebound effects*. In the field of energy economics the following effects are distinguished (Greening et al. 2000):

- *Direct Rebound Effect* (substitution effect, pure price effect): Greater efficiency may lead to a lower price of the service (or product or technology) which in turn may induce an increased use of this cheaper service.
- *Indirect Rebound Effect* (income effect, secondary effect): If prices of other commodities and income are constant, the reduction of costs for one commodity due to a particular efficiency increase implies that consumers have more money to spend on other goods.
- *General Equilibrium Effect* (economy-wide effects): The direct and indirect rebound effect lead to changed prices and consumption throughout the economy, which may increase or decrease production in distant sectors and changes the production functions.
- *Transformational Effect*: This includes changes in consumer preferences, alteration of social institutions, and the rearrangement of the organization of production.

Figure 1-1 illustrates what this means when two hypothetical products A and B are compared that fulfill both the same service, but cause different amount of environmental load per service unit, use a different amount of time for the consumption and have different costs. Alternative A shall be replaced by less polluting alternative B that also reduces the needed amount of time but comes at higher costs. The higher costs of alternative B will cause a reduction in consumption of alternative B and other products. Therefore, the totals pollution would be reduced even more. However, alternative B also uses less time. Therefore, additional time becomes available for consumption that causes additional pollution. Whether the net effect will be positive or negative is in this example hard to tell and will also depend on the ratio between time and income constraint consumers.

So far, we have mentioned changes in costs, energy use and time use as sources for rebound effects. In principle, all limiting consumption factors may cause rebound effects, i.e., storage, displaying and traffic space; skills and talents, all type of information, and other resources (see section 3.1).

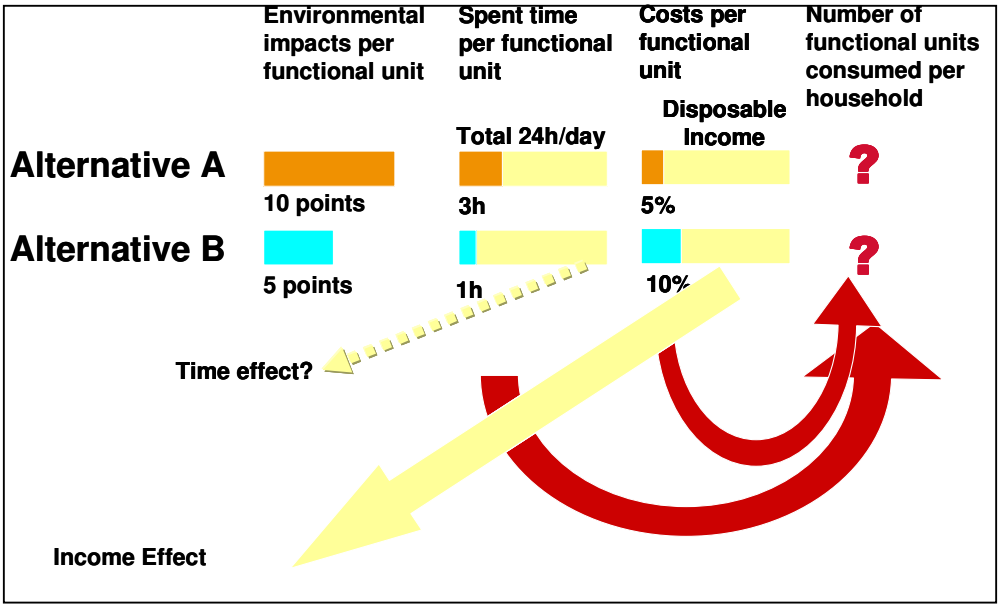

Figure 1-1: Example for time rebound and income effect if consumers shift from alternative A to B

Example 1. Energy saving light bulbs

Fluorescent light bulbs have been shown to both pollute and cost less than incascendent light bulbs when compared on a life cycle basis. What consequences does it have that they save money and that consumers know this?

Well, they may decide to install more bulbs for previously unlighted areas or they may use the lights for more hours (direct rebound). Since they may still save money the end up to spend the additional money on other consumer goods (indirect rebound effect).

Example 2. Diapers

Many LCA studies have looked into the question whether disposable one-way diapers or washable cotton diapers are preferable. The results of these studies depend not only on the commissioner but also how many times each of the diapers are changed per day, what type of washing and washing technology is used and which type of disposal (incineration or landfill) is applied. However, the options may also vary in terms of expenses and time use. The family that washes all diapers at home and dries them in the garden will use a considerable amount of time that cannot be used for other purposes, be it for environmentally benign activities like social interactions or playing with the baby, or for additional consumption like visiting the gym, reading newspapers, etc. The same argument can be made for the expenses related to the different diaper systems. Money that can be saved with one system may well be spent on, e.g., other baby equipment. Therefore, accounting for differences in used time and income may change the ranking of the alternatives.

Having shown that rebound effects occur and knowing that alternatives do often not have identical costs or need the identical amount of time we need to ask: How large are these rebound effects?

Unfortunately, there is considerable amount of discussion on this issue but very few studies that provide quantitative analysis. However, Figure 2 shows some results for the direct rebound effect from energy saving measures by private consumers and firms. This means that

cost-saving improvements in space heating motivate private consumers to heat somewhat more than they did before the measure was taken. However, form the energy savings (=100%) only 10 to 30% are lost due to the direct rebound effect.

Private Consumers	
Space heating	**10-30%**
Space cooling	**0-50%**
Water heating	**<10-40%**
Lighting	**5-12%**
Appliances	**0%**
Automative transport	**10-30%**
Firms	
Process uses (short-run)	**0-20%**
Lighting (short-run)	**0-2%**
Long-run aggregate impacts	**0-<100%**

Fig 1-2: Review of Studies on Direct Rebound Effects (Greening et al. 2000)

Grepperud (1999) provides a concise summary of the energy rebound effect discussion of the last 20 years. With a more sophisticated modeling approach-a general equilibrium model of Norway-he shows that such rebound effects may be smaller than predicted by some advocates of the efficiency trap but suggested that rebound effects may be larger if households (rather than industry) are looked at.

Similar numbers for time rebound effects are lacking and motivate this review of the literature and compilation of remaining gaps.

Needs and quality of life

The definitions for sustainable consumption include phrases like *meeting the needs* or improving *quality of life*. These terms can be understood as goal functions of or drivers behind consumption. Section 2 will elaborate in some detail on these questions. This working paper has a special interest in such goal functions or overarching meta-goals for two reasons:

1. To know the ultimate measurement unit of consumers' utility function allows to directly maximize utility without struggling with substitution effects, i.e., the rebound effects introduced above.

2. Quality of life and many other candidates for such ultimate goals have a clear relation to the time dimension.

Therefore, one of the theses of this investigation is that sustainable consumption shall attempt to minimize resource use, consumption, inequality, and inequity per unit of consumption time while maximizing quality of life and happiness during that time.

The focus on time

From the above discussion on rebound effects we learned that rebound effects due to energy savings can be considerable but do usually not offset all efficiency gains. Energy prices are just to low. Productivity gains, and sometimes they are initiated through eco-efficiency measures, have well the potential to completely offset the eco-efficiency improvements if the saved costs are completely re-invested in other consumption goods with higher energy

intensities (MJ/$) than the initial product[3]. However, avoiding productivity gains in order to prevent rebound effects is not attractive as a voluntary policy measure and would not necessarily improve quality of life. Among the remaining limiting factors (time, space, skills, information, resources) time was chosen for investigation for the following reasons:

- The limitation is obvious and everybody faces the limitation if not on a daily basis at least several times a year. The day has 24 hours, not more and not less.
- The metric is very clear (hours) compared to most other candidates
- Time and quality of life seem related
- Other researchers have started to work on the issue but not solved
- Statistical data on time use is widely available
- It is expected that the time-rebound effect is larger than the energy rebound effect and affects the sustainability of consumption in a relevant way.
- Time use and behavior are very closely linked, where behavior is the the actual cause of consumption.

However, other limiting factors need to be studied as well. Lack of affordable space in highly urbanized world centers has certainly a reducing effect on material consumption and it has been shown in many investigations that new traffic space (capacity) fosters additional traffic with very high rebound factors.

This working paper

Section 2 gives an overview into the drivers and satisfiers of consumption. This is provided in order to understand better how quality of life can be improved by consumption and how substitution processes can be controlled. Section 3 will then give some more insights on limiting factors and rebound effects. Section 4 summarizes our insights we got from a limited survey of the literature on the relationship between activities or consumption and quality of life, happiness, and life satisfaction. Section 5 provides a similar overview on available

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[3] Assume that the consumption of the initial product is replaced through a new product that is cheaper than the initial one thanks to productivity gains and allows to consume additional products. Assume further that income is constant (one would usually assume an increase as a consequence of productivity gains), then

$I = N + x*A$
In order to have a net saving in energy use the following relationship needs to be fulfilled:

$i*I < n*N + x*a*A$

From this equation it is clear that it is not sufficient that N < I and n < I, but also that

$$a < \frac{i*I - n*N}{I - N}$$

this is the requirement for having net energy gains through simultaneous productivity and energy-efficiency improvement.
where:
Initial product price = I ($), Energy intensity of initial product = i (MJ/$)
New product price = N, Energy intensity of new product = n (MJ/$)
Additional product price = A, Energy intensity of additional products = a (MJ/$)
x = number of additional products

literature that deals with the relationship between time use, consumption, and environmental impacts. In Section 6 we bring together this evidence to see what we can learn for sustainable consumption and IPP. We will conclude with a section on gaps that need further attention.

2. The why of consumption

"..men are continually in competition for honour and dignity".
Our truly final demands are
"striving for power, prestige, and respect, the maintenance
of old friendships and associations and the cultivation
of new ones, participation in public affairs, and - why not?
- the pursuit of achievement, truth, creativity, and salvation."

Thomas Hobbes (1588-1679) cited in Hirschmann (1973)

This early citation has lost little in actuality. It is important to understand these drivers towards ultimate utility when we attempt to change consumption patterns and make them more sustainable. If offered alternatives score lower on the dimensions mentioned in the citation above then the acceptability may be low or lead to additional consumption that provides the additional utility.

Section 2.1 will review some frameworks that try to describe the "why of consumption" and section 2.2 provides an overview on indicators for ultimate utility.

2.1 Drivers of consumption

In Gatersleben (2001) the extended Needs-Opportunity-Ability model of consumer behavior is described. Consumer behavior is driven by motivation and behavioral control. Motivation is based on the needs of a person (e.g. relations, comfort, status, freedom leisure-time) and the opportunities to satisfy these needs (e.g. shops). Behavioral control on the other hand is based on abilities like having enough money and opportunities. Needs, opportunities and abilities are influenced by macro-level factors (technology, economy, demography, institutions and culture). These macro-level factors are influenced by the outcome of consumer behavior what means by subjective well-being and environmental quality. According to Gatersleben (2001) people buy certain goods in order to satisfy needs that can also be satisfied in another (e.g. less energy-consuming) way as well.

Analyzing how consumer behavior meets human "needs" Csikszentmihalyi (2000) states that "because consumer behavior is largely driven by the desire to satisfy needs that have been programmed in our minds either by the genes we inherit or by the memes[4] we learn from the culture in which we live, it is useful to start the analysis with a consideration of human needs". To analyze these human needs he refers to Maslow's theory of needs (pyramid of needs). The lower needs are survival and safety. According to Csikszentmihalyi (2000) a great deal of consuming behavior is directed to satisfy these needs (like food, sheltering etc.). In the middle of Maslows pyramid are social needs like love and belonging. Satisfying these needs by consumption could according to Csikszentmihalyi (2000) mean going to bars and restaurants, attending sport events, going to concerts etc. The need to belong can also be satisfied by consumption (e.g. products giving you the feeling that you belong to a certain group of people and therefor you do not feel yourself alone or unloved). The higher needs are self-esteem and self-actualization. "At that point we can indulge in purchasing goods that show our uniqueness and separate us from the rest of the crowd" (Csikszentmihalyi 2000). Csikszentmihalyi (2000) further quotes Belk (1998) stating "Evidence supporting the general premise that possessions contribute to sense of self is found in a broad array of

[4] „A meme is a concept introduced by the British Biologist R. Dawkins (1976) to refer to programmed behavioral units that are learned rather than inherited genetically..." (Csikszentmihalyi 2000)

investigations". According to Csikszentmihalyi (2000) it seems that self-actualization has the least predictable impact on consumer behavior as a person looking for personal growth more probably lives a frugal life than investing heavily on goods. Csikszentmihalyi (2000) suggests that by using Maslow's model it may be possible "to measure the value of consumer behavior in terms of how various choices satisfy basic existential needs. It may be possible to answer such questions as: How expensive in terms of energy expended is it to satisfy security needs? Or esteem needs?....".

Jackson (2002) uses the important differentiation between finite needs and theoretically infinite satisfiers following Plato, Maslow (1954), Fromm (1976) and Max Neef (1991). Positional consumption, as often observed when cars or in other societies houses are bought is relevant as well (Hirsch 1977).

Ratneshwar et al. (2002) suggest instead of a classical hierarchical having-doing-being model (feature preferences, benefits sought, consumption intentions, current concerns, life projects, life themes & values) to use a procedural model that assumes a dynamic process of adaptation, abstraction and incorporation of context and different levels of goals.

Leitschuh-Fecht (1999) states that "often we consume because we are used to, we are bored, lonely, worry, and we try to compensate for stress, time pressure, overstrain, and anxiety while striving for reputation, recognition, and appreciation" (translated from German).

In LCA but also in the discussion on product service systems it is usually assumed that consumers are only interested in the end-services, i.e., not in the product or process to provide the end-services. Jalas (2002c) notes that sociological and psychological research rather supports the view that "consumption may be a means to achieve a social status or to distinguish between social strata..." It may have more psychological meaning in terms of identity creation and thus also be more a play. "Also the findings that it is difficult for consumers to explain the reasons of actions may be a sign that consumption is less rational and not driven by such 'functional' needs as presumed in the eco-efficiency discussion" (Jalas 2002c:3). And he adds "buying bread from the supermarket may not be a substitute for home baking and a handy person may be happy when repairing his or her own car" (Jalas 2002c:3). This non-functional view on consumption may indeed describe some of the observed gaps between the models of the efficiency revolution and actual development. Section 4 and 5 will try to show paths on how to model changes in consumption if the "function need approach" is not taken for granted.

In sustainable consumption, we are just at the beginning of understanding the potential of this "non-functional" need view towards consumption. Marketing has adapted much earlier to this view and was very successful in selling, e.g., brands, visions, dreams and associations rather than "just" products (Jensen 1999, Klein 2000). This could prove to be the true potential of sustainable consumption!

Yagita et al. (2002) make clear that there is no sustainable consumption if identified sustainable alternatives are not socially acceptable. Using the "Quality Function Deployment" method they apply a very broad and comprehensive definition of function that goes beyond the narrow definitions of LCA and other tools. Their research will show whether the social and psychological dimensions discussed above are covered sufficiently.

For sure, social acceptability is a prerequisite for the adoption of new consumption patterns. Therefore, the next sub-section will look into different ways to define ultimate utility.

2.2 Indicators for the measurement of ultimate utility

The definition of sustainable consumption in Section 1 from the Norwegian Ministry of Environment - that has also been adopted by OECD, the Commission on Sustainable Development (CSD) and many other actors - requests that quality of life is improved by sustainable consumption. It has also been mentioned that this is not only a success factor when sustainable consumption is introduced to consumers but it may also avoid further rebound effects. However, to achieve this we need to have insights on a general concept of the ultimate utility for consumers.

Happiness or thriving for the good life have been mentioned as other ultimate goals in life. These terms and especially quality of life has been used in different disciplines and therefore different definitions can be found in the literature. Table 2-1 provides some examples of such definitions.

Table 2-1: Some definitions for ultimate utility

Term	Definition	Source of information
Quality of Life (QoL)	Quality of life may be defined as subjective well-being	McCall, S: (1975)
	The degree on which a person enjoys the important possibilities of his/her life. Enjoyment has two components: the experience of satisfaction and the possession or achievement of some characteristics, as illustrated by the expression: "She enjoys good health". Three major life domains are identifies: Being, belonging and becoming	Quality of life research unit, University Toronto (source: http:// gdrc.org/uem/qol-define.html)
	In quality of life research one often distinguishes between the subjective and objective quality of life. Subjective quality of life is about feeling good and being satisfied with things in general. Objective quality of life is about fulfilling the societal and cultural demands for material wealth, social status, and physical well-being.	Quality of life center, Denmark (source: http:// gdrc.org/uem/qol-define.html)
	Currently the tern "Quality of life" denotes two meanings: 1) the presence of conditions deemed necessary for a good life and 2) the practice of good living as such Quality of life research tries to define what a good life is and how well reality meets these standards.	Veenhoven R. (1997)
	Quality of life contains subjective perceptions and objective assessments of the quality of life. Individual quality of life includes three separate but related concepts: • Satisfaction with life (elements of welfare, contentment, pleasure, flourishing and excellence) • Happiness (includes pleasure, satisfaction and a sense of the value in and worthiness of one's life • Well-being (a composite of life satisfaction and/or happiness)	Hancock (2000)
	A classical distinction is between "objective" and "subjective" quality of life. The first refers to the degree that a life meets explicit standards of the good life, the latter concerns self-appraisals based on implicit criteria e.g. one's subjective feeling for health.	Veenhoven (2001)
Quality of life indicators	Further there are different indexes like Human development Index (HDI), Quality of Life Index (QOLI), Genuine Progress Indicator (GDI), Fordham Index of Social Health (FISH) etc. that describe the aspects of quality of life	Walton D. (2001). Indications for Quality of Life (source: http:// gdrc.org/uem/qol-define.html)

Quality of life indicators	Possible quality of life indictors (indicator categories): • Personal sense of well-being (individual QoL) -happiness -life satisfaction - self reported health • Objective personal status - functional assessment/physical assessment -literacy level/educational attainment • Perception of community - quality/safety/healthfulness of community - participation on community life - influence on community life • Community conditions - Economic indicators - social indicators - environmental indicators - government performance, voter turnout etc. - overall population health/human development	Hancock (2000)
Happiness	Happiness is the degree to which a person evaluates the overall quality of his present life-as-a-whole positively. In other words, how much the person likes the life she/he leads. Happiness is one of the indicators of "apparent" quality of life. Together with indicators of mental and physical health it shows how well people thrive Out of the Dalai Lama in the Buddhism there are four factors to reach happiness: 1) wealth, 2) mundane satisfaction 3) spirituality and 4) enlightenment	Veenhoven R. (1997). Veenhoven R. (1997). Dalai Lama (1998)
Happiness Indicators	3-step happiness: Question "In general, how happy would you say you are?" 3) very happy, 2) fairly happy, 1) not very happy 4-step happiness: Question "Taking all together, would you say you are?" 1) very happy, 2) quite happy 3) not very happy, 4) not at all happy Oxford Happiness indicator (OHI). Factors of this OHI are satisfaction with life, efficacy, empathy, sociability/outlook, a positive well being and self-esteem (this happiness index is broader than the others as it contains also aspects of life satisfaction) Further happiness indicators are 7-step happiness, 11-step happiness, % time happy, happiness (MUNSH), net time happy	Veenhoven (1993) Veenhoven (1993) Hills et al. (1998) Michalos (1991, p. 21)
Subjective well-being (SWB)	Subjective well-being is an attitude consisting of two basic aspects of "cognition" and "affect". "Affect" is the label attached to moods and emotions. Affect reflects people's instant evaluation of the events that occur in their lives. The cognitive component refers to the rational or intellectual aspects of subjective well-being. It is usually assessed with measures of satisfaction. It has been shown, that pleasant affect, unpleasant affect and life satisfaction are different constructs (In literature it can be seen, that SWB is also been used as synonym for happiness or for life satisfaction).	Lucas et al. (1996)
(life) satisfaction	Satisfaction can be used to assess different aspects of life, while happiness refers to satisfaction with life-as-a-whole. Michalos (1991) makes in his research a distinction between life satisfaction (question: how do you feel about your life as a whole right now?) and happiness (Considering your life as a whole would you describe it unhappy.....happy?). Life satisfaction is a well accepted indicator for quality of life (Sirgy et al. 1998)	Veenhoven (1993) Michalos (1991) Sirgy et al. (1998)

(life) satisfaction indicators	3-step life satisfaction: Question "How satisfied are you with the way you are getting on now?" 3) very satisfied, 2) all right, 1) dissatisfied 4-step life satisfaction: Question "How satisfied you are with the life you lead?" 4) very satisfied, 3) fairly satisfied 2) not very satisfied, 1) not at all satisfied 7 step life satisfaction, life satisfaction (LSI-Z), life satisfaction SWLS etc.	Veenhoven (1993) Veenhoven (1993) Michalos (1991)
"The good life"	Concept based on the greek word "eudaimonia" (daimon means life and "eu" is the adverb for "good" so it means the good way of life. Sometime the concept good life is also translated as happiness but this does not cover the whole meaning of this concept. Veenhoven (1997) says, that the most interesting use of empirical happiness research is the validation of the ideas about conditions for the "good life" and related about the "good society". Contrarily Lane (1998) states that the happy society is not necessarily the good society	Wolf (1999)
"Flow"	Csikszentmihalyi (1992) brought up the concept of "flow" (optimal experience or autotelic experience) as the state of total involvement in an activity that requires complete concentration.	Csikszentmihalyi (1992)

Out of the definitions above the relationship between happiness, life satisfaction and subjective well-being can be described like this: happiness is the affective (emotional) aspect, life satisfaction is the cognitive (realization) aspect and subjective well-being is the affective and the cognitive aspect together. It has to be mentioned, that Michalos (1991) does not make this difference. For him it is a fact that when people talk about satisfaction or happiness with their whole life, they are typically referring to a relatively lasting, justified, good feeling and attitude about their lives. Therefore a theory of life satisfaction would be a theory of happiness and in general such theories would be theories of subjective well-being.

Quality of life is in most of the definitions a composition of subjective parts (subjective well-being) and objective parts (measurement of explicit standards like material wealth etc.).

Section 4.1.1 will discuss our selection of the indicator to measure ultimate utility and 4.1.2 discusses its validity.

3. Limitations to consumption and the efficiency trap

3.1 Our framework

Figure 3-1 illustrates in a conceptual model six limiting consumption factors (level 1), aspects of Quality of Life (QoL) on level 2 and on level 3 factors that drive and direct consumption. The six limiting factors on level 1 belong together because there is some substitutability between these factors. If one has time one can compensate for the skill of being fast, use cheaper modes of transportation, search for information, use less resource intensive alternatives, or park the second car on a more remote parking slot. Similar examples exist for all other substitutions. However, while money is well substitutable with all other factors, information alone will not help me to post three more Van Gogh on the same wall of my living room.

While these six limiting factors are just production factors in the sense of economics, the second and the third level include the produced utility. Level 3 would be the ultimate utility (or driver) that can be evaluated by a set of aspects (level 2).

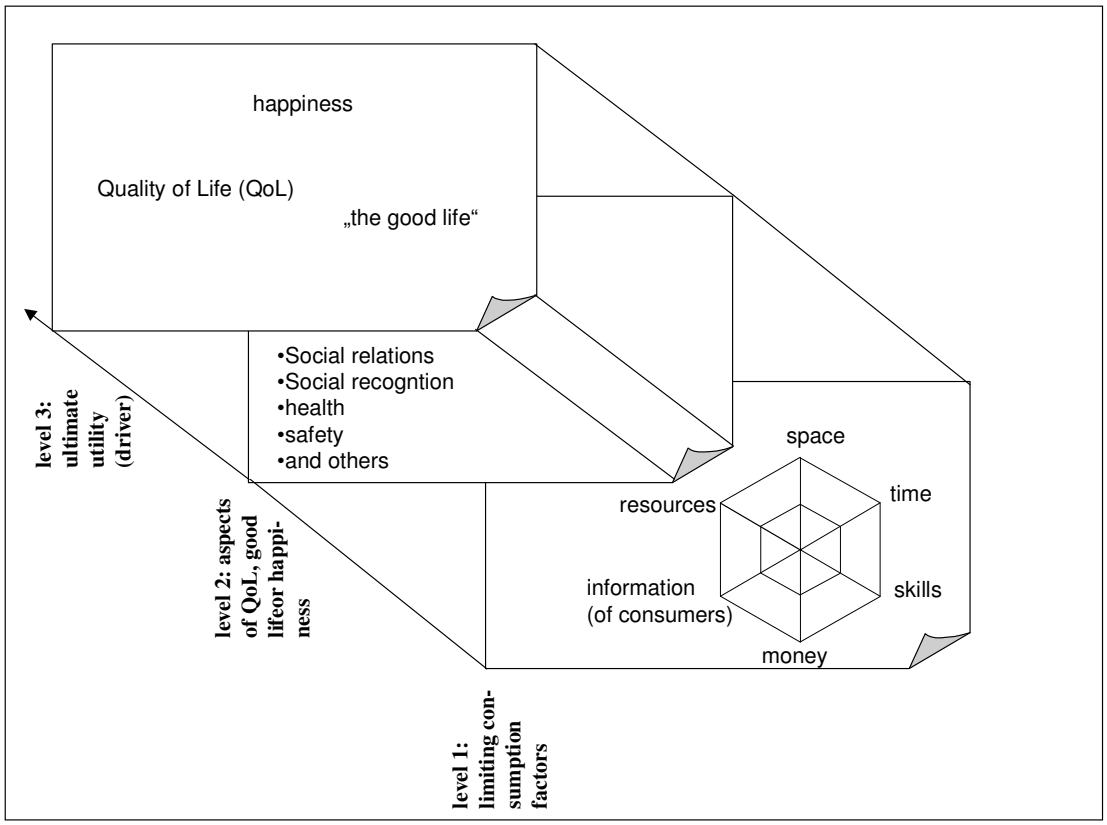

Figure 3-1: Framework for the relation of relevant consumption factors

Further possible level 2 aspects are described in Gatersleben (2000) where the following 15 quality of life aspects were used: health, social relations, work, freedom, income, education, nature, safety, recognition, leisure-time, comfort, car, washing machine, television set and computer.

3.2 Limiting consumption factors

Our proposal in figure 3-1 to rely on six limiting factors can also be supported by other proposals that suggest subsets of these factors or even came up with additional factors. Rebound effects due to the income effect is standard knowledge in economics. Time rebound has probably its origin in transportation research (see also section 5.4) where the fixed travel time budget hypothesis has been proposed many decades ago.

Perrels (2002) introduces the notion that skills are a relevant limiting factor that is able to substitute for time and/or money. He suggests an integrated assessment considering these three factors where he also gives high importance to the chronological nature of time.

McKean (1973) predicts that time consuming ceremonies, such as the tea ceremony or registration procedure in Japanese hotels will change because of the income increase (and the implied increase in time costs) in Japan. He also suggests that this may change the whole consumption pattern and may also change our tastes. Schipper et al. (1989) mentions the following constraints: demographics, economics, physical and social, and legal infrastructure. Therefore, Schipper would probably add the demographics and the social and legal infrastructure. For an individual consumer these factors can hardly be altered but on a governmental level they may provide a fruitful starting place to think about policy measures for sustainable consumption.

Spreng (1988) suggested that time, information and energy are exchangeable substitutes, where industrial men have no time, primitive men have no information and the starving philosopher has no energy. Spreng probably includes into information also skills, and into energy also other material production factors. Therefore, our proposal gets close to Spreng's proposal.

Zeckhauser (1973) argues that time should not just be treated as constraint as Becker (1965) and Linder (1979) do but as "the primary commodity", since "our primary objective is to enjoy ourselves, to reap periods of high utility." So he would probably suggest that time would be put into level 3 instead of level 1. Reisch (2001a) takes a similar stand when she makes a clear distinction between "wealth in time" and "wealth in goods" where time gets an intrinsic value per se as a genuine aspect of personal wellbeing. She also criticizes Becker (1965) and Winston (1982) for considering "time" too narrowly as production factor with opportunity costs. The example of feeding a baby is used to show that reducing the time to do so may decrease the satisfaction with and motivation for the activity. She cites Rinderspacher (1996) who claims that environmentally friendly behaviors are time investments in the environment because many environmental friendly behaviors need more time (gardening, public transport). With the example of the 4-day week at Volkswagen (VW) she also demonstrates that more time does not need to result in sustainability gains.

Goedkoop et al. (2002) mention three limiting factors 'cost', 'time' and 'volume' as constraints towards consumption. They suggest that costs may be the most sever constraint and present the E2 vector that displays environmental load per value added. The idea behind this is to maximize value added and minimize environmental load, i.e., to find sectors with minimal environmental load per value added. The sector analysis uses multiple IO tables and also adds a module for pollution in the use phase, the so-called direct pollution. Similar analysis could be done with environmental load per time or space unit since, e.g., one needs space to park a second car.

Rebound effects due to (the extension of) social, organizational and safety limits may be relevant as well. An example is the theory of risk homeothesis or risk thermometer (Adams

1995). This theory or hypothesis says that if one lowers, e.g., risks in the traffic by separated lanes, seat belts, or air bags, the drivers tend to drive faster and more reckless. Sometimes, they also adopt new risky hobbies such as paragliding, bungee jumping, or diving. Safety or risk level is a candidate to be added on level 1 above.
Winston (1992) distinguishes process utility and goal utility of activities. The introduction of process utility is important as bridge towards time as quality of life. Also, as a difference to Becker (1965), he suggests that not only the time duration but also the sequence and timing are important (no croissant at 5pm, delayed gratification or willpower and self-control relative to dinner at 7pm).

Timing is everything

Strike while the iron is hot

A stitch in time is worth nine

borrowed from Andreasen (1991)

4. Time use and happiness – insights from the literature

4.1 Introduction

The following questions are addressed in this section:

1) Is happiness the appropriate indicator to measure ultimate utility? (see section 4.1.1)

   1a) What are the limitations of using happiness as indicator? (see section 4.1.2)

2) Is happiness just a function of economic variables or what is the relationship between economic factors and happiness? (see section 4.2)

3) Is there a relationship between consumption and happiness? (see section 4.3)

   3a) Which activities make people particularly happy? (see section 4.3)

   3b) Does materialism (increased material consumption) make happy? (see section 4.3)

   3c) Could we influence specifically happiness by changing consumption patterns? (see section 4.3 and 4.4)?

   3d) Are the relationships between activities and happiness causal? (see section 4.4)

Section 4.5 attempts to answer these questions based on the collected evidence from literature.

In literature there is very little information analyzing directly quality of life or happiness related to time use. Most of the literature is about the relationship between happiness or life satisfaction and certain activities like working, leisure etc. Additionally not much data has been found about happiness and consumption activities out of longitudinal panel studies. This is a pity because those studies would give a good insight into the question about causal relationships between activity and happiness.

Next to happiness studies, studies analyzing the flow state (Csikszentmihalyi 1992, Graef et al. 1981, Schallberger & Pfister 2001, and Pfister 2002) are described because the flow state could be used as substitute indicator for happiness. Flow studies were done using the Experience Sampling Method (ESM) where testing persons have to fill out a questionnaire with about 45 questions describing their actual activity and their feelings each time when they hear a randomly created signal (alarm). Based on questionnaires not only the flow state is analyzed but also the positive and negative affects during all activities.

4.1.1 Quality of life or happiness measurement

Quality of life as indicator for ultimate utility

As shown in section 2.2 (definition of indicators from Hancock 2000) quality of life is measured by different indicators based on subjective components (feelings) and objective components (conditions) on an individual and on a community level.

Quality of life offers a balanced set of indicators that are valued differently in different cultures but are able to capture most aspects of an utility function. This balanced nature comes at the expense of always defining the set of indicators related to cultural aspects and of having to deal with a multitude of indicators. According to Hancock (2000) the process of which quality of life indicators are developed (particularly at the community level) is at least

as important as what is meant by quality of life. In addition for our question about the influence of consumption and possibilities to change consumption patterns the subjective components of quality of life could be relevant.

The "good life" as indicator for ultimate utility

"The good life" is widely used in ethics and is an expression that initiates a reflection process. It is based on values and is adaptable to different cultures as each culture defines what good life means for them. However, as "The good life" has to be defined in relation to culture and as no studies of activities and their contribution to "the good life" have been found yet, this seams not to be a valuable indicator.

"Flow" as indicator for ultimate utility

Flow measured by the Experience Sampling Method (ESM) gives a good indicator about the mood of the tested person during any kind of activities. Results that are deeper than mood or feelings are not captured by one general question (about happiness or satisfaction) but by a set of questions also analyzing influences on the actual mood. The disadvantage is, that little data are published analyzing to activities leading to flow estates. Therefore, flow analysis could be used as an additional source of information but not as sole indicator.

Happiness and/or life satisfaction as indicator for ultimate utility

Happiness (or life satisfaction) is appealing through its holistic and one-dimensional measurement and there are a lot of studies done about these topics, e.g. Veenhoven (1994) has developed a database about happiness with 7838 findings from 603 studies in 69 nations.

One question hereby is, if happiness and life satisfaction can be used as synonyms, which means that results of life satisfaction analysis could be used to assess happiness. Veenhoven (1993) and Michalos (1991) analyzed both the correlations between the different indicators of happiness and life satisfaction.

Michalos (1991, p. 23) looked at the correlation of different measures. For example, the correlation between 7-step happiness and 7-step life satisfaction is 0.63, between 3-step happiness and 7-step life satisfaction correlation is 0.49 and between 7-step happiness and 3-step happiness correlation is 0.57.

On a national level Veenhoven analyzed the regression of "happiness-in-life" with "satisfaction-with-life" using the 11 nations Gallup/Kettering World survey and the 22 nations World Value Study I (Veenhoven 1993:101). Due to a larger spread (he took a regression line with 10% acceptable range) he concluded, that the fit was not good enough to serve as a solid basis for estimating "satisfaction-with-life" in countries on the base of responses to questions about "happiness-in-life" or vice versa. But this item becomes only relevant by doing cross-national comparisons of activities were the underlying questions are different (once asking the correlation of an activity with "happiness-in-life" and once asking the correlation of an activity with "satisfaction-with-life").

Since there are quite a lot of data about happiness studies (e.g. Veenhoven 1994, Michalos 1991) and because reliability studies have found, that reported subjective well-being (happiness) is moderately stable and a consistent concept (e.g. according to Frey et al. (2002) consistency tests reveal, that happy people are more often smiling during social interactions and are less likely to commit suicide), happiness could serve as the single indicator.

A further point is that also economists like Easterlin, Oswald & Frey use happiness as utility indicators for their research. According to Frey et al. (2002) happiness is not identical to the

traditional concept of utility in economics but is closely related and is a valuable approach which covers many more aspects of human well-being than the standard concept of utility.

4.1.2 Relativity and cultural differences

Relativity of happiness

A question discussed in the literature is, whether happiness is relative or not. This question is related to the possibilities to influence the happiness level by influencing the circumstances.

Indications that happiness is relative are given by Easterlin (2001). He showed that although household income increased over the last years and although persons with higher income are, on average, happier than those with low income the average happiness was stable. His theory is, that in fact at a given time those persons with higher income are, on average, happier. But as with higher income the aspiration level rises too, happiness with the new situation is related to the higher level of aspiration and therefore happiness level came down to where it was before. Looking back into the past, the old situation is always worse as the old situation is judged by the (new) higher level of aspiration. We think that this could be one possible explanation but it could be that parallel to the (positive) effect of higher income there were other diminishing effects on happiness.

Frey et al. (2002) show that although income per capita in Japan rose between 1958 to 1991 from less than 3000 US$ to about 15'000 US$ the life satisfaction was more or less stable over this time (life satisfaction was between 2.5 and 2.8 rated on a 4-point scale, transformed on a mean scale from 0-10 the change in life satisfaction over time can be seen in figure 4-1).

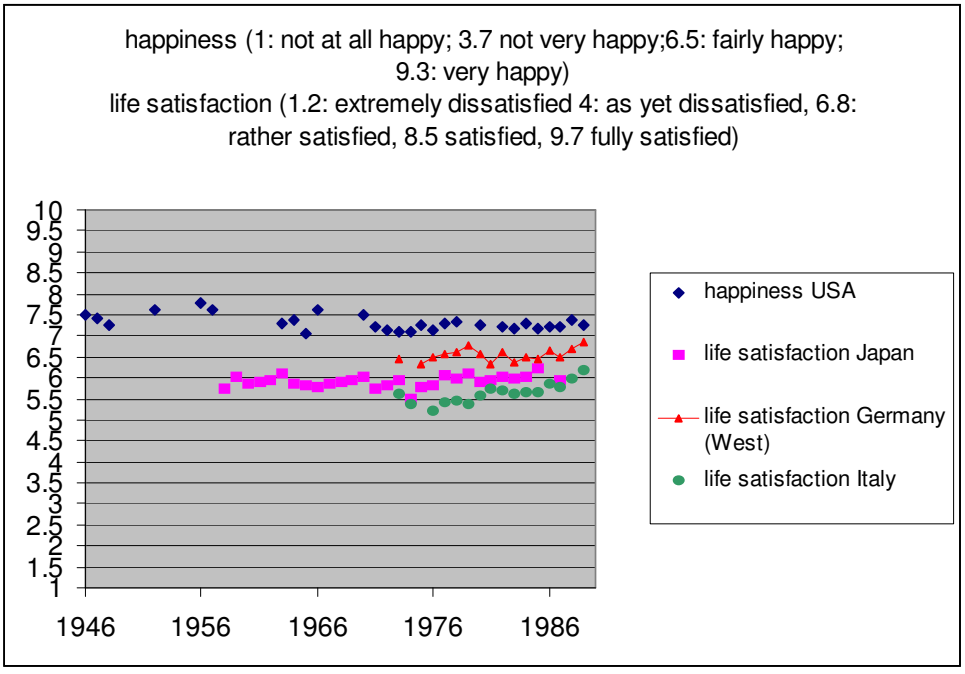

Figure 4-1: Happiness in different nations (Veenhoven 1993)

Concerning income and happiness over time he stresses on three important consequences: 1) The upward adjustment of aspirations induces human being to accomplish more and more 2) Wants are insatiable, the utility of income changes with the income level and 3) Most people

think that they felt less happy in the past and expect to be more happy in the future (see Easterlin 2001 above).

Further arguments towards the relativity of happiness are given by examples of lottery winners and people disabled by an accident were it was shown, that after a certain time the happiness of the lottery winner came down towards their happiness level they had in advance and the same happened with the disabled person (Csikszentmihalyi 2000, Brickman 1978).

Veenhoven (1989) acknowledges that Greek philosophers like Epicurus, economists like Easterlin (see above), sociologists like Runicman and psychologists like Brickman and Cambell believe in the theory that happiness is relative. However, he finds that happiness is not completely relative and therefore it makes sense to promote happiness. Based on the world wide Gallup study in 1975, the correlation between GNP per capita and average happiness of +0.84 was calculated. In addition he shows examples where happiness is not relative like studies of mothers of handicapped children that are less happy than the matched control (6.7 versus 8.4 on a 10 point scale), or 60+ widowers compared to 60+ married males (5.5 versus 8.0) or holocaust survivors compared to Israelis on the same age (5.6 versus 6.5).

Out of the discussion in the literature it is not clear whether happiness is relative. We think that happiness is only partially relative as beside the comparison of GDP and happiness contradictory statements concerning the relativity of happiness exist.

Cultural Differences

According to Ahuvia (2002) collectivist cultures of Japan and South Korea have despite their economic development a low subjective well being but the author was astonished about the low priority given to subjective well being in discussion with people from Asian collectivist cultures. He mentioned, that achieving one's intrinsic goals for personal growth, close personal relationship, and maintaining one's health is related with higher levels of subjective well being. Cross-cultural research shows that "enjoying life" and "leading an exciting life" are stronger in individualistic societies, whereas "social recognition", "preserving my public image", being "humble" and "honoring parents and elders" are strong in collectivist societies.

According to Diener et al (1997) individualists and collectivists construct their life satisfaction judgement in different ways. For college students in individualistic cultures life satisfaction judgement are predominantly based on one's recent emotional experiences whereas the satisfaction of collectivistic college students is based on emotions as well as on the perceived cultural value of a satisfying life.

Diener et al. (2000) emphasize that it is important to distinguish between culturally-specific needs and needs that are truly universal. They found, that self-esteem was much more strongly related to life satisfaction in individualistic cultures than in collectivistic one's. Similarly, values such as autonomy and purpose of life were more highly valued in the U.S.A. than in China or Korea. In addition, meaning in life shows weaker correlation with well-being in Germany than in the U.S.A.

Veenhoven (1993) analyzed the happiness in different countries. As different measures have been used (3-step happiness not very happy, fairly happy, very happy, 4-step happiness like not at all happy, not very happy, quite happy, very happy; 4-step life satisfaction like not at all satisfied, not very satisfied, fairly satisfied, very satisfied) a mean scale from 0-10 was calculated by Veenhoven.

As seen in figure 4-1 life satisfaction does not change much over time specially if one keeps in mind the happiness index varies also according to the study (e.g. in USA in1974 6

happiness studies during different month have been done and the lowest score of happiness was 6.78 the highest was 7.35). According to Veenhoven (1993) between 1973 and 1992 life satisfaction in other South European countries like Portugal (happiness between 5 and 5.9) and Spain (life satisfaction between 5.81 and 6.52) was lower than in the Netherlands (happiness between 7.07 and 7.69) or in Great Britain (life satisfaction between 6.8 and 7.11).

Garhammer (2002) stated as well that while he found evidence for a South-North-gap in Europe with regards to time prosperity the analysis of life satisfaction in Europe (Standard Eurobarometer 52 in 1999) shows that there is evidence for a continuous North-South gap with regards to life satisfaction (see also table 4-1).

Table 4-1: Life satisfaction and happiness (EU14, U.S.A, Japan) 1996-99 (Garhammer 2002)

Country	**percentage of those very or quite satisfied**	**Overall life satisfaction scale 1-10 1996**	**Taking all things toget-her happy? Scale 1-10, 1996**		**Country**	**percentage of those very or quite satisfied**	**Overall life satisfaction scale 1-10 1996**	**Taking all things toget-her happy? Scale 1-10, 1996**
Denmark	96	8.33	7.75		UK	83	6.93	7.73
Sweden	95	7.32	7.75		EU 14	82	6.71	7.29
Netherlands	94	7.64	7.84		Germany	82	6.38	6.99
Austria	93	6.96	7.49		France	80	5.89	7.38
Finland	90	6.96	7.31		Japan		6.14	7.17
USA	89	7.45	7.71		Italy	78	6.18	6.76
Ireland	87	7.12	7.88		Portugal	67	5.60	6.48
Spain	84	6.17	7.03		Greece	63	5.49	5.97
Belgium	83	6.91	7.71					

Inglehard suggested, that cynical attitudes are the reason for the lower happiness in South Europe (see Veenhoven 1993, p. 67). Veenhoven stated that if Inglehard's hypothesis is true, the South European countries must also be the most distrusting one's. By analyzing 11 Western countries plus the USA and Canada he found, that average happiness is low in countries where distrust in one's fellow is most common but distrust is also common in happy countries.

Michalos (1991) analyzed the happiness of students in 42 countries (68 scholars) using a 7-point-Likert-type scale. A selection of the results are given in table 4-2.

Table 4-2 is sorted according to the happiness. Comparing all countries it can be seen, that the highest stated happiness was found in the USA followed by the Netherlands and the U.K. Lowest happiness was stated in Portugal followed by Cameroon (4.025) Korea and Kenya (4.46). Portugal's life satisfaction score was 135% of a standard deviation below the world mean and it's happiness score was 194% below the world mean. The result, that stated happiness and life satisfaction are quite lower in Southern Europe than in Northern Europe can also be seen in table 4-1.

Satisfaction with family is in all countries higher than happiness with life as a whole. Countries with highest satisfaction with family are Bahrain (5.8) followed by Jordan (5.7), Israel and Bangladesh (5.6). Lowest satisfaction with family was stated in Cameroon (4.8), followed by Spain, Germany and Japan.

Satisfaction with friendship is highest in Bahrain (5.7), followed by the USA Belgium (5.5), Egypt (5.5), The Netherlands and Puerto Rico (5.5). Lowest satisfaction was stated in Hungary (4.6), Cameroon (4.7), Taiwan (4.8) and Turkey.

[5] For countries not listed in table 4-2 the scores are indicated in brackets

Satisfaction with self-esteem is highest in Israel followed by South Africa. Turkey, Chile, India and the USA are on a high level whereas Western Europe countries are lower than the world average, lowest is Japan. It would be interesting to know, if in Japanese culture self-esteem appears as a relevant quality.

Satisfaction with recreation could be an indicator for leisure activities. Highest satisfaction with recreation are stated in Portugal, Finland (5.4), the Netherlands and the Philippines (5.3). Lowest satisfaction is reported for Turkey and Korea followed by Cameroon (4.1) and Jordan (4.1). It is astonishing, that Portugal (the country with the by far lowest happiness and the lowest satisfaction with life) has the highest satisfaction with recreation.

Table 4-2: Mean satisfaction, mean happiness and satisfaction with different parts of life (Michalos 1991). Only a sample of countries is listed, "world" is the average of all countries.

Country	Happiness with life as a whole	Life satis-faction as a whole	Satisfaction with family	Satisfaction with one's friendship	Satisfaction with self-esteem	Satisfaction with housing	Satisfaction with education	Satisfaction with religion	Satisfaction with recreation
USA	5.27	5.28	5.5	5.6	5.2	5.2	5.3	4.9	5.2
Netherlands	5.23	5.17	5.3	5.5	5.0	5.1	5.2	5.5	5.3
U.K.	5.22	5.20	5.5	5.4	4.8	4.8	4.9	4.7	5.2
Sweden	5.19	4.96	5.4	5.2	4.8	5.1	5.0	4.8	4.8
Canada	5.06	5.11	5.4	5.5	5.1	5.1	5.1	4.7	5.0
Germany	4.97	4.84	5.0	5.0	4.9	4.7	4.5	4.6	4.9
Switzerland	4.95	5.08	5.2	5.2	4.9	5.2	4.7	4.6	4.9
India	4.82	4.72	5.5	5.2	5.2	4.7	4.7	4.9	4.9
World	4.71	4.76	5.3	5.2	5.1	4.8	4.7	4.9	4.7
Chile	4.70	4.97	5.3	5.2	5.2	5.0	5.1	5.0	4.9
Turkey	4.61	4.21	5.1	4.8	5.2	4.3	3.4	3.9	3.8
Israel	4.58	4.98	5.6	5.2	5.5	4.7	5.0	4.3	4.3
Spain	4.52	4.55	4.9	5.2	4.5	4.8	4.0	4.1	4.6
Japan	4.49	4.09	5.0	5.0	4.0	4.2	3.8	4.3	4.2
Austria	4.48	4.92	5.0	5.1	4.9	5.2	4.6	4.6	4.9
Greece	4.42	4.83	5.4	5.3	5.1	4.9	3.9	4.6	4.7
Korea	4.38	4.21	5.1	5.1	4.1	4.4	3.7	4.2	3.8
South Africa	4.37	4.53	5.5	5.3	5.3	4.2	4.4	4.9	4.6
Portugal	2.25	3.26	5.4	5.4	5.1	4.5	5.2	3.7	5.5

If happiness is used in different cultures, two main aspects have to be considered. First the relevance of happiness in the specific culture (see section cultural differences) has to be considered and on second the meaning of the expression has to be clarified related to a specific culture because, e.g. Dalai Lama's definition of "happiness" (see definitions) is much broader than other definitions of "happiness".

4.2 Relationship between economic aspects and happiness

Quality of life includes according to the definition in section 2.2 also economic aspects. Therefore, if we use only happiness as indicator, the relation between economic aspects and happiness has to be examined.

Ahuvia (2002) showed in his study, that the relation between consumption (income) and subjective well being (SWB) is significant among different countries but not within a country. Within developed countries there is a low correlation (only 2-3%), but between different nations the correlation is about 60-70%. He states, that richer countries stand for more open and more free countries, for better education, and a more pluralistic society. He makes also differentiation between collectivistic and individualistic societies and says, that there is a lower priority of SBW in Asian cultures (see also section 4.1.2).

Di Tela et al (1998, 2002) used regression analysis in two models. First life satisfaction was related to inflation, unemployment and some adjustment factors (Di Tela et al. 1998).

Second, happiness was related to the Gross Domestic Product (GDP), personal characteristics like unemployment, income quartile, gender, martial status, education, age and number of children and again some adjusting factors (Di Tela et al. 2002). They indeed showed that significant regression coefficients could be derived and that macroeconomic variables are to explain differences in happiness or life satisfaction.

Economic depression and unemployment have not only an influence on happiness but also on time perception. Klein (2002) describes a village (Marienthal) where during the world economic crisis (1929) more or less the whole village was unemployed. Social life broke down, the whole village fell into agony and by asking the people to report on diaries what they do they report e.g. “17-18 h walking from the park to home” a walking distance of 5 minutes. Walking speed became slower and people were depressed and without energy.

Frey et al. (2002) analyzed the influence from inflation on well-being (happiness). They show, that increasing the inflation rate by 5 percentage points reduces the subjective well-being by 0.05 units (this means that 5 percent of the population shift in the life satisfaction category to the next lower level e.g. from very satisfied to fairly satisfied. In addition Frey et al. (2002) calculated, that one percentage point increase in unemployment rate is compensated by a 1.7 percentage point decrease in the inflation rate. Thus if unemployment raises by 5 percentage point the inflation rate must be decrease by 8.5 percentage points to keep population equally satisfied.

Easterlin (2001) shows, that happiness varies directly with socio-economic status as measured by education. Higher educated persons are happier. His theory also postulates, that over the life cycle material aspiration rises roughly in proportion to income. On the other hand he shows, that persons with higher education have a higher desire of consumer goods and also own more consumer goods. By analyzing the desire of the school seniors (18 years-old) he shows, that the material desire for students with or without college plans is the same which means that the material aspiration is not related to the background of the students. At this point, those with higher income are happier because material aspirations is fairly similar through population and those with more income are better able to fulfill their aspirations. Contrarily to Easterlin’s conclusion that higher income relates to higher materialism Lane (2000) argues out of two studies that the correlation of materialism with income was 0.4 (study of Richins & Dawson) and almost 0 (study of Kasser & Ryan). Therefore, that is no clear evidence concerning the relation between income and materialism.

Based on the provided evidence we can ask whether economic circumstances only influences happiness or whether happiness can influence also economic circumstances.

4.3 Activities and changes in happiness

Gershuny (1996) is one of the few exceptions relating time use analysis and happiness (or satisfaction). He analyzed based on personal diaries how the 1'440 minutes (24 h) of a UK adult’s day were used in 1961 and 1984 and divided the activities into three categories: sleep, satisfaction of basic wants and satisfaction of sophisticated wants. In 1961 309 minutes have been spent for the satisfaction of basic wants and 270 min have been spent for sophisticated wants, while in 1984 it is vice versa. For various activities the mean preference score from the diaries was analyzed. In figure 4-2 the enjoyment of the different activities and the time per day doing this particular activity can be seen.

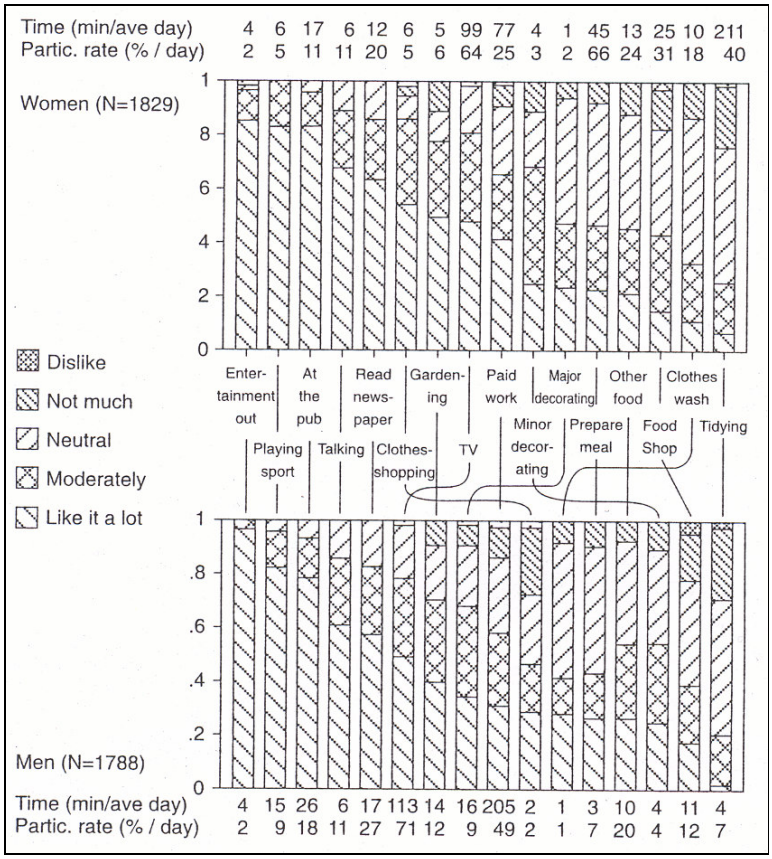

Figure 4-2: How much do you enjoy activities (Gershuny 1996)

For men and woman highest enjoyment was in entertainment followed by playing sport, going to the pub, talking, reading newspaper. For women tidying came on the last place, followed by clothes washing, food shopping, other food and preparing meal. For man also tidying is the least enjoyable activity followed by food shopping, minor decorating, other food and preparing meals.

Sullivan (1996) analyzed the enjoyment of activities and the association between the well-being of partners using 380 heterosexual couples who kept simultaneous 5-day time-use diaries in June/July 1986. The overall enjoyment for different activities (paid work, food preparation, cleaning, cloth care, child care etc.) for men and women was measured (rating scale: 1=enjoying a lot, 2=enjoying a little, 3=neutral, 4=not enjoying much, 5= not enjoying at all). Highest enjoyment rate for men was for socializing (1.39) followed by sleeping (1.54), eating (1.71) and relaxing (1.71). Men had their lowest enjoyment rate for cleaning (3.06) followed by food preparation (2.75) and paid work (2.62). Highest enjoyment rate for women was also by socializing (1.33) sleeping (1.41) and relaxing (1.64), lowest enjoyment rate was for cleaning (2.91) followed by cloth care (2.77) and food preparation. By analyzing the time-use data, Sullivan (1996) investigated whether there is a higher level of overall well-being among those who were able to allocate a higher proportion of their time to more enjoyable (i.e. leisure) activities. He found, that there is ***no*** significant effect of either the proportion of leisure time or the proportion of joint (i.e. simultaneous) leisure time on either men or women's overall enjoyment rate. In addition, he showed that persons with higher than average enjoyment rate are in general more enjoying their time irrespective of the activity they are undertaking. This means that by increasing enjoyment rate (or happiness) one can influence the happiness doing any kind of activity.

Möller (1986) did a weekday time-use study over a three-week period in October 1992 among 300 multigenerational urban black households. One main question was related to the contribution on daily activities to family solidarity and subjective well being. Analysis of activities for 3 generations (median ages 17, 38, 66) was made. Satisfaction was highest for the 17 year old persons (64% satisfied with life as-a-whole), for the 38 and 66 year old persons it is 48 and 47%, respectively. The satisfaction with peace and harmony in the household is for all 3 generations between 80 and 82%. By analyzing the different activities and the underlying motivations to these activities (like obligations, duty, relational, enjoyment, to pass time etc.) the result suggests that persons who fill their day with meaningless activities and perform no social activities are at risk of alienation from their families. So doing social work within the family could not only influence the happiness of the family members but also the happiness of the acting person.

Veenhoven (1994) has brought together 603 studies from 69 nations in a database. Table 4-3 shows for which topics the happiness index or the change of happiness related to an activity has been compiled.

Table 4-3: Index for happiness studies (possible interesting domains for the study are marked bold), Veenhoven (1994)

Activity level	**Friendship**	Local environment	Problems
Activity-pattern	Gender	Lottery	Psycho-somatic complaints
Affective life	Grief	Love-life	Religion
Aggression	Handicap	Marriage	**Resources**
Anomy	Happiness (attitudes, level)	Meaning	Retirement
Appearance	Health-behavior	Medical treatment	Roles
Attitiudes	Hope	Mental health	School
Authoritarianism	**Household**	Migration	**Self image**
Body	**Housing**	Military life	Sex-life
Children	Income	Modernity	Sleep
Communal living	Institutional living	Mood	**Social mobility**
Concerns	Intelligence	Nationality	**Social participation**
Coping	**Interests**	Nation	**Sports**
Creativeness	Intimacy	**Nutrition**	**Stimulants**
Daily hassles	Leadership	Occupation	Suicide
Education	**Leisure**	Organ-transplantation	**Time-behavior**
Employment	Life-appraisals	Personality	Therapy
Ethnicity	Life-change	Physical health	**Values**
Expressive behavior	Life-events	Planning	Victimization
Family	Life-goals	Politics	War
Farming	Live-history	Popularity	Work
Freedom	Life-style	**Possessions**	Worries

Table 4-4: Examples out of the database (r = Pearson's product-moment correlation; avr = average r; rpc = partial correlation coefficient (correlation after the effect of other variables is filtered away; G=Goodman& Kruskal's Gamma (range –1;+1);ns = not significant). If there are several findings the spectrum of r is indicated e.g. 0.2<r<0.5. Negative correlation's will be marked with a (-), in the examples of table 4-4 only positive correlation's appear (Veenhoven 1994)

index	activity	correlation		index	activity	correlation
Friendship	Current number of friends (page 700)	0.1<r<0.28		leisure	Reading books	0.14<G<0.38
	Satisfaction with friendship (page 710 ff.)	0.1<r<0.63 (mean about 0.35)			Shopping (page 1022), study in Manila	0.18<G<0.45
household	housecleaning laundry shopping for food preparing meals (page 882)	ns ns ns ns			Theater/movies (page 1022), study in Manila	0.02<G<0.52
	Satisfaction with privacy (page 880)	r=+0.36		nutrition	Healthy eating habits (page 1445)	r=0.02
	Handicapped or disabled people at home (page 879)	0.05<r<0.16		possession	Goods (Luxury), (page 1682)	r=0.24
	Living with children (page 875)	0.1<r<0.4			Level of living (page 1682	r=0.10
housing	Objective or subjective crowding (page 888 ff.)	ns			Availability of a car	r=0.15
	Satisfaction with housing/ apartment (>page 891 ff.)	0.13<r<0.37		resources	Religiousness (page 1732)	ns<r<0.33
interests	Having hobbies (page 981)	r=0.16		Self image	Self esteem (page 1782 ff.)	0.12<r<0.36
leisure	New hobbies (page 1012 ff.)	0.3<G<0.37		Social mobility	Perceived subjective social class position in future	0.15yG<=0.23
	Watching more TV (page 1013)	ns		Social participation	Having made new friends (page 1823)	G=0.37
	Bodily activities in pursuit of pleasure (page 1013)	0.36<r<0.47		Sports	Active involvement in sports (page 1890 ff.)	0.13<r<0.15 0.07<G<0.14
	Mental work (games etc.) upon pleasure (page 1013)	r=0.43			Passive involvement in sports (page 1892 ff.)	0.07<G<0.33
	Social activities (page 1016)	r=0.17		Stimulants	Consumption of alcohol (page 1897)	Ns<G<0.16
	Eating/drinking out (page 1020)	0.12<G<0.53			Using tobacco	r=0.03

As seen in table 4-4 if one has the choice between watching more TV or starting a new hobby, watching TV does not influence the happiness while new hobbies lead on average to higher happiness.

Graef et al. (1981) analyzed based on the flow principle energy consumption in leisure and perceived happiness. Happiness was measured using the Experience Sampling Method (ESM). 125 full-time employees (men and woman) with ages between 19 and 63 from five companies in the Chicago area were participating, 86% adequately completed the study. Figure 4-3 bears relevant information for sustainable consumption.

The three BtU categories are based on very early attempts to quantify energy use by Fritsch (1974) and may nowdays look differently, e.g. sports would probably be in middle or high BtU while playing music would probably be in low BtU and TV watching would probably be rather on a middle BtU. They also find that for visiting restaurants, happiness is high.
For female Graef et al. (1981) find that there is an inverse relationship between energy use and happiness. However, the findings for men only show a less clear picture and we need to be aware that it is not clear in which direction the causal relation goes, i.e., do happier people perform less energy consuming activities or vise versa?

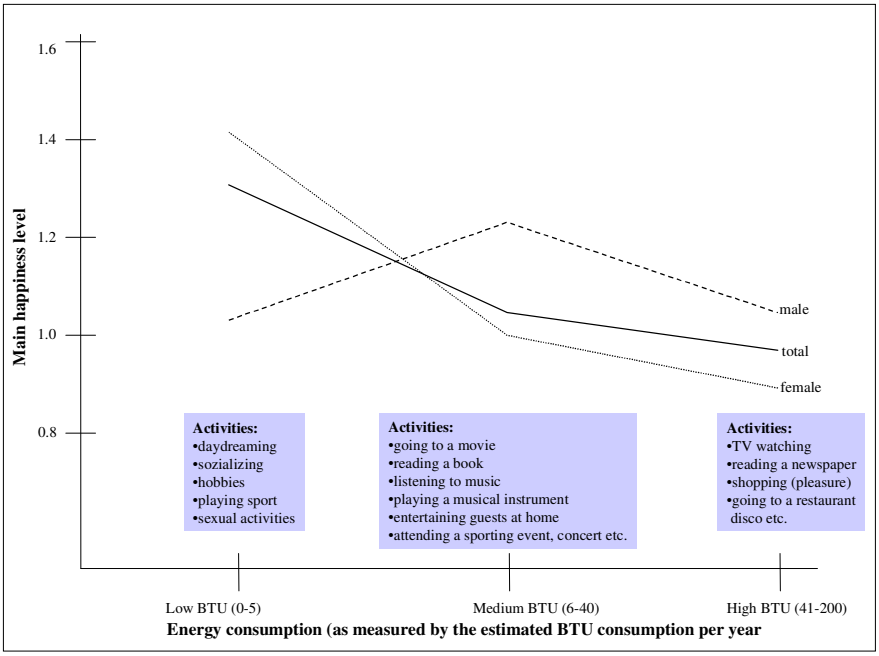

Figure 4-3: Relationship between energy consumption in leisure and people's feeling of happiness (Graef et al 1981)

Passive versus active participation is suggested as major variable to explain the differences in happiness. According to Csikszentmihalyi (2000 „the reason activities with low external physical energy requirement result in greater happiness is that they usually require greater inputs in psychic energy".

Gatersleben (2001) found that when she asked 111 households to reduce their energy consumption by less than 30 GJ per year the respondents thought that their quality of life on average be improved. However, those households that have been asked to reduce energy use more than 30 GJ/a thought that this would overall reduce their quality of life. Environmental resources and quality of nature were the two quality of life aspects that correlated well with reduced energy consumption. Therefore, the overall quality of life does not reflect the happiness with low energy activities but a trade-off between different quality of life aspects.

Sirgy et al. (1998) analyzed, that the correlation between life satisfaction and satisfaction with possession was 0.28. To analyze whether the materialism is a base for different perception of satisfaction he divides his group (n= 297) based on the median split into a high materialism group (n=132) and a low materialism group (n=151). He found then, that for the materialistic group economic independence and material satisfaction significantly affect their overall life satisfaction while in the low materialism group education, friends and associates, leisure life and cultural life significantly affect their overall life satisfaction. In addition he showed, that for high materialism subjects the dissatisfaction with the possession is greater than for the low materialistic group. We suppose that high materialism subjects believe that material consumption leads to happiness and by realizing that they are not happier with the new possession they believe that not being happier is related to the consumed material and not to their behavior. So they buy always new materials without really becoming satisfied.

Kau et al (2000) analyzed 153 households in Singapore related to the influence of materialistic inclination on values. They saw that low materialistic people were found to be more satisfied with life overall. High material people were less satisfied with friends, job,

material comfort and money than low material people. According to Kau et al (2000) some of these aspects were also found in US studies. Ryan et al. (2000) who did a survey with 162 Australian adults came to the same result, that materialism is negatively related to life satisfaction.

Oropesa (1995) analyzed the linkage between consumer goods (telecommunications, computer, automobiles) and well-being. The most important consumer durable in American society is the automobile. He states, that this attraction to the automobile is attributed to the fact, that it symbolically communicates status. Looking into Veenhoven's data base (Veenhoven 1994) correlation between status and happiness availability of a car has a correlation index of r=+0.15 (see table 4-4).

Vlek et al (1998) did a study with about 200 adults, were they evaluated the relative importance of 22 different subjective quality of life attributes. Health, family, environmental quality, nature and safety were the attributes with the highest importance, followed by privacy, security, learning, freedom, work, leisure time, social relations, esthetic beauty, equity, money etc. Status and spiritual life are the most unimportant points. In addition they analyzed the change of the different quality of life indicators related to 3 scenarios (deteriorated economy and improved environment, improved economy and deteriorated environment, deteriorated economy an deteriorated environment). Only the first scenario is assessed positively related to the most important attributes (health, family, environmental quality, nature). We think this outcome is contrary to the behavior of the people. If environmental safety is indeed valued that high the behavior of the people should be different.

Hills & Argyle (1998) analyzed four leisure activities (sport, music, church, watching TV and their correlation with happiness using the Oxford Happiness Inventory (OHI). Each of the four leisure activities is a source of positive affect for those who took part. But despite the clear evidence that the leisure activities produce positive moods, Hills & Argyle (1998) stated, that only participants of the sports group were significantly happier than non-participants. Further a highly significant positive correlation between extraversion and affect levels for music, sports and TV was found. According to Hills & Argyle (1998) this is consistent with the findings, that the social element is an important source of leisure satisfaction. TV (soap) watchers play hereby a bit a paradox role as against the general expectations they also report a higher level of extraversion. The authors suggest, that they are more inclined to turn to their (imaginary) social contacts.

In Zapf et al (1996:207ff) the influence of life style on life satisfaction was analyzed. Nine life style types have been defined and their influence on life satisfaction was analyzed. Looking at West Germany the different life style types are presented. Type 1 (10% of the people) shows high social engagement, family life and self expression are important characteristics. Type 2 (13% of the people) focuses on working engagement and success. Type 3 (10% of the people) is a cultural interested hedonistic person with high living standard and outdoor leisure activities. Type 4 (14% of the people) is a family type with leisure activities close to the home surrounding. Type 5 (15% of the people) has priorities for work and sports, is good informed and is pleasure and consumption oriented. Type 6 (4% of the people) is expressive with focus on clothes and fitting out. For type 7 (13% of the people) pleasure, socializing, leisure time are relevant. Type 8 (11% of the people) can be described by leading a modest life, little cultural interested and safety oriented. Type 9 (11% of the people) is traditional and functional oriented, likes gardening and hobbies. With a mean value for life satisfaction of 7.96 in West Germany the two life style groups with the lowest

life satisfaction were type 8 (life satisfaction 7.34) and type 3 (life satisfaction 7.43). By keeping living standard, age and social status in mind the result is only significant for type 3 (Zapf et al. 1996). This type of young, good educated broadly interested type is mainly unsatisfied with environmental protection and social security. While overall living standard and family are the dominant influences on life satisfaction this varies by analyzing the different life styles, e.g., deficits in the possibility of having political influence lowers the satisfaction of type 3 (Zapf et al. 1996). His analysis of life satisfaction related to the different life styles could be an additional indicator to check what activities lead to life satisfaction.

Argyle et al. (1996) showed the relationship of domain satisfaction with well-being and psychological distress based on a study done by Headey & Wearing with 600 Australian subjects (results in table 4-5)

Table 4-5: Relationship of domain satisfaction with well-being and psychological distress: correlations (Argyle et al. 1996).

Domain satisfaction	Life satisfaction index	Positive affect	Anxiety	Depression
Leisure	0.42	0.28	-0.29	-0.29
Marriage	0.39	0.17	-0.29	-0.32
Work	0.38	0.26	-0.27	-0.36
Standard of living	0.38	0.20	-0.18	-0.26
Friendship	0.37	0.19	-0.15	-0.12
Sex life	0.34	0.17	-0.19	-0.33
Health	0.25	0.11	-0.23	-0.14

As leisure is highly correlated with life satisfaction, leisure activities are an interesting field to analyze changing behavior in consumption.

Analyzing the flow status, Schallberger et al. (2001) shows that during work people are more often in a flow status than in leisure time (36.2% versus 12.8%). This result is based on the fact that during work people are more often faced with a real challenge. Therefore, leisure activities (we see the correlation leisure with life satisfaction above) that highly challenge people and use few natural resources could be a motivator to change consumption behavior.

4.4 Causal relationship between activity and happiness

Whether a relationship between an activity and happiness is causal or not can not easily be answered. Different studies who postulate causal relationship are in fact not causal but correlated. A good example for this is unemployment. Unemployment leads according to Frey et al. (2002) to a loss of subjective well-being of 0.33 units in the satisfaction scale (range from 1 “not at all satisfied” to 4 “very satisfied”). Frey et al. (2002) states that “although unhappy people are not performing well on the labor market, according to the main causation seems to run from unemployment to unhappiness. Thereby younger and older employees suffer less when hit by unemployment than employees in the middle of their working life”. Further they mentioned that “n a general level, raising the general unemployment rate in Europe from 9 to 10% reduces life satisfaction by 0.028 units on the four-point scale applied”. In a U.S. study from 1972-91 using longitudinal data it was found, that unemployment is positively related to suicides and thata one percent point increase in state unemployment rate will increase suicides by 1.3 percent (Frey et al. 2002).

By doing a longitudinal study of four nationally representative cohorts[6] of young Australian (initial sample: over 5'000 respondents) Marks et al. (1999) analyzed the effects of well being as well as the effects on well-being. Their conclusion were shown in table 4-6:

Table 4-6 effects on well-being and effects of well being (Marks et al. 1999)

Effects on well-being	**Effects of well-being**
• Women show higher well-being than men. The gender difference increases with the age. • Marriage significantly increases well-being levels. • People in de-facto relationship reported higher well-being (as it is the case for married people) but here the effect was stronger in the older cohorts (for marriage no significant interaction effects were found between age and marriage). • Living at home did not have a consistent effect on well-being (for the 1965 cohort living at home was negative, for the 1975 cohort living at home was positive, for the two others it was not significant. • Children have a negative effect on well-being (effects were greatest for the 1965and 1970 cohort). • Income has a comparable effect on well-being. A standard deviation difference in income translated into a 1.5 unit difference in score on the well-being index. • Like income the effect of occupational prestige is also small but large for comparison at the extremes of the distribution (e.g. the difference between a professional and a semi-skilled manual worker produces a difference in well-being scores of 4.3 in the 1975 cohort. The effect is greater for younger cohorts. • Unemployment has one of the largest effects on well-being (score between three and five units less on well-being measure)	• Well being affects the likelihood of being married. For the three oldest cohorts unmarried respondents one standard deviation above the mean were about 1.5 times more likely to be married at the second time point than unmarried respondents with mean level of well-being. • Well-being also affects in a de-facto relationship, however the effect is weaker and age specific. • Well-being has only weak effects on subsequent occupational status. • Well-being is related to income. A one standard deviation increase in well-being increased income by two to three percent points, net of prior income. Tests of the interaction with gender indicate, that income returns on well-being are higher for woman than for man. • Well-being has substantial effects on unemployment. In all cohorts the effect was significantly and remarkably consistent. Respondents that scored one standard deviation above the mean on the well-being index were 1.3 times less likely to be subsequently unemployed net of prior unemployment status. Comparison of respondents two standard deviations above and below the mean are nearly three times less likely to be unemployed. In other words those with higher level of happiness are, if employed, more likely to remain employed and if unemployed more likely to get a job.

Table 4-6 shows that for employed as well as for unemployed people well-being has an influence on unemployment. The same statement can be made for marriage. Not only marriage influences the well-being but well-being could also influence the chance to get married. In addition these statements give an indicator that happiness is not only relative.

Lane (2000) described the change of the index of well-being and the satisfaction with non-work time. People that report that they are never rushed as well as people always rushed are dissatisfied with the non-work time and their index of well-being is negative. People in the middle of never rushed and always rushed report satisfaction with non-work time and have a high index of well-being.

Frey et al. (2000) analyzed based on a survey in Switzerland with 6'000 persons spread over all 26 Swiss cantons, that the more developed the institution of direct democracy is, the happier the individuals are (due to the federal structure of Switzerland major competencies remain with the cantons).

Zapf et al (1996:94) analyzed the life satisfaction in West Germany and in East Germany related to the education. In West Germany in 1988 there was nearly no difference in life satisfaction (scale 0-10) between persons visiting primary school, secondary school, and gymnasium (life satisfaction was 7.9, 8.0, 7.9). In 1995 the same survey shows scores of 6.8,

[6] The cohorts were born in 1961, 1965, 1970 and 1975, life satisfaction for the first cohort was analyzed beginning in 1979 until 1994, for the second cohort from 1982 to 1995, the third cohort was asked from 1986 until 1994 while the fourth cohort was asked from 1992 to 1995

7.2 and 7.4, respectively. In East Germany, life satisfaction started in 1990 with 6.4, 6.7 and 6.6 (primary school, secondary school and gymnasium) and was reported in 1995 with 6.0, 6.5 and 6.4, respectively. In addition they analyzed fear and sorrow of the people and found out, that 17% of the West Germans and 26% of the East Germans have often fears and sorrows. This percentage is higher at lower education (the percentage of persons having often fears and sorrows is also higher with higher age (age classes 18-34, 35-64, 65-), and is higher for woman than for men).

A common thinking is, that time pressure leads to lower life satisfaction. Garhammer (2002) analyzed life pace and stress in different countries of EU, US and Japan using personal time budget and his results show, that time pressure does not reduce life satisfaction and happiness. He shows that neither very high work speed nor suffering from frequent time pressure or having stress or sleeping problems are significantly related with life satisfaction. He gives two explanations: 1) negative impacts are neutralized by higher living standard. 2) time pressure mobilizes individual resources (eu-stress or positive stress). As seen by the analysis of Schallberger et al. (2001) flow states are experienced more often during work. They also found, that managers have more often flow states than workers. Having this in mind, life satisfaction could be stable despite higher stress situations but it has also be analyzed if this is only an intermediate state. Switching from eu-stress to stress, life satisfaction is affected (humans might be like lakes that buffer certain pollution but then from one moment to the other the collapse could appear).

4.5 What have we learned?

Answer to question 1 (is happiness the appropriate indicator?)

The first question was whether happiness is an appropriate indicator. Happiness (or life satisfaction) are both parts of subjective well-being and subjective well-being is the relevant indicator for the subjective part of individual quality of life. If consumption is mainly driven by personal motivations then happiness (or satisfaction) could serve as ultimate indicator. Since we suggest in section 2 that social factors may be other relevant drivers, happiness will only indirectly cover these drivers.

As seen in section 4.1.1 there are quite a lot of happiness studies, the result of the happiness studies seem to be reliable and not only psychologists but also economists use happiness as utility measure. This measure is quite easy to handle by keeping in mind their cultural circumstances when comparing different countries.

A more detailed view about the effect of an activity on happiness can be gained by using the Experience Sampling Method (see Graef et al. 1981 and Schallberger et al. 2001). Flow could be a good motivator for persons to change their behavior. Therefore, data on the flow principle could serve alternatively as basis to evaluate happiness related to consumption.

Answer to question 1a (limitations of happiness as indicator)

A Limitation of the happiness indicator is, that data about “satisfaction-with-life” in countries could not be used to give a quantitative responses to questions about “happiness-in-life” or vice versa. Based on Veenhoven it remains open, whether the happiness related to an activity can be compared with the satisfaction related to an activity.

Comparing across different cultures calls for attention. If lower happiness (like it appears in South European countries where socializing is an important issue) is a possible basis for

socializing, e.g., complaining about any issue is an attempt to start discussions, then this needs to be considered. A further explanation could be, that in some cultures it could be "not adequate" to state that one is happy or that complaining (without mistrust) could be a part of the cultural behavior.

Answer to question 2 (is happiness just a function of economic variables?)

Based on the provided data it can be seen that economic circumstances like GDP, together with some personal adjustment factors like unemployment and some country specific adjustment factors could influence happiness. However, happiness is also influencing the personal factors (like unemployment). Therefore, happiness can not be explained by economic factors only.

Economic impacts like economic depression can have a significant influence on the persons happiness and life satisfaction. However, the data record presented in figure 4-2 reveals that these effects are not very visible.

Answer to question 3 (does a relationship between consumption and happiness exist?)

There is a relationship between consumption and happiness. Studies like Graef et. al. (1981) show the relation between consumption (leisure time activities) and happiness and show that activities with lower energy consumption correlates with higher happiness (for women this relationship is clearer than for men).

Answer to question 3a (what activities make people particularly happy?)

Out of the sample from Veenhoven's data base for leisure activities the highest correlation's exist with "mental work bestowed upon pleasure like games etc." (r=+0.47.....+0.43), "new activity or new hobbies engaged in" (G=+0.3....+0.4)[7], "meeting new people" (G=+0.34), "gone to new places" (G=+0.25), "reading books" (G'=+0.14 to +0.38 depending on age) "social activities like attending sport events, attending church, doing volunteer work, visiting etc." (r=+0.9). For possessions, higher correlation exists for "a fashionable wardrobe and many luxuries" (r=+24)[8], and having a car (r=+0.15). Using Veenhovens' data base it has to be mentioned that it is important to check the country and the sample size of the studies. Studies about 'theatre' and 'going out' are in Veenhoven's data base only based on a study from the Philippines and therefore it has to be checked whether the results can be used in other cultures or countries.

Based on Graef et al. (1981) the correlation of happiness with activities can be seen in table 4-7.

[7] G=Goodman& Kruskal's Gamma (range –1;+1)
[8] Pearson's product-moment correlation

Table 4-7: Activities and happiness (Graef et al. 1981)

Happiness	Activities (male)	Activities (female)
Highest happiness	reading a book listening to music playing a musical instrument entertaining guests at home attending a sporting event, concert etc.	daydreaming, socializing, having hobbies, playing sport and performing sexual activities followed by going to a movie
Medium happiness	TV watching, reading a newspaper, shopping (pleasure), going to a restaurant, disco etc., daydreaming, socializing, having hobbies, playing sport and performing sexual activities followed by going to a movie	reading a book, listening to music, playing a musical instrument, entertaining guests at home, attending a sporting event, concert etc.
Lowest happiness		TV watching, reading a newspaper, shopping (pleasure), going to a restaurant, disco etc.

Sullivan (1996) finds that the highest enjoyment for men are socializing followed by sleeping, eating and relaxing. For women, socializing is followed by sleeping, relaxing, and eating.

Gershuny et al. (1996) find that activities with the highest enjoyment are entertainment, playing sport, going to a pub, talking, and reading newspaper (see figure 4-2).

Activities requiring greater inputs of psychic energy makes more happy (Csikszentmihalyi 2000). As active participation is in most of the cases related to the involvement of psychic energy, activities requiring active participation like learning a new sport technique will make happier than passive activities like watching TV. Identifying leisure activities where (psychic) requirements are high but not too high (flow status) and where energy consumption is low could serve as a model for sustainable consumption.

Answer to question 3b (Does materialism make happy?)

According to Sirgy et al. (1998), Kau et al. (2000), and Ryan et al. (2000) materialistic persons are less happy than non-materialistic persons. Further the preferences of materialistic and non-materialistic persons are different (for non-materialistic persons satisfaction is mainly affected by education, friends and associated leisure life and cultural life (Sirgy et al. 1998)).

Answer to question 3c (could we influence happiness by changing consumption patterns?)

It could be that by changing consumption habits happiness can be influenced but we have not found enough studies to answer this question. To answer this question more longitudinal panel studies have to be analyzed. Another question hereby is, whether changing in happiness could lead to a change in consumption habits. As seen in Marks et al. (1999) a change in happiness could lead to a change in the marital status or in the working status so there is a chance that by increasing the level of happiness, consumption habits can be changed. Increasing happiness is not anything impossible as one can seen in Klein (2002). Beside others he described (p. 237) a “well-being therapy” developed by the Italian psychiatrist Giovanni Fava where the patients had to keep a happiness diary. After 10 weeks they were less depressed, less anxious and happier with their life.

Answer to question 3d (are the relationships between activity and happiness causal?)

Based on the literature review there are very little truly causal relationships reported. Many relationships that seem to be causal at first glance appear not to be causal (as the influence on being married or loosing a job). Elchardus (1991) suggests in his critique of utilitarism that the causality of this link is indeed questionable or weak. Maybe not the causal relationship of activity and happiness but the "driver" for doing an activity is important. According to Diener et al (1997), optimism, self-esteem and extraversion are some of the personality traits possessed by happy people. Therefore, analyzing the pattern and effects of optimism, self-esteem and extraversion to consumption and happiness could give an interesting input.

Remaining questions:

1) As discussed in answers to question 3c) further longitudinal panel studies have to be analyzed to check, if a causal relationship between consumption and happiness exists.
2) If happiness is indeed related to low energy consumption respectively to low materialistic needs then information and education about this knowledge is relevant. Possible ways leading out of materialism have to be developed. Analyzing patterns and effects of optimism, self-esteem and extraversion on materialism could be a help to further understand the behavioral mechanism.
3) Beside cultural differences like collectivistic or individualistic societies, it remains open, if time prosperity is an important indicator for happiness or life satisfaction in different nations (see Garhammer 2002).
4) Between 1974 and 1994 social behavior has changed according to Lane (2000). Lane showed that during this time period the percentage of persons visiting their neighbors was frequently reduced from about 30% to 22%. The percentage visiting relatives diminished from 38 to 34%, and the percentage of people visiting parents rose from 18% in 1978 to 21% in 1987 and fell then on the level of 19% in 1994. Only the percentage of visiting friends frequently rose from around 22% in 1974 to about 23% in 1994. Do these changes in social behavior have an effect on satisfaction with consumption?

5. Time use, consumption, and environmental impacts – insights from the literature

5.1 Overview

Consumption is linked to activities and these activities require time. This even holds if acquired goods are not really used because we spend considerable time on shopping goods and services. Since consumption is also linked to the production of goods and services and its associated resource use and environmental impacts, this section will look into the causal relationship between time-use, consumption, and environmental impacts.

Section 1 introduced both, the notion of sustainable consumption and (time) rebound effect. Therefore, we are especially interested in research results that look into changes in time-use and environmental impacts due to changes in consumption. Finally we attempt to answer the question what type of data and models we need to predict environmental consequences of changes towards sustainable consumption.

Section 5.2 gives a brief insight into time-use research, available and required data, and the discussion of research results that provide first insights to the question of how people change behavior when they adopt changes in consumption. Section 5.3 provides results that link data on time, consumption and energy use or material use, discusses time-rebound effects and in section 5.4 we summarize the need for data and models to predict changes in environmental impacts due to changes in consumption. This is an essential prerequisite to promote the environmental dimension of sustainable consumption.

5.2 Time use surveys

5.2.1 Purpose and history of time use surveys

The measurement of time-use on a regular basis was probably introduced in the planned economies since monetary units for planning are less dominant. Most time-use studies have been motivated by the need to analysis and valuate non-market work (e.g., household work) and to get additional insights on, e.g., leisure and transport activities (Juster & Stafford 1991, Klevmarken 1998, Harvey 1999, Breedveld et al. 2002).

Klevmarken (1998:1) summarizes the main incentives to derive time-use measurements:

1. Give better measures of market work
2. Improve the analysis of labor supply by explicitly including competing activities in the home.
3. Make feasible studies of gender differences in market and nonmarket work, and thus also improve our understanding of female labor supply.
4. Improve our understanding of the demand for consumer goods by permitting the estimation of joint demand and time-use models.
5. Give better measures of economic well-being and further our knowledge of its distribution.

Incentives 4 and 5 are common to our interests.

A large number of countries have set up time-use surveys, some of them are already performed for decades, others are more directed to special needs and cover few waves or single year data. However, as, e.g., Klevmarken (1998) notes, there is less work *using* time-use data than one would expect[9]. He gives a number of potential reasons for this underutilization of time use data, including the important fact that time-use data are often noisy due to very short spells of data (sometimes 1 day), the frequent lack of time series for the same individual, many zero observations, and insufficient coverage of questions such as individual versus household surveys, joint activities, place of activity, and supply of socio economic information and arrangements (e.g. child care).

The five incentives listed above are framed in a static and analysis mode. These questions are not framed in terms of change and consequences. This may explain the format of most time-use survey and the lacking use by researchers to answer questions relevant in decision support.

5.2.2 Our requirements for time-use data

Our intention is to link time-use data with (consumption) activities and happiness data. In addition, we are interested in striving for sustainable consumption patterns. This needs changing present behaviors. Therefore, we are interested in time-use data that reflect the consequences of changes. At end we would like to be able to show how time-use changes and happiness changes based on changes in consumption and how this affects environmental, social and economic impacts.

In order to arrive at this promised land, the time-use data would ideally:

- Allow to follow up individuals over at least a few years where voluntary and/or mandatory changes in consumption activities occur. This calls for a longitudinal panel design.
- Since income and many environmentally relevant expenditures are household expenditures (e.g., housing, cars, but also newspapers) we need both individual and household data.
- Transportation has relevant environmental impacts. Therefore, time-use data should include the place of the activity and the used transportation modes should be attributable to single activities.
- Some activities can be done together with other people. Therefore, we need to know with whom an activity is done.
- Further, we need for the same individuals and households also the household expenditure survey in a way that allows to link the expenditures to environmental input output analysis models.
- The survey would also need to include diaries on happiness in a way that moods are attributable to activities. This suggests that the chronology of time, expenditures, and happiness are retained.
- Finally, in order to be able to interpret the observed changes, the whole set of socio-economic parameters including such aspects as illnesses of the subjects or their family/friend, changes in relationships, etc. need to be recorded.

[9] See Harvey (1999) for a nice overview on application disciplines and major time use initiatives.

If this large number of variables is collected it is necessary to have a large number of individuals and households that contribute in order to receive statistically significant results. The need to follow these individuals even increases the sample size for the first wave due to drop outs in later years.

The burden of collecting all these data would cause a selection bias because only a very special species of human being would agree to reveal[10] and report these data. In addition, the huge burden of reporting would alter the time budget to an extent that may make the whole data useless.

These are reasons why such data are unavailable today. However, new micro and nano technology might already today allow for equipping subjects with cameras, microphones, and potentially even sensors to report happiness. Watches, belts or baseball caps would make good places to fix such instruments and intelligent software may be able to provide automated reports once it is trained for particular individuals.

Since such a data collection would take years this is beyond this pre-study but also not feasible within the research program. Therefore, Section 5.2.3 will give insights into what the literature has to offer in terms of analysis that is directly relevant for our goal. Section 5.2.4 will then give hints where time-use data can be found and what survey may prove useful in our context.

5.2.3 Results from the literature

As mentioned earlier, there are a large number of time-use surveys but limited applications. One frequent topic of investigations are cross-national investigations. Sullivan & Gershuny (2001) find, e.g., that the balance between work and leisure time remained relative stable from 1960 to the 1990s for the included European and North-American countries. However, rather than listing such results we refer to the provided summaries in Juster & Stafford (1991), Klevmarken (1998), and Harvey (1999).

Here we first show what kind of data was needed to derive time elasticities, i.e., to quantify what happens to all other activities if one activity changes to take more or less time. For consequential analysis this is the way to quantify changes in behavior. Economists use price elasticities to quantify how the market (the total of consumers) reacts to changes in prices. A longitudinal panel study was recently started in UK (Home OnLine 1998-2001[11]) and provides for 1999, 2000, and 2001 time-use data.

With the help of this data Gershuny (2002) is looking into the question whether web-users are net-nerds, i.e., people that abandon social life and live in a cyber-world instead, as has been suggested by earlier research results (see Nie 2000 below). The panel approach allowed that the same people were surveyed in three consecutive years. However, due to low response rate, additional people were added in wave 2 and 3. With this approach it was possible to get closer to the answer of the question on how people that start using the internet change their behavior. For this purpose, Gershuny selected 116 individuals that are new users, i.e., were not using the internet in wave 1 or 2, but using it in wave 2 or 3, respectively. Alternatively one could also analysis, e.g., those individuals that abandoned the use of the internet. The most important outcome for our purpose is that Gershuny computed time-elasticities for a small number of activities (see table 5-1). The dataset might be used for re-analysis looking at additional activities.

[10] See reality shows on non-stop observation of individuals and groups.
[11] http://www.data-archive.ac.uk/findingData/snDescription.asp?sn=4607

Table 5-1: Modeling change in time use for both sexes and women only. Reading guide: 1 unit of time spent in addition in the activities in column 1 causes changes of time units in the activities mentioned in row 1. (Gershuny 2002) [bold refers to p<0.05, bold and underline to p<0.005]

ALL	Sleep and personal care	Social life, 'going out'	Visits to friends houses, being visited	Playing sports, walks, outings	Telephone calls	Hobbies, games etc.	Radio, TV, video etc.	Reading newspapers, books, magazines	Doing nothing	Not known
Change in										
Paid work	**-0.23**	**-0.1**	**-0.23**	**-0.06**	**-0.01**	**-0.02**	**-0.19**	**-0.05**	**-0.11**	-0.01
Unpaid work	**-0.14**	**-0.16**	**-0.17**	**-0.06**	**-0.01**	**-0.03**	**-0.24**	**-0.06**	**-0.11**	**-0.01**
Computer games	-0.26	**-0.36**	-0.04	0.03	0.02	-0.05	**-0.39**	0.11	-0.07	0.02
Computer www	-0.16	0.23	-0.2	-0.11	-0.02	-0.18	**-0.43**	-0.03	-0.13	0.03
Computer other	0.03	**-0.17**	**-0.23**	**-0.1**	0	**-0.13**	**-0.2**	-0.04	**-0.17**	0.01

WOMEN	Sleep and personal care	Social life, 'going out'	Visits to friends houses, being visited	Playing sports, walks, outings	Telephone calls	Hobbies, games etc.	Radio, TV, video etc.	Reading newspapers, books, magazines	Doing nothing	Not known
Change in										
Paid work	**-0.2**	**-0.11**	**-0.23**	**-0.06**	-0.01	**-0.03**	**-0.18**	**-0.06**	**-0.11**	-0.01
Unpaid work	**-0.12**	**-0.2**	**-0.17**	**-0.07**	**-0.02**	**-0.04**	**-0.2**	**-0.06**	**-0.11**	-0.01
Computer games	-0.68	-0.21	0.76	0.05	-0.05	0.06	-0.44	0.07	-0.64	0.08
Computer www	0.02	**0.51**	-0.46	-0.07	0.07	**-0.6**	**-0.77**	0.25	0.08	-0.02
Computer other	-0.23	**-0.29**	0.09	**-0.19**	0.02	-0.11	-0.03	-0.08	-0.22	0.03

Table 5-1 also shows the time elasticities for changes in working hours, being it unpaid or paid. However, here we focus on the use of the internet.

Nie (2000) found in their internet study that the more time people spend using the internet:

- the more they lose contact with their social environment (phone, visits, events),
- the less they use traditional media (TV, newspaper),
- the more time they spend working at home, *and* at work, and
- the less time they spend shopping.

However, it does not reduce commuting. However, Nie used cross-sectional analysis and therefore the causation may also show the other way around, i.e., the less social contacts they want the more internet they use. Such cross-sectional studies are often biased because they were looking to internet-users versus non-users and were unable to control, for all the differences between these people[12].

Figure 5-1 confirms Nie's finding on the impact on listening radio and watching TV. However, the effect on visiting friends and going out is in Gershuny neutral, i.e., the decrease in visiting friends and getting visits is compensated by an enhanced social life and going out. Therefore, Nie's finding is most probably an artefact of the method where a group of less sociable individuals that also use the internet was compared to the average non-internet user.

[12] Hoag (1998) find that cable modem users spend more time online, use more applications and are more satisfied than 56k modem users. "Faster access does NOT lead to less time spent on-line". Dial-up modem users watch more TV (140 Min vs. 90 minutes) and phone more but use less other multi-media. However, these correlations are not necessarily causal because the research design was not longitudinal.

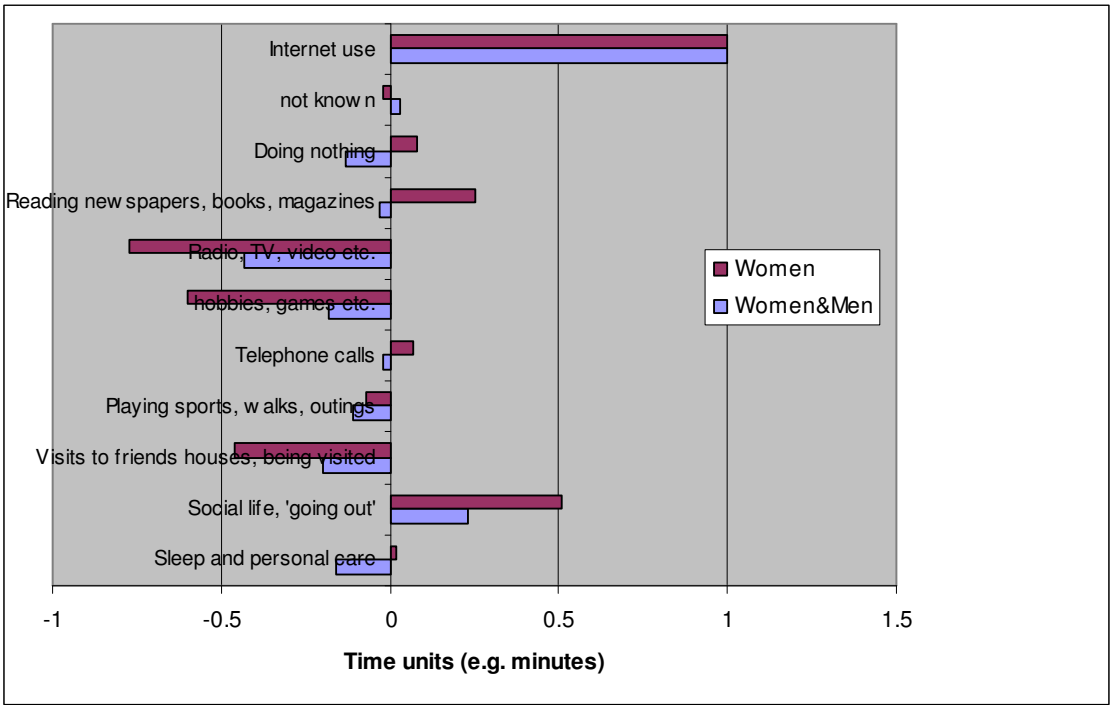

Figure 5-1: Time budget changes due to the increase in Internet usage for women versus women and men (Gershuny 2002)

The findings in Table 5-1 and figure 5-1 suggest that there is a gender difference in time elasticities. Women read not less but more if they start to use the internet, reduce much more the radio, TV, hobbies, and games activities (actually more than one minute per minute of internet use). They also spend about half a minute more with 'going out' while they reduce by the same amount visits to and from friends. This drastic change does not allow for reduced sleep, something that men reduce.

Although only few of these time elasticities are statistically significant, this suggests that men and women have different time-styles or at least a different way to change time-use when internet usage is added. Spangenberger (2002) reports another time-related finding that has to do with gender differences. He reports that men prefer a "high-speed feeling" in commuting or short range transportation while women mention the door-to-door time needed for travel as important criterion.

Linking the time-use with lifestyle leads according to Cotte & Ratneshwar (2000) to so called 'time-styles'. Potential determinants of time-styles are: culture, family, work group, age, gender, life themes and values, life projects, and situational influences. They argue that time-use is very different for these different lifestyles. They also show that the people differ a lot in the way they plan their (leisure) time.

Therefore, we hypothesize here that people with different time-styles have also different time elasticities. The determinants for different time-styles are certainly not limited to gender but probably as wide as has been found in the lifestyle discussion. If this proves true we need to distinguish different time-style groups.

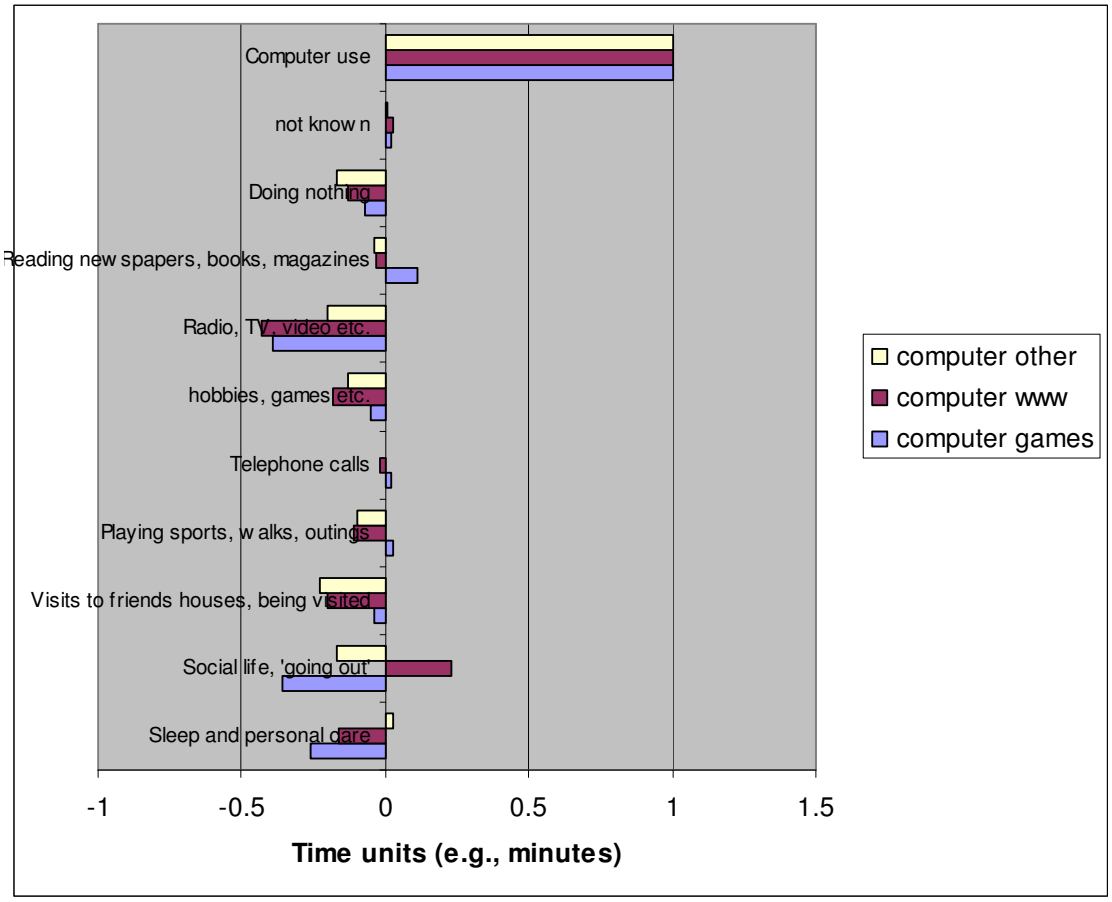

Figure 5-2: Time budget changes due to the increase in different usages of computers, average for both sexes (Gershuny 2002)

Using computers for playing games, doing homework for school, or accessing the internet are obviously rather different activities. Therefore, it is no surprise that figure 5-2 finds even deviations of the sign for reading, going out, playing sports and sleep. These results suggest that i) it is not only important what product is used but also what the product is used for when time elasticity is determined, and ii) increasing time use for different activities leads to activity-specific time-elasticities. The data-set of Gershuny (2002) could also be used to show that it also makes a difference for time elasticities whether somebody increases or decreases the time spent with an activity. However, these data are not provided.

Meijkamp (2000) looked into car-sharing and found very similar results as provided above (see also Prettenthaler & Steiniger 1999). Car sharing reduced in terms of number of trips the use of car by 43%, but increased cycle use by 14%, train use by 36%, city transport use by 28%. Overall this caused an increase of trips by 10%. However, he found large differences for different groups. The car mileage dropped for previously car-less people by 29%, for substituters by 65%, but increased for second car drivers by 3%. Similarly, the change of modal split was different for the different sub-groups. Although Meijkamp (2000) did not include the time use it is obvious that adopting car sharing changes not only the individuals modal split but also their time spent for travel (see section 5.4 for a discussion on time use for travel). In order to predict the environmental consequences of adopting car-sharing, not only the change in modal split and absolute mileage but also the shift in all other activities

needs to be assessed. This could be done by looking into the impact of the change in travel behavior on the time budget.

Time-elasticities seem to be a fairly underdeveloped area in time-use research and we doubt that much data has been published so far. However, the Home OnLine data and some data sets below may allow to derive such elasticities. The elasticities found in table 4-1 justify the relevance of such investigations to assess environmental, economic, and social impacts of changes in consumption behavior.

5.2.4 Sources for time use data

For overviews on time-use data sets and compilation networks see, e.g., Harvey (1999), CHER (2002), Fisher et al. (2002), Fisher et al. (2003), MTUS (-), NRC (2000), United Nations (2002).

United Nations (2002) provides for a considerable number of countries information on availability, survey design, methods, instruments, activity classification, context variables etc. Sometimes, simultaneous time use is reported (Australia), sometimes not (Japan). Australia is also very specific on whom with the activity is performed, which technology is used, the physical and spatial location, and the mode of transportation that can be allocated to the activity. Therefore, the Australian data set may provide useful insights for our purposes.

According to a personal communication with Kimberly Fisher (ISER), the person that overseas a huge data warehouse on longitudinal data (Fisher et al. 2002), two databases are potentially interesting for studying the change of activities due to changes in availability of time: The "Home OnLine" panel performed by ISER for British Telecom surveys that was used above by Gershuny (2002), and a Danish study managed to survey the same people in 2001 as they did in 1987. Although this time period is very long and we may not know why they changed their behavior one may derive some long-term elasticities.

Mikami (1999) reports on a time use survey that is established since 1976 and takes place every 5 years (last available data from 1996). More than 100 leisure activities are distinguished and they report with whom the activity is performed. However, no simultaneous activities are reported and transportation is not separated per activity. The expenditure survey is very detailed as well but not based on the same sample and the detailed version is carried out in different years (1999). The time use survey does include some expenditure information but not per activity. A specialty of the Japanese time use survey is the linkage to the actual hour of day. Panel (-) provides an overview on long-term panel data sets and confirms that usually not both, consumption expenditures and time-use are reported. Japan seems to be an exception for women from 24-34 years of age in 1993[13]. This set seems to include information on consumption, satisfaction and time-use. The data is in Japanese but an English version of the questionnaire is available[14].

We suggest to further analyze six of these longitudinal data sets: The Home OnLine set from UK, the Danish set, and the Japanese JPSC set because all of them promise the necessary data to calculate time-elasticities. Further, the Australian, Swedish, and Japanese time-use survey look especially rich in terms of linking them with expenditure data and prioritizing

[13] This is a different survey than that described above and information is provided on http://www.kakeiken.or.jp .
[14] The Institute for Research on Household Economics performs this 'Japanese Panel Survey of Consumers (JPSC)', which includes the variables of time-use data, consumption data and quality of life/life satisfaction. They write in a personal communication that the English-versioned variables list of date JPSC is now in the process of translation. However, they say there are a couple of English users of this data that use the English questionnaire and Japanese variables list. The Japanese variables list contains variables names that lists serial numbers, such as q1, q2, thus understandable for non-Japanese users.

activities. The JPSC data set may come very close to the requirements set forth in Section 5.2.2 with the major limitation that it is focused on young women.

5.3 Linking Time use, consumption, and resource use

Very few studies have so far provided detailed results on the linkage of time use, consumption, and resource use or environmental impacts in the form of environmental impacts per time unit for activity XY. None of the identified studies provides such a model for the envisaged consequential view, i.e., the consideration of such aspects as time-elasticities.

We shortly address in section 5.3.1 the partial model of the consumption-environmental impact-interaction and then summarize in 5.3.2 and 5.3.3 the few results on energy use and material use per time unit, respectively.

5.3.1 Consumption and environmental impacts

There is no lack in studies that assess the environmental impacts of consumption. There are basically three groups of assessments:

1. There are those studies that look at the total pollution and resource use of economies, nations or the globe. These studies allow to assess the aggregate consequences of consumption and often provide time series.
2. Another group of assessments looks at national household consumption but separates groups of similar households and the different consumption activities. These studies often rely on statistics for household expenditures that are linked to the national input-output tables distinguishing a set of production sectors. The economic input-output tables are then extended to include also physical resource use and pollution. Data limitations for the extension of the input-output table with environmental information, the high aggregation level of input-output tables and the lacking fit with the household survey data makes that only relatively few consumption activities can be adequately distinguished and the only proxies of environmental pollution can be assessed (an exception might be the U.S.A. with more comprehensive data).
3. Finally, there is the tool of process life cycle assessment that allows to assess single consumption activities and include comprehensive sets of environmental interventions. Due to the extensive need of data collection only few consumption activities can be assessed within reasonable time.

Only group 2 and 3 are relevant for our purpose. If we focus on the introduction of one new consumption activities we may be able to perform process life cycle assessment for the product system at stake and the impacted activities through the change in time use pattern. For changes in several consumption items one may need to turn to environmental input output analysis.

In order to be truly consequential, computable general equilibrium models that are extended with environmental data are needed. But so far such model exist only for CO2-emissions and high aggregation levels.

5.3.2 Results from the literature on energy use per time unit

Schipper et al. (1989) were probably among the first to quantitatively analysis the energy use per time unit. They combine 15 energy use sectors and 40 time use sectors and calculate

energy intensities per time, separating time spent at home, transport, and personal services (such as leisure and family business). From this analysis they conclude that transport is by far the most energy intensive activity per time unit and that moving activities from "at home" to "personal services" may increase total energy demand. However, rebound effects are not really addressed. Energy forecasting has been the primary focus of the analysis.

Also Chateau et al. (2002) realized that the very long term "prediction" of energy demand can partly be based on the time budgets of individuals. They suggest that for food and feeding the time use is minimized with increasing affluence and use of energy services, while for shelter and lodging there is U-shape in time use, i.e. for high affluence and need of energy services there is also an increase in time use. Unfortunately, it is not completely clear how these relationships have actually been used in the project.

Wenke (1999) was one of the first and few attempts to link all elements of households, economy, and environmental impacts. He suggests to combine national accounts, environmental protection measures by households, and time use. However, at this stage his model remained theoretical and it was not clear how he can operationalize all elements. Further, it seems that he was thinking in terms of analyzing the existing system and not to model consequences of changes.

Binswanger (2001) was one of the early authors to suggest that time-rebound may be more relevant than price-related energy rebound effects and extended in Binswanger (2002) the classical household production functions (see e.g., Becker 1965 and Winston 1982) by not only including time but also energy. From this basic model he confirms that when the wage rates are high and energy prices low, time-saving innovations are likely to increase energy consumption. This means that there is a time-rebound effect that may increase total energy use, even if the new time-saving activity uses less energy than the substituted one.

In his diploma thesis Van der Werf (2002) attempts to better understand the relationship between energy use and time use. Some of the results include the energy consumption per age-class but also a list of activities and their energy consumption per hour (see table 5-2). Further, the inclusion of time in the DoMUS software (Domestic Metabolism User-friendly Simulated) was studied where such problems like the problem of time being bound to individuals rather than households and its chronology were discovered.

Van der Werf (2002) used data on time use for a single activity when performed, e.g., reading in a book is done during 1 hour, but not every day by everybody. Then he added up the direct energy use for the activity (heating the house to read the book), calculated the costs to allow the activity (buying the book or the 20 pages that are read in an hour), calculated the indirect energy use in the economy due to these expenditures using a hybrid analysis[15], and finally also estimates travel distance and its energy requirements (zero for reading the book at home). Combining these energy data with time use allows to derive the energy intensity in MJ/h. From this we learn that if somebody switches one hour of newspaper reading to one hour book reading, ceteris paribus, the energy requirement would decrease by 9 MJ (22.8-13.8 MJ/h). If the book reader would switch to TV watching, ceteris paribus, another 2.6 MJ could be conserved on average.

[15] Hybrind analysis combines the approaches 2 and 3 mentioned in section 5.3.1 and was already available at IVEM, Groningen for the Netherlands.

Table 5-2: Energy use per time unit for 14 activities including transport and indirect usage (van der Werf 2002)

	Time use per activity	Travel distance	Total costs	indirect energy use	Direct energy use	Mobility energy use	Total energy use	Energy intensity
	h/event	km/event	NLG	MJ/event	MJ/event	MJ/event	MJ/event	MJ/h
Work	7	27.5	4.08	0	0	96.3	96.3	13.8
Housekeeping	2.7	3	0.88	0.6	27.2	6.1	33.9	12.6
Education	6.5	12.5	4.08	3.5	0	24.8	28.3	4.4
Sleep	8.7	0	0.24	0.6	0	0	0.6	0.1
Personal care	0.25	0.98	0.75	0	8.4	2	10.4	41.6
Eating at home	1.5	0	10.34	49.3	15.5	0	64.8	43.2
Eating out	3.5	3.5	60.52	183	0	5.9	188.9	54.0
Reading books	1	0	1.85	3.7	10.1	0	13.8	13.8
Reading newspapers	0.5	0	1.35	6.4	5	0	11.4	22.8
Watching TV	2	0	0.36	2.1	20.2	0	22.3	11.2
Using computers	1	0	1.2	2.5	10.1	0	12.6	12.6
Playing games	1.5	0	0.2	0.1	15.1	0	15.2	10.1
Visiting cultural events	3	3.5	20.52	39.4	0	5.9	45.3	15.1
Doing sports	1.3	3.5	5.52	9.9	0	5.9	15.8	12.2

Jalas (2002a) followed a similar path by combining the household expenditure survey (2-person households), the Finnish input-output table with energy intensities, information on direct energy use, and time-use survey for 2-person households. Travelling time and less specific household infrastructure such as heating was not allocated to activities. For this reason, but also due to the differences between Finland and the Netherlands the final energy intensities per time unit in Table 5-3 have a poor fit with the data of van der Werf (2002).

Table 5-3: Energy use per time unit for 13 activities separating transport and house heating from activities (Jalas 2002a)

	Annual expenditure	indirect energy demand	Direct energy demand	Time-use of 2-person household	Energy intensity
	FIM/a	kWh/a	kWh/a	h/a	MJ/h
Washing and ironing	426	141	457	106	20.3
Cleaning and organizing	101	30	96	300	1.5
All activities related to home meals					27.4
Cooking, preserving and dishwashing	1091	383	2971	730	16.5
All transport related activities		2516	12271	839	63.4
Use of private car		1997	11125	444	106.4
Use of car in shopping and family business		429	2391	89	114.1
Use of car in commuting		746	4159	102	173.1
Eating is restaurants	1809	360		31	41.8
Culture and sports events	330	69		57	4.4
Reading	2301	692		751	3.3
Using TV and audio equipment	854	253	686	1531	2.2
Having a sauna			925	125	26.6
Average of activities under study		12531	17405	5342	20.2
Average of non-contracted time			45786	15225	10.8

Jalas (2002a) finds that the energy intensity per time unit have a large range (figure 5-3). Potentially, they offer large energy conservation potentials if substitutability could be assumed between the analyzed activities. This “if” is exactly the reason, why these type of analyses are not sufficient to support consumption decisions. As argued earlier, time

elasticities need to be determined to take into account the full complexity of the substitution mechanisms.

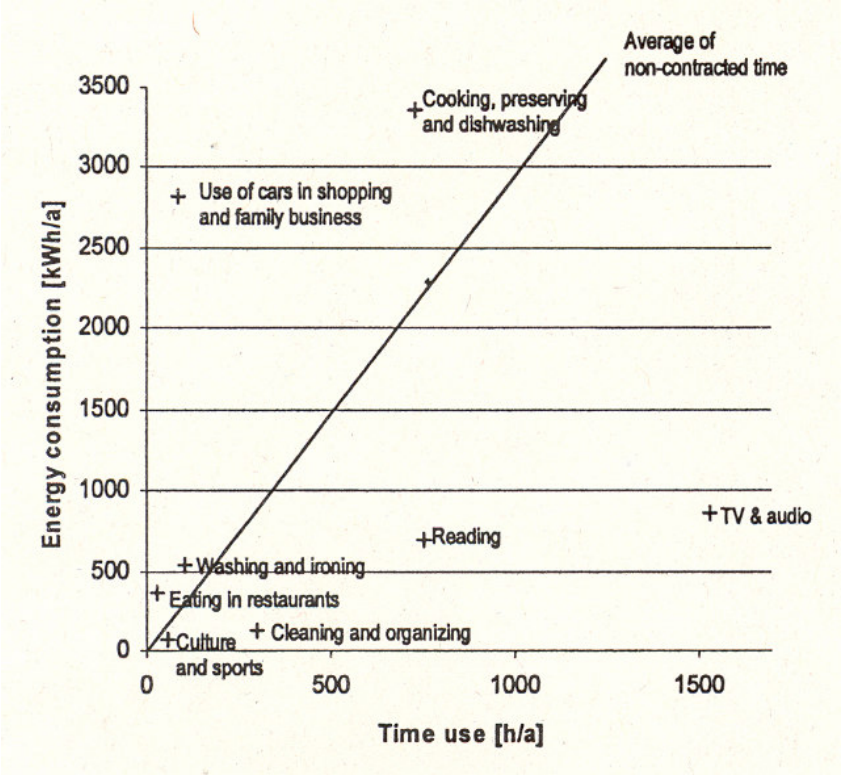

Figure 5-3: Energy intensities of selected household activities of two-person households in Finland in 1987-1990 (excluding attributable travel and heating). (Jalas 2002a)

5.3.3 Change in material intensity due to changes in time use

Mikko Jalas, who realized the shortcomings of his analysis in Jalas (2002a) was looking in a second paper into the material intensity rather than energy intensity per time unit. However, more important is his attempt to look at the change of material intensities. For this reason he used data sets from two different decades and analyzed for 15 activities the material intensity in the end of the 1980ies and 1990ies. It has to be added that the used data was from many different sources and there is no panel data involved.

His preliminary findings are displayed in Figure 5-4. The arrows that indicate the change are in general short. However, even short arrows may indicate large changes if they are close to the origin, i.e., the material intensity of calling by telephone has dramatically increased (this number will be checked by Jalas), while the percentage change in time for services and civic matters decreased drastically. The only long arrow is for TV watching which increased a lot in absolute terms.

To assume that the change in material intensity has only to do with the changes in time budget is obviously not correct. Therefore, Jalas (2002b) performed a decomposition analysis and finds in figure 5-5 that actuality only a small change in total material use can be attributed to changes in time-use. Changes in number of inhabitants and household structure are clearly more important. Jalas (2002b) cautious the reader interpreting to much into the data because the quality of some data is poor, the bridges between the data sets involve sometimes guesses, and other relevant factors may be missing. Nevertheless, this is probably

the first and only analysis of this issue and shows another avenue of application areas of time use research.

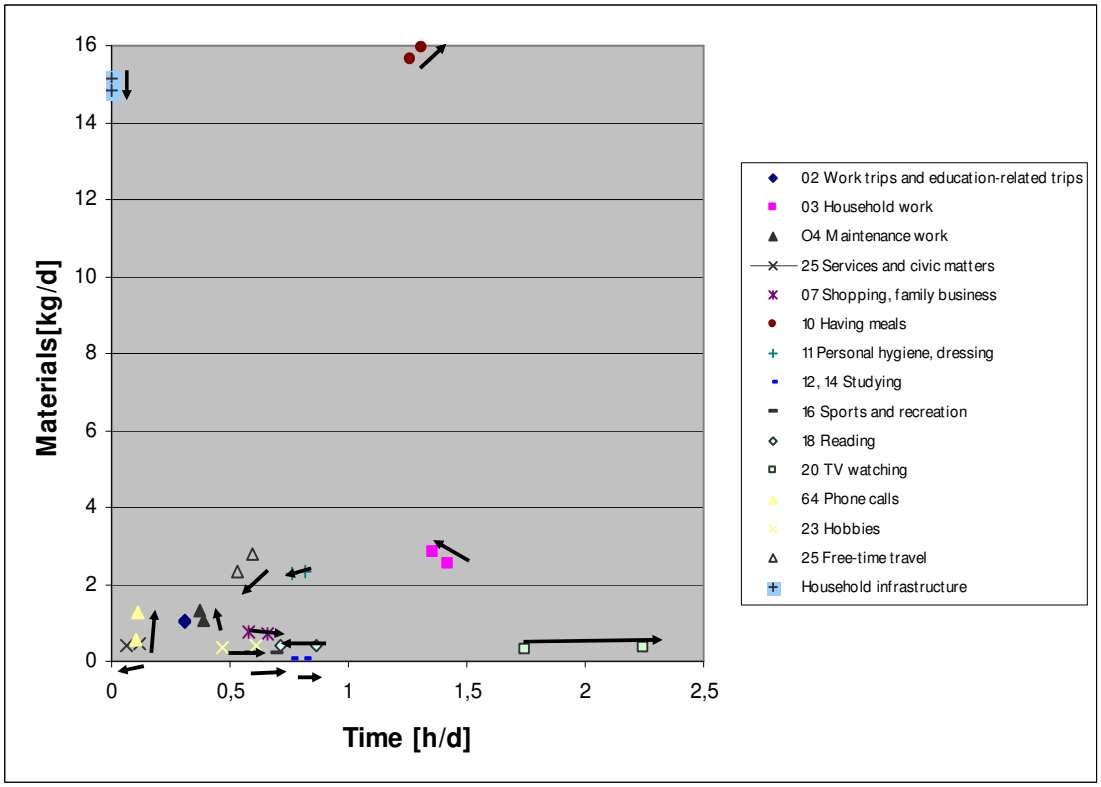

Figure 5-4: The time use and materials requirements of selected household activities in 1987-90 and in 98-2000. The arrows describe the direction of the change. (Jalas 2002b)

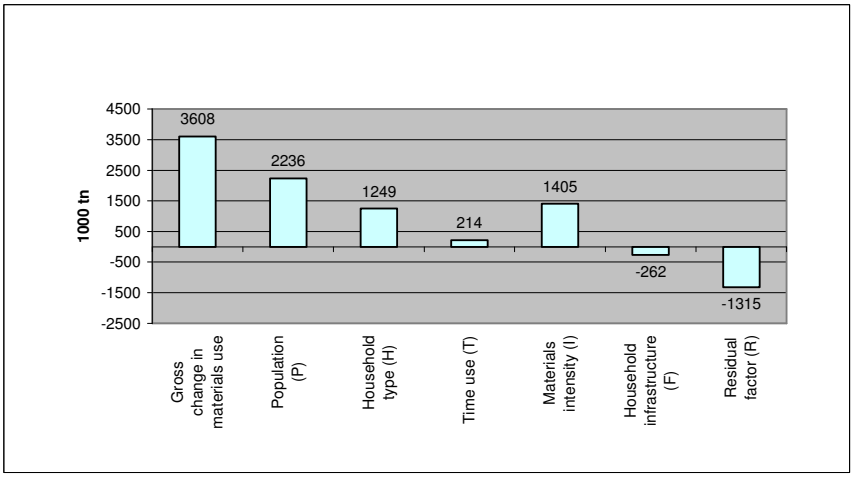

Figure 5-5: The results of a base-year decomposition of the change in the gross materials use of the Finnish private final consumption from 1987-90 to 1998-2000. (Jalas 2002b)

5.4 Required steps to quantify time-rebound effects

TDM Encyclopedia (2002) defines rebound effect (= take back effect = offsetting behavior) as a law of demand: "A program or technology that reduces consumers' costs tends to increase consumption. Where costs include financial costs, time, risk or discomfort." Since

this definition is derived from transport research they provide the example of new road capacity that is absorbed by induced traffic by 50-90%. Strategies likely to generate additional traffic are: compressed work week, flextime, park & ride, ridesharing, and telework. These are exactly some of the changes that have been suggested to *reduce* traffic. While the reported rebound effect of 50-90% is a combination of price, time, risk, and discomfort rebound effects, we look here more isolated to time rebound effects.

Jalas (2002a) provides two hypothetical examples to demonstrate time-rebound effect (Figure 5-6). Using market delivery instead of own shopping for daily goods seems to save both time and energy in Finland. However, assuming a mixture of average activities of non-contracted nature compensates for some of the energy savings. There remains in this hypothetical a small energy saving due to online shopping. In the other example of handy-man Jalas provides an example where the good intention to save energy may actual turn into the opposite. However, Jalas (2002a) mentions the problem that he does not know the actual substitute activities and that he had to assume just average energy intensity of freed time. The suggested time-elasticities in section 5.3.2 may solve this problem and allow to actually provide accurate predictions on the preferability of these compared activities.

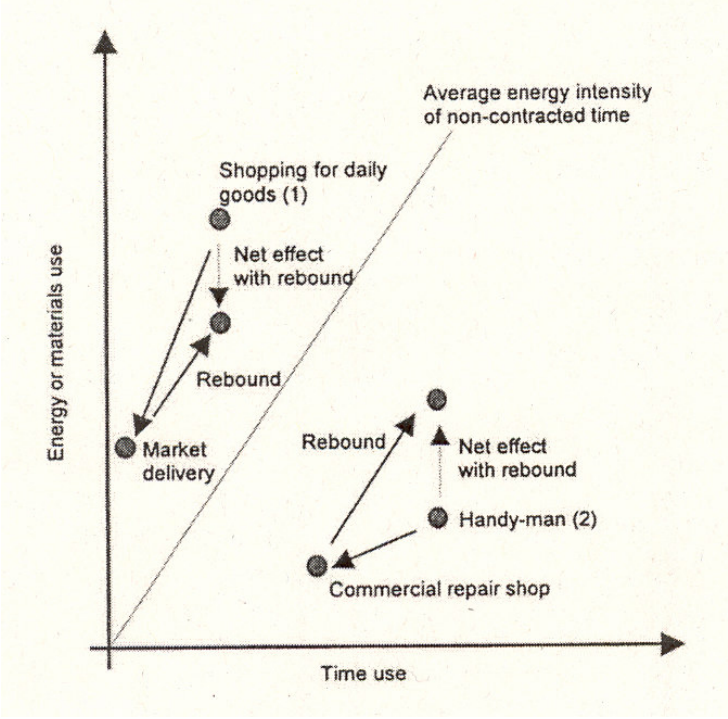

Figure 5-6: Theoretical model of time use rebound effect and two hypothetical examples (Jalas 2002a)

A well studied and understood application is mobility (see, e.g., Schipper 1997 or Binswanger 2002 for short overviews). Many studies confirm the hypothesis that travel time remains about the same even if environmental and technological factors change. Faster trains and highways may reduce on the short run total travel time. On the long run, people tend to travel larger distances. Since faster traffic means more energy use per km this leads to a time-rebound effects that increases net energy use. Of course, there are differences in travel time across different nations (Schipper 1997) and the travel budget is not fixed for all times. Disproportionate changes in the share of transport costs in relation to household income or additional activities during travel (use of mobile phones, entertainment centers thanks to

traffic control systems, etc.) may change the travel time budget. Goodwin (1978) suggests that travel time may have a saturation level around 90 minutes and highlights limiting factors such as income class and travel costs.

The required steps to calculate time-rebound effects include the determination of time elasticities (section 5.2.3) that can be linked with models such as described in section 5.3.1. As we already suggest in section 5.2.2, the determination of time elasticities requires a systematic that allows both to link time use to consumption and happiness. This requires substantial efforts on gathering data.

In the meantime, the five time-use surveys selected in section 5.2.4 should be used to calculate time elasticities and link them with additional data from environmental input-output analysis and LCA to make initial calculations of time rebound effects.

6. Insights on time use and sustainable consumption

6.1 Is there a causal link along time use – consumption – environmental impacts – happiness?

This question is important if we want to proceed in developing an integrated model that includes these factors. In order to answer this question we split the chain in sub-elements of the system (see figure 6-1) and indicate why the aspects seem relevant:

Time use and consumption: There is a strong causal relation between these two factors since most consumption activities require time and most use of time stimulates some sort of consumption. This means that the causality may go both ways.

Time use and happiness, consumption and happiness: We found in section 4 some evidence that there are causal links between these pairs. However, variation in time use and consumption explains only parts of the variation of happiness between individuals. Further, the direction of the causality is not always evident and research gaps have been identified.

Consumption and environmental impacts: There is no doubt that the provision of products and services causes environmental impacts. Here we make the assumption that consumption causes the provision of products and services. Although there are example where the causality may run in the other direction it is a safe assumption to work with.

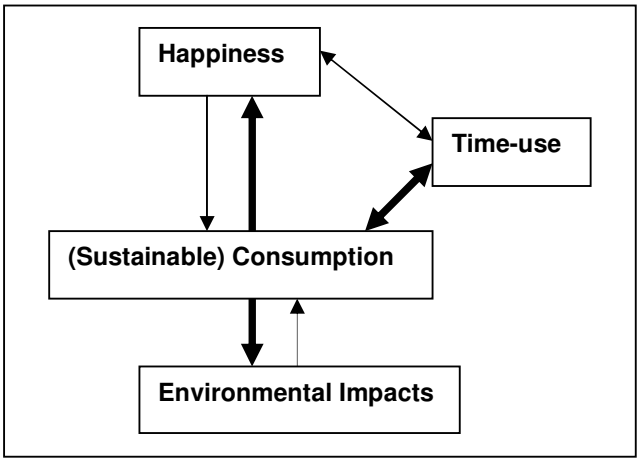

Figure 6-1: Links among relevant system parameters in sustainable consumption

Observing changes in happiness due to changes towards sustainable consumption is important because the acceptability of such changes and behavioral changes towards other consumption activities can be controlled in a socially acceptable way. Consumption needs to be looked at because its strong link to production, where production itself causes environmental problems. Environmental impacts are looked at because this is one of three sustainability dimension. Time use is highlighted as one important limiting factor that can perfectly serve in understanding behavioral effects of changes in consumption. Other limiting factors mentioned in figure 3-1 may be added in a more complex model.

The weakest element in the suggested integrated approach is the link to happiness. However, the suggested analysis of the time use data that also includes measures of satisfaction/happiness (section 5.2.4) is able to shed light on this question.

6.2 What additional criteria need sustainable consumption to fulfill?

Sustainability and sustainable consumption as defined in section 1 can so far only be assessed when the full consumption pattern of all human beings are considered. Introducing the time dimension allows now to look at the sustainability of single activities without violating the totality principle, i.e., the pot of sustainable resources and absorption capacity can be divided among all inhabitants and then divided by the considered time (hours per year or life-time). In this way, sustainability goals can be defined per lifetime hour.

We do not say here whether this division uses even shares per capita, how inter-generational questions are solved, or how population scenarios should look like. These are normative questions to be resolved in international bodies.

Another addition to the currently used definitions of sustainable consumption could be phrased as follows:

The introduction of single consumption activities provide net benefits to sustainability without causing rebound effects through changes in behavior that cause other consumption activities to become less sustainable. Changes in time use, space use, resource use, prices, and required skill levels and information are likely causes of such rebound effects and are considered when assessing sustainable consumption activities.

6.3 What does this mean for IPP?

Sustainable consumption is the main goal for integrated product policy (IPP). Policy instruments to achieve sustainable consumption have recently been compiled in OECD (2002b).

What can we learn for IPP based on this working paper?

1. The future lies probably in the selling of dreams and stories. Products need to tell a story (see Rolex, Nike etc) (Jensen 1999). This is a departure from the function approach that is dominant in service systems and LCA.
2. IPP schemes shall be designed to potentially improve happiness and quality of life. This improves the acceptability and slows down substitute consumption.
3. Assessment schemes used in IPP need to look carefully at behavioral changes due to the changes in consumption activities. Time-use surveys may serve as starting point. Other limiting factors that can cause rebound effects should be considered as well.
4. Changes in consumption have different effects for different socio-economic and lifestyle groups. A large number of different policy packages may be tailored towards single lifestyle groups. UBA (2002:137ff) includes an analysis of distinct consumer groups (lifestyles) with useful profiles on the groups motivations, interests, and how they can be approached by different media. (p137ff). The grouping should also allow taking time-styles into account.

We want to emphasize here that points 2 and 3 are rather novel in this context but absolutely essential to make IPP a successful policy that strives for the right direction. So far, eco-efficiency has been promoted by environmental business managers as major answer to the environmental crisis. Another more critical group of researchers and deep ecologists often referred to the need for sufficiency in order to achieve absolute rather than relative progress. In this report we suggest a way to bridge those two perspectives by addressing major elements that are responsible for the efficiency trap, i.e., the fact that despite large efficiency gains total resource consumption has increased during the last decades.

This bridge has two main pillars: First, behavioral changes of consumers and its consequences on consumption and environmental impacts are evaluated as part of the efficiency assessment. Second, the utility to be maximized is defined on the level of ultimate utility, i.e., happiness, satisfaction, and quality of life rather than functional units or value added. This allows to bring the efficiency versus sufficiency discussions on the level where quantitative and more sophisticated modeling is possible and activities of sustainable consumption can be assessed. The new metric might be environmental impacts per unit of happiness and time.

Although this will not resolve people steady thrive to maximize and increase happiness it makes this ultimate utility dimensions explicit and adds the limiting factor time as constraint to consumption.

This proposed change in assessing sustainable consumption can also feed into the policies for IPP. In fact, economic, regulatory and social policies within IPP can profit from departing the efficiency trap without adopting the often normative sufficiency debate.

7. Remaining research and data needs

Many needs for further research have been mentioned throughout all sections.

We certainly need to better understand:

- the causal relation between consumption activities and happiness,

- the behavioral changes caused by adopting new consumption habits,

- the interaction of all limiting factors on the rebound effect.

Steps to clarify such questions have been suggested and the calculation of time elasticities and "happiness elasticities" due to changes in consumption are a useful first step. This allows to estimate the size of the rebound effect and the practicability of the happiness indicator.

In a next step available time use survey can be used to make initial calculations. This will clarify how time elasticities vary for different consumption activities and consumer groups (time-styles). On a longer run, additional surveys may be needed following the requirements defined in section 5.2.2.

In order to elaborate these questions one may work with historical examples that save time, such as: public transportation systems that is faster, cheaper, and energy efficient, washing and dryer machines, dish washers, air planes, e-mail, internet, telephone, vacuum cleaner, razors, vapor iron, vapor cleaners, leave blowers, high pressure cleaners, newspaper home delivery, TV instead of cinema, water taps in houses, automatic heating systems, self-service ticketing (see also Forseback (2000), van Brakel (2002), Leitschuh-Fecht (1999) and Hertwich et al. (2003) for more recent and new examples on sustainable consumption).

Røpke (1999) provides a systematic analysis to the why of consumption. She finds that along the three axes of socio-economic, socio-psychological, and the socio-technical explanations most reasons for the willingness to consume can be identified. She offers for all three axes a number of political implications if the present consumption patterns shall be changed. Since she did neither assess the acceptability nor the net contribution to sustainable consumption patterns of these measures these suggestions could be analyzed within the METI/AIST project. This would combine analysis of acceptance, assessment of CO2-emissions and potentially the consideration of all limiting factors mentioned in our framework in figure 3-1.

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