

SUFO:TROP

Sustainable Food Consumption: Trends and Opportunities

Interim Report

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Information on project status

The project 'Sustainable Food Consumption in Austria: Trends and Options (Acronym: Sufo:trop)' focuses on food consumption patterns in Austria, and by relating them to economic data from households, it makes policy recommendations related to sustainable food consumption.

The overall objectives of the project are to contribute to a transition to more sustainable food consumption in Austria through an improved understanding of food consumption patterns and trends and their direct environmental impacts. Policy recommendations will be based on detailed analysis of trends and patterns, as well as a dialogue with stakeholders.

In the project, different groups of food are considered: meat vs. vegetables; conventional vs. organic production; regional vs. more distant production; subsistence food vs. delicatessen etc. The second focus is on the household specific consumption patterns, taking household income, family structure and household location into account. Simulations with respect to different consumption patterns provide the basis for policy recommendations regarding sustainable food consumption.

The project started in September 2005 and is planned as a 2-year project. It is carried out by a team from the Sustainable Europe Research Institute (Dr. Ines Omann, in charge of the project) and the Department of Economics at the University of Graz (Dr. Birgit Friedl, in charge of the project). The aim of the first 4 months of the project was to carry out the first part of WP 1: 'Short survey of literature and data compilation'. Starting with a literature survey on trends in food consumption and the associated environmental effects, a concise description of trends in food consumption in Austria was produced (different food categories; household-specific differences like income, education, family structure; good practice examples).

The next steps of the project are:

- Carrying out the second part of WP 1. An econometric data set will be established, combining income and environmental impact data from the Austrian Consumption Survey, the official Austrian Nutrition Report etc. Based on that information, food categories to be further worked on in the project will be selected.
- Starting with WP 2: 'Selection of indicators of sustainable food consumption and analysis of consumption patterns and environmental impacts.' Based on the literature survey in WP 1, suitable indicators of sustainable food consumption will be selected. Environmental effects of current Austrian food consumption (base case) will be calculated. These environmental effects will be evaluated according to the earlier selected indicators.

The following report gives the results of the literature survey on trends in Austrian food consumption and their environmental effects.

Sustainable Food Consumption

- An Overview

Abstract

Our eating and drinking patterns lead to large environmental pressures. According to the European Environmental Agency (2005) approximately one third of total environmental impacts from households can be related to food and drink consumption. Within the area of food consumption, however, impacts do vary - fats and oils, sweeteners and bottled beverages, are associated with much more adverse environmental impacts than fruits, vegetables, and dairy products. Therefore, while a change of food production and consumption patterns is inevitable for achieving sustainable development the field of food consumption requires a deeper analysis to identify major driving forces and measures to reverse current trends.

This paper starts with a definition of sustainable food consumption. Then, an overview of the research on sustainable food is given, where methodologies (for analysing food consumption patterns and their impacts), key results and open research questions are addressed. Wherever appropriate, insights from international (cross-country) studies are related to Austrian results. Thereafter the paper moves to the analysis of present consumption patterns and their change over time and relates them to socio-economic and demographic drivers (age, gender, education, income). Afterwards, the negative health and environmental impacts of current consumption patterns are addressed, both in total and for different food categories. In order to suggest measures to reverse unsustainable trends, models integrating the driving forces to consumption patterns are presented, such as the Batson's model of pro-social behaviour and the NOA model. A concluding section identifies caveats from existing research, such as a lack of data on different food categories (based on their environmental impacts), and a requirement for relating food consumption to drivers and (economic) constraints. Despite a stated preference for healthy (and organic) food, the majority of households decides primarily on the basis of food prices, not quality. To address these issues for Austria is the objective of the remainder of the SUFO:TROP project.

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1 Introduction

The transformation of food consumption patterns has its roots in the 19th century when both the agricultural and industrial revolutions took place. They are responsible for the growth in food productivity on the one hand, and rising income on the other. In fact, productivity growth was so strong that it enabled a doubling and redoubling of food production during only a few decades. However, at that time consumption was determined by local availability and storability of food. It was the introduction of modern transportation and food conservation techniques - such as freezing and cooling - that made the change of consumption patterns possible. Today's trends in food consumption are the move to a higher consumption of meat, vegetables and fruits, with adverse environmental effects: Compared with other food categories, meat requires intensive land use for grazing and grain production, water use and pollution. Although the production of fruits and vegetables is less harmful than meat production, the demand for year-round availability leads to high energy use from greenhouse production and food imports.

In order to arrange our lives more sustainably, a change in food consumption patterns is inevitable. However, in a world where people's purchasing behaviour is mainly driven by convenience, price, taste and health concerns, it is not easy to encourage consumers to think and buy in a sustainable manner. While information and education can contribute to positive attitudes towards pro-environmental products, a general positive attitude towards environmental improvements does not automatically imply actual green purchasing behaviour. Accordingly, strategies in order to change consumer behaviour are required, such as taxes, fees or subsidies. For more fundamental, long term behavioural changes, however, stimulating people's values and altering people's conception of life seems to be the task.

The aim of this paper is to give a literature survey on both basic and new developments in the research on sustainable food consumption, with a focus on methodologies applied and major results, in single-country, international and cross-country studies. In order to relate the results to Austria, national figures are presented in boxes within each chapter. The lack of adequate surveys on the topic of food consumption in Austria means that figures refer mainly to two publications namely **Payer, Burger and Lorek (2000)** and the periodical publication *Lebensmittelbericht* of the Austrian **Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW, 2003)**.

The paper is structured as follows. After defining sustainable food consumption for the present approach, the paper moves to the analysis of changing consumption patterns in the last 50 years and the socio-economic and demographic driving forces. Section 3 deals with the negative impacts of current consumption behaviour and the differences across food categories. While negative impacts comprise impacts on the environment, on human health, on social and economic structures, the present study focuses primarily on environmental impacts. Section 4 summarises the driving forces of (un)sustainable food consumption and presents three behavioural models to explain the consumption decision making process. Finally, the paper concludes with the state of research and makes proposals for further interesting investigations.

1.1 Definition of sustainable food consumption and related terms

The first term to be defined is *sustainable (food) consumption*.

The **Norwegian Ministry of Environment (1994, 1995)** defines *sustainable consumption* as "...the use of goods and service that respond to the basic needs, bringing better quality of life, while minimising the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardise the need of future generation.". For **Tanner and Kast (2003)** the term *sustainable food consumption* stands for the purchase of *green products*. The authors point out that green food products are not solely organically grown. The term *green* should also imply domestically cultivated, seasonal, fresh, less wrapped food as well as food from fair trade.

Related expressions are *green consumption*, *sustainable diet*, *sustainable nutrition behaviour*, and finally, *sustainable products*. *Green consumption* and *green diet*, for example, were defined by **Alfredsson (2002)** and used as a label for commodities and consumption patterns that have a low energy and CO₂ intensity. The term *sustainable diet* mentioned by **Duchin (2004)** refers to a diet that protects health and has relatively low environmental impacts. According to a German study by **Hayn, Empacher and Halbes (2005)** *sustainable diet* not only considers the positive effects on health and environment but also takes into account the practicability in every day life.

Leitzmann (2003) defines *sustainable nutrition behaviour* by means of seven food characteristics: predominantly plant derived, originating from organic farming, produced regionally and seasonally, minimally processed, ecologically packaged, tastefully prepared and traded fairly.

Vermeir and Verbeke (2004) claim that *sustainable or ethical products* stem from organic farming and fair trade and must be animal friendly products.

On the basis of this variety of definitions, the working definition for sustainable food consumption within this research project is:

- preference for foods that have less impact on the environment and higher resource efficiency
- preference for local foods to imported foods
- preference for organically produced foods over conventionally produced foods

Two further characteristics sometimes identified are preference for fresh foods instead of frozen foods and a low degree of food packaging. However, the impact of frozen food is ambiguous, as is the impact of food packaging. We argue that frozen food and packaging could have positive environmental effects in terms of avoided organic waste. Therefore we plan to investigate both characteristics but will not consider them as a prerequisite for sustainable food consumption.

2 Sustainable food consumption - patterns, impacts and consumer decisions

Two broad approaches to the investigation of food consumption patterns can be singled out in the literature; one dealing with household food consumption based on budget surveys and the other analyzing the effects of socio-economic differences on food consumption.

2.1 Changes in food consumption patterns

On household-specific food consumption patterns, two international papers can be cited. **OECD (2001)** outlines the trends in OECD countries related to food consumption patterns, but detailed figures are only available for four case study countries, namely Austria, Poland, Sweden and the US. The second important paper on the international level is a report published by the **European Environment Agency (EEA 2005)**, which investigates the same subject on the European level.

Both reports express clearly that the share of total household budget spent on food has been declining for the last few decades, i.e. food expenditures have been growing more slowly than household income. Actual household food expenditure as percentage of total expenditure ranges between 10% and 20% across OECD countries (**OECD 2001**). **EEA (2005)** additionally indicates that the average figures are higher for New Member States (35%), than in the EU- 15 with 10%.

Box 1: Household food expenditures in Austria

The share of household budget spent on food in Austria has been declining since the mid-1980s as show in Table 1.

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1999/2000*
21.4	20.6	20.1	19.0	18.6	18.5	18.1	17.8	17.2	16.6	15.6	15.3	15.9*

Table 1: Share of food expenditure (food, beverages and tobacco) in percent of total private consumption

SOURCE: ÖSTAT 1999 (in: Payer et al. 2000), Statistik Austria 2001

By including expenditures for out-of-home consumption (cafes, restaurants), the share of food expenditures is higher as indicated in Table 2.

	1984	1993/1994	1999/2000
Share of food expenditure on total household expenditure	23.5	21.3	20.0

Table 2: Share of food expenditure (including food expenditure for out of home eating) on total household expenditure

SOURCE: Statistisches Jahrbuch 2002 (in: BMLFUW 2002)

The phenomenon of declining household expenditures on food as a share of total budget is not a singularity, since it has been verified by several national and international studies. The disparities of budget spent on food in high and low income countries was discussed, for instance, by **Regmi et al. (2001)**. They point out that high income countries spend only 16% of their expenditures on food while low income countries spend 55%. This phenomenon was also explored by **Birch (2004)**. Although the author focuses on consumption in general, he concludes that despite income doubling between 1954 and 1994 the share of food expenditures in absolute figures remained constant.

In order to state whether household food consumption patterns are sustainable or not and to what extent they are, it is necessary to analyse the consumption trends of people by dividing nourishment into several food categories. The **OECD**, for instance, distinguishes the following food categories: meat (poultry, pork and beef), vegetables, fruits, fats and oils, flour and cereals, soft drinks, mineral water, sweeteners, milk, cheese and potatoes. On the basis of household expenditures on these food categories, the per capita consumption in kilogrammes (or litres) per year is determined for each category.¹ Although the total energy input and total food intake differs across the four case study countries, a general trend is that meat consumption rises, mainly in favour of pork and poultry and on

¹ EEA (2005) also includes a chapter on changing food consumption of several food groups (in kilogramme or litre per person and year). However, the report gives only a short and rough overview for the European Union. The food groups used are more or less the same as in the OECD report and the trends are roughly the same.

account of beef. An increase in vegetable and fruit supply in supermarkets, partly due to higher imports, partly due to an increasing yield in agriculture productivity, induces a higher demand for vegetables and fruits. However, much of that increase has been in frozen vegetables; moreover, a substitution of self-production by bought vegetables took place, yielding higher sales numbers.

According to OECD (2001), additional increases can be found in flour and cereal products, as a result of higher consumption of fast food, pizzas and pasta, as well as in bottled beverages including fruit juice, mineral water and carbonated soft drinks, and in sweeteners, an essential ingredient of carbonated soft drinks. As far as fats and oils are concerned, households begin to avoid animal fats and substitute them by vegetable oils. A strong consumption decline could be observed for potatoes and dairy products, with the exception of cheese which is rising.

Although this paper serves as preparatory work for investigations of sustainable food consumption in industrialized countries, mainly in Austria, an overview of the world-wide food trends should be briefly considered. It is generally confirmed that these trends are not only valid for industrialized countries, like the European Union or OECD countries, but are worldwide trends. For instance, **FAO** in collaboration with the **WHO (FAO/WHO 2003)** investigate the impact of diet and nutrition on the prevention of chronic disease, based on global and regional food consumption trends. The authors take a somewhat different approach in determining consumption trends by using not only data on per capita food consumption (demand side) but also on per capita food availability for consumption of special food groups like fat, animal products, fish and vegetables (supply side).² Their key results are that (i) food consumption, expressed in kilocalories (kcal) per capita and day, has been rising both in industrialized and developing countries, (ii) the shift in diets towards more livestock products and vegetables can be recognized worldwide, (iii) the supply of vegetables per capita has increased from 1979 to 2000 about 54% worldwide and almost doubled in developing countries, and (iv) the per capita consumption of meat and milk in kilogramme per year has risen in both developing and industrialized countries, somewhat in contradiction to the OECD results.

Studies on changing consumption patterns related to sustainability on a **national level** do exist, but they are very often less comprehensive, pick out just a small part of the whole issue and sometimes regard only changing consumption patterns but neglect the sustainability issue. For instance, **Gerbens-Leenes and Nonhebel (2002)** investigate the food consumption trends in the Netherlands by using consumption data for several food categories in kilogramme per capita and year. They highlight that a higher consumption of meat, beverages, citrus fruits and dairy products, like cheese, resulted in higher land requirements between 1950 and 1990. Like the OECD, EEA and FAO/WHO, the authors come to the conclusion that total per capita consumption of meat has risen noticeably. Whereas in 1950 mostly beef, veal and pork were consumed, by 1990 the consumption of beef and veal dropped in favour of poultry, while pork consumption remained half of the total meat consumption. The consumption of potatoes dropped, while consumption of citrus fruits rose. Similar results are found in an Austrian study by **Payer, Burger and Lorek (2000)**, set up as preparatory work for the OECD programme on sustainable consumption. The results of this research are included in the OECD report and therefore are not discussed again here.

² *Average food available for consumption* is used as an approximation for average food intake.

Box 2: Food consumption patterns in Austria

After Austria's accession to the European Union in 1995, data sampling methods had to be adjusted. Therefore, interpretation of developments of food consumption before 1995 differs from interpretation from 1995 onwards.

Payer et al. (2002) record the developments of food consumption before Austria's EU accession. Between 1983/84 and 1993/94 the per capita consumption (in kilogramme per year) of fruit juices (+49%), rice (+30%), cheese (+27%) and legumes (+27%) increased significantly. A slight increase (below 20%) was found for fish, vegetables, fresh fruits, pork and beer consumption. The intake of potatoes decreased by more than 50 percent between 1950/51 and the beginning of the 1980s. Since then the consumption of potatoes remain unchanged at about 60 kg per person and year.

The consumption of sugar and milk stayed stable during the period of time considered. By extending the time horizon, milk consumption decreased from 160l in the 1950s to around 100l at the beginning of the 1990s. Slight decreases (around minus 3%) are recorded for butter, bread, cereals and eggs, significant decreases concern beef, veal, honey and rye consumption.

A detailed investigation of food consumption trends in the period from 1995 up to 2002 was made by the Ministry of Agriculture, Forestry, Environment and Water Management in the "Lebensmittelbericht 2002" (BMLFUW 2002). Table 3 summarises the consumption of several food groups (in kilogramme per capita) in the year 2002 and indicates relative changes (in percent) since 1995. Between 1995 and 2002, the highest increase was found in the consumption of cheese (+22.3%) and vegetables (+18.8). The most preferred vegetables, on a quantitative basis, are tomatoes (17.4kg), butterhead lettuce (8.1kg), onions (9.7kg) and carrots (5.5kg). The consumption of milk (+6.4%) and fruits (+8.1%) have increased slightly. The demand for apples ranks first, followed by pears. The consumption of both fruits increased considerably between 1995 and 2002, plus 23,7% for apple and plus 44,4% for pear intake. The increase in vegetable and fruit consumption could be a consequence of the declining self production of foods in private gardens for self consumption. In 2000 only one quarter of Austrian consumers produce herbs and vegetables for self consumption compared to one third in 1996. The production of fruits decreased from one quarter in 1996 to one fifth in 2002. A rather stable development can be noticed for the consumption of potatoes, fish, eggs and meat (in total). Within the meat category, the consumption of beef (and veal) declines in favour of poultry. The share of pork consumption in total meat consumption is about 50%.

	consumption 2002 in kg/capita	annual changes (in percent) since 1995
Vegetables (excluding potatoes)	101.9	+18.8
Potatoes	62.0	+1.8%
Fruits (total)	95.0	+8.1
Milk	98.0	+6.4
Butter	4.7	-4.1
Cheese	17.0	+22.3
Eggs (in units)	223	+1.3
Meat (total)	98.1	+1.3
Pork	56.6	-0.4
Beef and Veal	18.8	-3.6
Poultry	18.0	+17.6
Fish	6	-

Table 3: Food consumption of several food groups (in kilogramme per capita) in 2002 and relative changes (in percent) since 1995

SOURCE: BMLFUW 2002

The following groups of reports pay attention to the change in consumption of specific food categories on the national level. **Haley (2001)**, for instance, observed the meat consumption in the US between 1970 and 2000 by making use of USDA data on per capita consumption in pounds of different meat groups. The study showed that the American consumer spent 27% of her/his budget on meat products and confirmed the rising meat consumption and preference for poultry. This trend has been encouraged by the fact that poultry meat is cheaper, has a positive effect on human health and can be quickly prepared. For the consumption of vegetables and fruits, another US case study by **Pollack (2001)** denotes the increasing market, again by using USDA time series data (1979 to 1999). They also explore the way people consume fruits and vegetables - either fresh, canned, frozen, dried or in form of juices (fruit juices). Although the consumption of fresh vegetables is predominant (ca. 50% of total vegetable consumption), Pollack points out that frozen vegetables have become an important share, currently about 20% of total vegetable consumption and still increasing. At the same time, the

consumption of canned (ca. 22%) and dried (ca. 8%) vegetables loses importance. Fruits are mainly consumed through fruit juices: But also the share of fresh fruit is about 35%.

The last group of publications on changing consumption patterns are investigations that solely register consumption data and food habits but do not relate them to household income, like publications on nutrition from governmental and private market research institutes. **BMLFUW (2003)**, **Institute of Nutritional Science in Vienna (1998)** and **National Statistics of the UK (2004)** are some examples of national nutritional reports, containing a lot of information in order to get an overview of food consumption trends, food preparing, storing and shopping habits. They build an important basis for further investigations. However, such reports only offer already evaluated statistical data, which are usually not accessible for further statistical operations. Moreover, they also neglect the sustainability issues related to food consumption.

2.2 Trends in food consumption

In order to investigate the sustainability of food consumption patterns, analyzing solely the changes of consumed food categories is not sufficient. Food consumption related activities, such as shopping, storing and preparing and cooking conditions, should be taken into account, too. Several reports by **OECD (2001)**, **EEA (2005)**, **Payer et al. (2000)** and **BMLFUW (2003)** come to the conclusion that today's households spend less time on meal preparation than 40 or 50 years ago. This trend can be seen from the preference of households in buying predictable and quick-to-prepare food, like pre-cut and/or pre-prepared meat, fruits and vegetables or frozen foods. Especially the demand for frozen foods has become an important factor because they are less time consuming, easier to store and independent of the season. The demand for instant meals and canned foods, however, is rather small (**BMLFUW 2003**).

The rising number of small households, especially the increasing number of single households, has caused an increasing demand for individual portions and smaller packaging units. **Payer et al. (2000)** indicate that in 1960 there were half a million single households in Austria, whereas in 2000 the numbers had gone up to one million. This trend is stronger in urban areas than in rural ones.

Concerning shopping habits, **OECD (2001)** claims that the number of food retail stores has declined, but at the same time their average size has increased. In addition, the supply of products (in variety and total numbers) has enlarged. Whereas in the 1960s an average grocery had only 2000 product lines, a modern supermarket has more than 15 000 (**EEA 2005**).

Another important issue is the upward trend towards out-of-home consumption. Eating out of home can be divided into two groups, namely eating in communal settings (kindergartens, schools, hospitals, work canteens, barracks, jail) and, on the other hand, in gastronomic sites (cafes, restaurants, snack bars, fast-food chains, catering services etc.).

Box 3: Trends in out of home consumption in Austria

The frequency as well as the share of food expenditure for out-of-home consumption in Austria is rising. In 1984 21.4% of total budget available for food consumption was spent on out-of-home food (28% in 2000) - see Table 4. Payer et al. (2000) estimated that this share would reach 30-40% in the future.

	1984	1993/1994	1999/2000
Share of food expenditure for out of home consumption as percent of total expenditure for food	21.4%	25.3%	28.0%

Table 4: Changes in the share of food expenditure for out of home consumption in percent of total expenditure for food

SOURCE: BMLFUW 2002

According to the Austrian consumer survey from 2001/02 (BMLFUW 2002), 43% of Austrians have their lunch outside the home. Out-of-home consumption plays a considerable role, especially for people in the labour force. 59% of the working population have their lunch either at the workplace, in communal settings or in gastronomic sites. The total economic revenue of the out-of-home food market is estimated to be about 11.2 billion euros. Gastronomic sites contribute with two thirds (7.4 billion euros) and communal settings with one third (3.8 billion euros).

When analyzing the sustainability of our food consumption patterns, one is not only interested in past and present figures but also in future trends. For that reason several reports contain information on outlooks for future food consumption. **OECD (2001)** estimates that the total caloric intake will go up - a 7% increase in the household consumption (in kilocalories per person and day) of meat, milk and egg products, a 13% increase in vegetables, oils, oilseeds and related products from 1995 up to 2020. In particular the **FAO/WHO (2003)** assumes that by 2030 per capita consumption of livestock products could rise by a further 24% worldwide from 36.4 in 1997/1999 to 45.3 kilogrammes per year in 2030, and by 14.3%, from 88.2 in 1997/1999 to 1001.1 kilogramme per year in 2030 in industrialized countries. Poultry consumption is predicted to grow fastest. **OECD (2001)** also predict an upward trend in the demand for foods that are believed to have positive health effects, especially organic foods, functional or nutrient-fortified foods and foods prepared or conserved in a particular way.

Another interesting study on future food consumption trends was made in the US by **Blisard et al. (2003)**. By using data from the Bureau of Labour Statistics' Consumer Expenditure Survey and from USDA (2000), the study makes predictions for per capita food expenditures and quantities in 2020 for certain food categories under different assumptions, such as a changing age distribution towards an *older society*, regional distribution, racial composition, a changing educational level, so that people are more aware of diet and health issues, a rising income (1% per year), and a population increase from 281.4 m in 2000 to 331.9 m in 2020. Results are available from comparative static analysis as well as in total (combination of all variables). The analysis shows that the total effect of income, demographics and population growth leads to a 26.3% increase in expenditures on food, which is equivalent to a 7.1% increase per capita (in 2020 relative to 2000), whereas quantities rise only slightly. The reason for this asymmetry is that people spend their extra money on quality and convenience rather than on quantity. Above all per capita expenditures on fruits, vegetables and fish will increase significantly in comparison to other food categories. Analogously the per capita expenditure on out-of-home eating is rising due to a growing number of working women, more double income households, higher incomes and smaller household size.

Box 4: Food demand and age structure in Austria

While the global demand for food is rising, other studies show that local trends can be declining. The Austrian Case Study of Payer, Burger and Lorek (2000) draw upon the theory of an aging population. Due to the fact that the share of people over 60 will increase in future, the demand for food will decline, because older people have lower energy requirements.

To sum up, the literature survey on household food consumption has shown three key results: First the shift to a diet that consists of more vegetables, fruits and meat, especially pork and poultry. Secondly, households prefer to buy 'quick-to-prepare' food and to consume increasingly out of the home. Thirdly, this trend will continue also in the future.

The reasons for changes in food consumption and related activities are very complex and are not discussed in detail in the cited reports. Demographic, economic and lifestyle changes, health concerns and convenience play an important role as well as the increasing number of women in the workforce. This is discussed further in Section 2.3.

2.3 Socio-economic determinants of food consumption

The second approach in order to examine food consumption patterns is the focus on disparities in food habits. Instead of analyzing time series data, the emphasis is on the effects of socio-economic and demographic factors on food consumption patterns. This is a very important approach, because it helps to identify which groups consume more sustainably and which groups indicate a need for action. This field of research is relatively new, because usually information on dietary habits was and partly still is based on household expenditure. In the past the availability of dietary data at the individual level was limited and relied on single initiatives. Today, individual based consumption data are collected by public and private institutions.

This chapter starts with the presentation of papers that have identified the relevant socio-economic and demographic features. Thereafter results and methods of specific research are summarised.

To focus on all relevant socio-economic and demographic factors and their effects on food consumption is not feasible. Therefore, a lot of studies pick out specific factors and investigate their effects on food consumption in general or on specific food categories.

The work of **Hayn et al. (2005)** singles out seven socio-economic factors that lead to food consumption disparities: *age*, *social class* (determined by income or occupation), *education*, *gender*, *location of residence*, *ethnic affiliation* and *individual lifestyle*. The work of Hayn et al. is based only on German literature and the results presented are mainly taken from other publications, like the German consumer analysis or other empirical investigations. The authors claim that one of the best investigated areas is *age* differences and related differences in preferences for food, in particular for fast food, ready-to-serve meals and frozen products. They point out that younger people in particular make use more often of ready-to-serve meals and fast food than the elderly, whereas the use of frozen foods is largely independent of age. At the same time, the elderly pay more attention to health orientated diets and usually have more knowledge about nutrition than the younger generations. Middle-age people are interested in food that can be quickly prepared, whereas children are only interested in taste and have no awareness of health-related issues. The second best analysed factors are social class and gender disparities.

The fact that lower *income* households respond mainly to price, on the one hand, and look for filling food such as noodles, potatoes, bread and rolls, on the other hand, was confirmed by several studies (**Hayn et al. 2005, Trichopoulou et al. 2002**). In addition **Hayn et al. (2005)** indicate that the consumption of fast food is more or less independent of income.

The influence of the *educational level* on food consumption in several European countries is the focus of **Trichopoulou, Naska and Costacou (2002)**. By using data from the national household budget surveys, they estimate the daily average food availability in gramme or millilitre per capita. Due to missing information on the educational level of the head of the household for several European countries, they concentrate their analysis on Greece, Norway, Portugal and Italy. Greek and Norwegian households show a tendency with higher educational level to have a lower consumption of cereals, meat products, fish, potatoes and legumes but a higher consumption of low fat milk, fresh fruit, vegetables oils and animal lipids. Only in Portugal meat consumption increases with educational level, whereas in Italy an average lower consumption of all food items with higher education could be observed. The authors claim that this trend can be explained by the fact that more educated households tend to adopt a healthier lifestyle. The report agrees that while other factors like income, age and gender have significant effects on people's diet, the educational level is the strongest determinant because education is the precondition for the understanding of health and environmental related information.

The influence of the educational level especially on the consumption of fruit and vegetables in several European countries was investigated by **Irala-Estevez et al. (2000)** and **Roos et al. (2001)**. Both reports indicate the difficulty of analyzing individual food consumption patterns, because most of the data are based on household budget surveys and do not include food habits of individuals with their socio-economic characteristics. Therefore, separate estimates by making use of a wide range of literature in books, journals, electronic databases and contacts to researchers were necessary. The observed time period is nearly the same for both reports, 1985-1999 for Irala-Estevez et al. and 1985-1997 for Roos et al. **Irala- Estevez et al. (2000)** observe a positive correlation between a higher level of education and a greater consumption of both fruits and vegetables in Belgium, Denmark, Estonia, Finland, Germany, Lithuania, Norway, Spain, Sweden and UK. **Roos et al. (2001)** find different results: They show that a higher educational level can lead to higher amounts of vegetable and fruit consumption in Western, Central and Northern Europe but with an opposite tendency in Southern and Eastern Europe. However, the absolute level of fruit and vegetable consumption is still higher in Southern and Eastern Europe than in the rest of Europe. Therefore, the study concludes that negative trends of fruit and vegetable consumption with rising educational level is found especially in regions where consumption of those foods is more common and builds an essential part of the traditional diet.

Concerning *gender* disparities in food consumption, national and international studies confirm that women consume more vegetable, fruits and cheese, whereas men's diets are more concentrated on meat (**Hayn et al. 2005, BMLFUW 2005, OECD 2001, Payer et al. 2000**).

Because of the general belief that meat production leads to extensive environmental problems, a US study by **Gossard and York (2003)** explores the effects of education, age, social class, race, gender and location of residence on meat consumption. Similar to the above mentioned examinations, the authors come to the conclusion that men consume more meat, above all more beef, than women. Higher educational level, age and social status result in less meat intake. Income, however, has no influence on total meat consumption, but on the consumption of beef. The higher the income the higher is the portion of beef consumed.

Finally, one should not forget that national nutrition reports also contain information concerning disparities in food habits. The aforementioned “Lebensmittelbericht” (**BMLFUW 2002**) and the report by the **National Statistics of the UK (2004)** address regional and demographic disparities and their effects on diet choice. Whereas the Austrian report only touches on the subject by highlighting that men consume differently than women, the UK report also focus on regional and demographic comparison.

Box 5: Meat consumption habits: gender and occupation

The effects of gender and occupation on meat consumption in Austria were investigated by BMLFUW 2002. The report indicates that women eat more vegetable foods (fruits, vegetables and cereals). Men prefer meat products, which are consumed in higher quantities and almost daily. In addition, Payer et al. (2000) indicate that men favour beef and pork, whereas the consumption of poultry is independent of gender. Meat consumption not only depends on gender but also on profession. Farmers, blue-collar workers and managers have the highest meat intake (Payer et al. 2000).

Summing up, there are many socio-economic and demographic factors that influence the demand for food in general and for several food categories. This short overview identified the most significant factors and the least investigated causes and effects of food consumption. Gender and food consumption disparities are quite well investigated. Ethnic affiliation is of minor importance, at least for Austria. What is left is the social class, determined by income or occupation level, location of residence, especially the difference between urban and non-urban residents and the educational level. Out of all the above-named factors, education seems to be the key variable and should not be neglected in further research.

The exploration of age groups and their preference for several food groups was another emphasis of several studies. However, differences can be found mainly for food related activities like the frequency of out-of-home, fast food or frozen dinner consumption, than for food demand per se.

3 Environmental and health impacts of food consumption patterns

Analyzing solely trends of food consumption is insufficient to draw conclusions about whether trends are sustainable or not. Addressing the environmental, social and economic dimensions of sustainability with respect to food consumption patterns requires investigation of the impacts of diet patterns in general or rather of specific food categories on human health, environment, economy and social structures. As stated before, the main focus of the present study is on environmental impacts but the impact on human health will be briefly reviewed as well.

3.1 Health

A detailed elaboration and recommendation of nutrients that have a positive health effect is not the main focus of this paper. This chapter gives only a brief overview of what is meant by a *sustainable healthy diet*.

A good survey of studies dealing with the sustainability of diets and their human health impact, is provided by **Duchin (2004)**. She points out that current western diets, especially the American diet, is

characterized by a high intake of calories with a large portion of energy from animal fats and added sugars. The standard American diet leads to obesity, disabilities and chronic diseases and thus cannot be sustainable. Duchin comes to the conclusion that a sustainable diet can only be reached by reductions in fat intake. Women consume more vegetables, fruits, and cheese, whereas men's diets are concentrated on meat and sweetener consumption, combined with an increasing intake of fruit and vegetables. While the consumption of cereals and meat should be moderate, if meat is consumed at all, people should shift their preference from beef and pork to poultry and fish in order to follow a sustainable healthy diet.

For the purpose of this paper it is essential to know about the ingredients of a healthy diet. According to publications by the **FAO** and **WHO (2003)** and **Fond Gesundes Österreich (2005)**, the key elements of a healthy diet can be described as follows: It consists of a low intake of fat, added sugars and protein from animals, implying a reduction in the consumption of meat and eggs. Substitutes for animal protein can be fish, dairy products and legumes. Indispensable for a sustainable diet is the consumption of wholemeal products, potatoes and, above all, vegetables and fruits, fresh if possible.

3.2 Environment

For the present study, we focus on the environmental impacts of food consumption. Two approaches can be identified for determining the environmental impacts of food consumption patterns: a qualitative (or descriptive) and a quantitative approach. **EEA (2005)** and **OECD (2001)**, taking a descriptive approach, stress the complexity of interactions between food consumption/production and the environment. The studies agree that current eating and drinking patterns lead to large environmental pressures, especially when considering that approximately one third of total environmental impacts from households can be related to food and drink consumption (**Danish EPA 2002 in: EEA 2005**).

The environmental impacts from household food consumption can be divided into direct and indirect impacts. According to the **OECD (2001)**, the *indirect impacts* from meat consumption are intensive land use for grazing and grain production, water use and pollution. Analogously, the consumption of cereals and flour leads to intensive land use. The impacts of vegetable and fruit consumption comprise water pollution caused by pesticides and fertilizer utilisation, agglomeration of organic waste as well as high energy use for greenhouse production and food transport in order to assure year round availability (**OECD 2001**). Finally, the process of food processing requires additional water and energy use for all food categories, as does the waste generated by packaging. The *direct environmental impacts* from consumers refer to energy use for cooling devices, cooking and dish washers. It is a fact that the increasing use of the car for going shopping, due to the disappearance of local food stores but also due to convenience, contributes rigorously to direct environmental impacts from food consumption. However, these impacts have not been quantified (**OECD 2001, EEA 2005**).

In contrast to the qualitative approach, other studies try to quantify the impacts numerically by using different methods. **Faist, Kytzia and Baccini (2001)** use a *material flow analysis* (MFA) to illustrate the energy and resource requirements for the Swiss food production and consumption system. The MFA is a method that describes flows of different materials through a defined space within a certain period of time. In other words, the MFA accounts for all inputs to and outputs from a system (life cycle assessment). The prerequisite for this method is the availability of consumption data as well as data about the energy use during the entire life cycle from production and processing, to transport, retailing and storing of various products. The results show that the highest resource demand is for agricultural production of meat and dairy products. For instance, 800,000 tonnes of fodder are needed to produce

90,000 tonnes of milk and meat (Faist et al. 2001). With respect to energy requirements for food production and consumption, their analysis indicates that almost 30% of the entire energy demand in the food sector is used by households, namely for cooking, freezing and cooling. Agricultural production requires 28% of the food sector’s total energy requirement, including cultivation, fertilizers, pesticides and greenhouse production. Transport needs only 7% of the energy requirements. Furthermore, Faist et al. calculate two possible scenarios for future consumption patterns, one with a total shift from conventional agricultural production to organic production and a second technological one with a focus on more efficient cooling devices. Under the assumption that the product mix consumed by people and the technical standards stay the same, energy savings amount to roughly 5% in the first approach. These savings result from less use of fertilizers and greenhouses. In the second scenario, total energy demand in food production and consumption would decrease by 10%. They conclude that increases in resource efficiency cannot be attained only by measures in agriculture production but also require optimization of technical devices in private households.

Box 6: Food related energy demand

Austrian households’ energy use for nutrition-related activities (shopping, storing, preparing, cooking and cleansing activities excluding fuel for shopping trips) accounts for 7% of total household energy consumption (Payer et al. 2000). Table 5 summarises energy consumption data of some nutrition related activities of an average Austrian household with two adults and two children.

Activities	Average household energy consumption, in kWh/a
Cooking	330
Cooling	360
Freezing	230

Table 5: Energy consumption data on nutrition related activities with

SOURCE: Payer et al. 2000

While it is true that the efficiency of household appliances for food related activities is continuously growing, the size and volume of household equipments is rising, too. Hence, efficiency gains are more than compensated by the increase in quantity (see Table. 6).

	1970	1980	1990	1998
Refrigerators	66.5	97.5	96.0	97.0
Freezers	11.0	53.5	65.4	67.0
Dishwashers	0.5	11.5	30.0	44.0
Microwaves	0.0	0.0	23.0	45.0

Table 6: Kitchen equipment quota 1970 to 1998 in percent of total number of households

SOURCE: Payer et al. 2000

Environmental impacts can also be estimated by focusing on land requirements due to food consumption. By calculating land requirements for certain food groups, **Gerbens-Leenes and Nonhebel (2002)** focus on changes in Dutch consumption patterns and consequences for land requirements. For that purpose land requirements per food item are combined with data on per capita food consumption. They find that land requirements for agricultural production are predominantly determined by population size but also by the types and amounts of food. The study demonstrates clearly that changes in consumption patterns, especially the shift to a higher intake of meat, beverages like coffee, wine and beer, definitely result in higher land requirements, leading e.g. in the Netherlands to an increase in land requirement by more than one third between 1950 and 1990. Not only meat but also the consumption of fats and beverages require large agricultural land areas. In Europe, 10% of the total land requirement for food production is needed for the production of only four beverages (beer, wine, coffee and tea). Including soft drinks and juices would yield an even higher share. Thus,

the authors come to the conclusion that if consumption patterns in developing countries shifted towards those of western countries the global per capita land requirement would rise substantially.

The central contribution on energy demand for special food groups is undoubtedly the publication of **Carlsson-Kanyama and Faist (2000)**. By means of a **life-cycle assessment (LCA)**, explicit energy demands of special food groups due to agricultural production, storage, transportation, processing, preparation and waste disposal were determined. Energy requirements are defined as demand for fuel, electricity, fertilizers, pesticides and/or machine usage per output unit of crop, forage crop, fruit, vegetable, meat, fishery products etc. To show the practical implementation, they calculate the energy use for the consumption of a hamburger. Although the data collection can be implemented, the interpretation is not easy. The main results are that meat has higher energy requirements than vegetables. From an environmental perspective open air cultivation should be preferred to greenhouse cultivation (**Duchin 2005**).

A different approach was taken in an earlier study by **Carlsson-Kanyama (1998)**. Through an **LCA** she calculates the entire greenhouse gas emissions for certain food categories. Her approach is targeted on the correlation of food consumption patterns and climate change. While fuel combustion is the main source for CO₂ emissions, there are also other greenhouse gases that are emitted in great magnitude during food production and consumption. Methane (CH₄), for example, is pollution from animal husbandry, waste and rice planting. High amounts of nitrous oxide (N₂O) emitted from industry and agricultural soils have to be taken into account, too. Moreover, the study indicates which stages of the food life cycle of several food groups, such as transportation, storage, crop farming, production of fertilizers, drying, milling, contribute most to energy consumption and greenhouse gas emissions. A general conclusion is not possible because the contribution of different food life cycles to total carbon dioxide or total greenhouse gas emissions differ from food group to food group. The example of rice shows the difference of both approaches: By considering carbon dioxide emissions only, transportation takes 50% of total energy requirements during the life cycle of rice. When considering total greenhouse gas emissions of the rice life cycle, transportation is responsible for less than 10% of total greenhouse gas emissions, whereas crop farming account for roughly 80%.

An LCA helps to identify problems and areas that call for action. Therefore, Carlsson-Kanyama (1998) argues that a greenhouse gas analysis is a better instrument to model environmental impacts than energy related ones because the former includes emissions from many sources. When only considering energy inputs, transportation is seen as the most energy demanding process during a product's life-cycle. By including all greenhouse gases, transportation becomes only a small factor. Other areas, like the production of fertilizers, crop farming of rice and rearing of pigs, appear to have major impacts on the environment due to their significant emissions of methane or nitrous oxide, which are not included in energy related analysis.

A related study was carried out by **Kramer et al. (1998)** for the Netherlands on the topic of food consumption and greenhouse gas emissions. It contains estimations for the amount of CO₂, NH₄ and N₂O emissions in kilogramme per monetary unit for several food categories. According to their results, rice, salad, and tomatoes turn out to have much higher CO₂ emissions than other vegetables, due to greenhouse production and long distance transports. In general, fresh vegetables have lower emissions than processed ones. Likewise, meat products emit more CO₂ per monetary unit than vegetables. Rice performs worst in terms of methane emissions, while other relevant methane emissions can be observed for dairy products, like milk, butter and cheese. Nitrous oxide is highest for processed foods in categories like fish, sugar, pastry, rice, bread, oil and fats.

In order to estimate which food categories contribute most to greenhouse gas emissions, **Kramer et al. (1998)** combine emission data on different food categories with statistics on household expenditure on certain food groups. According to the food consumption patterns of Dutch consumers in 1990, 50% of total greenhouse gas emissions in the food sector are related to meat and dairy consumption. The categories of potatoes, vegetables, fruits and the category of beverage products contribute each with 14% to total emissions.

In assessing environmental impacts from food consumption, the comparison of a meat based diet with a vegetable or plant based one is a very popular field of research. The fact that meat production requires larger quantities of natural resources, in particular land, energy and water, was confirmed by many studies (**Leitzmann 2003, Gossard and York 2003, White 2000, Goodland 1997, Carlsson-Kanyama and Faist 2000, OECD 2001**). It was found that not only livestock grazing leads to several ecological problems, like overgrazing, soil erosion, deforestation, desertification and water pollution, but also the production of fodder grain grown for livestock. In addition, it is often argued that livestock production is inefficient in terms of input-output ratios of livestock production. To consume one kilogramme of beef, a cow must eat seven kilogramme of grain, and a pig needs about four kilogramme whereas chicken and turkey need only two (**Goodland 1997**).

White (2000) compares meat based and vegetarian based diets by using the method of the **ecological footprint**, a measure reflecting the amount of land necessary to satisfy current consumption levels. He compares the ecological footprint for vegetable and meat consumption, for several regions. White shows that the highest total ecological impact, measured in hectare per capita, is caused by the North American diet, followed by Oceania and Europe. Moreover, the ecological footprint triggered by meat consumption is higher than by vegetarian consumption in all regions.

Pimentel and Pimentel (2003) also compare the environmental effects of a meat based (average American) with a plant based diet (i.e. a *lactoovovegetarian* diet consisting of vegetables, fruits, eggs and dairy products). The authors calculate the amount of feed grain required to satisfy each diet under the assumption that the quantity of calories consumed by both diets are the same. The result is that the meat based diet needs twice as much grain cultivation as the plant based diet. In contrast to Carlsson-Kanyama and Faist (2000), **Pimentel and Pimentel (2003)** include only the energy requirements for producing feed grains but not energy inputs for subsequent food production and processing stages (as would be the case in a LCA approach).

To sum up, the environmental impacts from meat based diets are higher than from plant based diets regardless of the method used for calculation. Likewise frozen, canned and ready to eat food is more harmful to the environment than fresh food.

4 Motivating consumers towards more sustainable consumption patterns

After a review of current consumption trends in Section 2.1 and sustainability impacts thereof in Section 2.2., one can conclude that current consumption trends are not sustainable, because they are causing a wide range of environmental problems. Therefore, changes of lifestyles are essential for achieving sustainable consumption. This section deals with underlying factors that influence consumers' purchasing behaviour. By identifying those factors, scientists, governments and environmental protection agencies hope to be able to change individuals' consumption patterns in a

more sustainable direction. The analysis starts with the presentation of results of empirical studies and then discusses a theoretical framework of the decision making process of consumers.

4.1 Consumer driving factors

Consumer driving factors can be identified by consumer surveys such as **Mainieri et. al. 1997; Robinson and Smith 2002; Diamantopoulos, Schlegelmilch, Sinkovics, Bohlen 2003; Vermeir, Verbeke 2004; BMLFUW 2003**. Some of these surveys identify solely individual factors, that is to say factors that motivate consumer behaviour in order to fulfil their personal needs. For instance, **BMLFUW (2003)** mentions three factors that drive Austrian consumer decisions: *convenience*, *health orientation* and *taste*. Convenience results in the purchase of ready-to-eat products in order to reduce time and effort for cooking and is especially important for people under 40 and single households. In general, health orientation and the role of nutrition therein are becoming more popular.

A US study by **Mainieri et al. (1997)** is based on a questionnaire in Los Angeles in 1993 addressing the motives of consumption behaviour not in particular for food but in general for consumer goods. They show that the purchase decision of consumers is primarily influenced by quality, followed by the possible use and cost of the product, while environmental effects are of minor importance.

However, according to **Duchin (2004)**, consumers' purchasing behaviour is not only motivated by selfish reasons, but also by non-materialistic factors, like environmental and social concerns. **Vermeir and Verbeke (2004)** also point out that the decision making process of consumers to buy a certain product is influenced by two factors: consumers' social responsibility, like animal welfare, environment and fair trade, and individual needs like taste, price and convenience. However, both authors agree that individual factors are predominant.

Nevertheless, while several studies have shown that there are consumers who consciously buy ethical or sustainable products, the consumer group of so-called *ethical* or *green consumers* is very small so that sustainable food markets remain niche markets. However, the interest of consumers in sustainable products is growing. Many consumers have positive attitudes towards sustainable products, which are perceived to be better in taste, quality, safety and freshness and which are believed to contribute positively to regional economies, human health and environment. Unfortunately, positive attitudes do not automatically imply active purchasing behaviour (**Lee and Holden 1999**).

Also **Vermeir and Verbeke (2004)** claim that, although people may have a positive attitude, they are largely passive in their role as a consumer when it comes to supporting environmental issues or animal welfare with their available budget. Convenience, appearance, availability, confusion about eco-labelling and prices, which are perceived as too high, are mentioned as barriers.

These obstacles to environmentally friendly purchasing behaviour are confirmed by several studies. Indeed, **Mainieri et al. (1997)** indicate that there is a positive correlation between a higher educational level and pro-environmental attitudes, but they also agree that a general positive environmental attitude does not imply actual green purchasing. Determinants of purchasing behaviour are personal (knowledge, motivations) and situational characteristics (economic constraints, availability of goods and services).

Box 7: Austrian consumers' attitude towards organic food products

A survey from the year 2000 indicates that Austrians are willing to pay an extra amount of money for environmentally friendly products. An average of plus 20% compared with conventional foods is mentioned. The willingness to pay more for food with lower environmental impacts is rising with higher educational level (*ÖSTAT 2000, in: Payer et al. 2000*).

Current figures on the purchase of environmentally friendly food, especially organic food, are available at the homepage of Austria's "Bio Garantie", an organisation which controls the certification of origin for organic foods in Austria. They refer to a representative consumer survey conducted in Vienna (2003), which comes to the conclusion that 72% of Austrians purchase organic products. One third does it regularly, whereas one quarter of the Austrian population never buys them. The influence of socio-economic and demographic factors on purchasing organic foods was examined, too. The proportion of women who purchase organic foods is significantly higher (81%) than that of men (61%). The proportion of purchasers of organic products differs also between age classes. 90% of people between 40 and 49 indicated that they buy organic products occasionally, whereas only 60% of people over 60 buy them.

Education plays an important role for the purchase of environmentally friendly products. The survey finds that the proportion of organic food purchases rises with higher educational level. A correlation between income and the purchase of organic foods could not be identified (*Austria Bio Garantie, December 2005*).

Payer et al. indicate that "...89% of all Austrian consumers wish to be informed in detail about the origin of the products they buy." (*Payer et al 2000, p. 30*). Moreover, 60% of the respondents state that they get their information (nutritional facts and origin) solely from labels. Advertising, brochures and newspapers as information source play only a subordinate role (*Payer et al. 2000*).

In a related effort, a Swiss consumer study by **Tanner and Kast (2003)** points out that the willingness to buy "green" food is higher if people have positive attitudes towards the environment, fair trade and local products. Knowledge about products that are environmentally friendly contributes to creating the green consumer. As barriers to green purchases the authors identify socio-economic factors like low income, unemployment status and low quality occupations which determine purchasing power and time constraints. Also unfavourable living conditions, like inconvenient housing locations and the lack of adequate stores with green products can hinder sustainable consumption.

The question that arises is: which factors do stimulate green consumerism? As a response **Vermeir and Verbeke (2004)** identify personal values and information as major factors that could motivate green consumerism. Personal values like universalism, honesty, idealism, benevolence, self-direction, equality, freedom and responsibility are identified as contributors to sustainable consumption, whereas personal values, like ambition, hedonism, power, tradition, security and conformity are claimed to be barriers. Education on sustainable products and their positive health and environmental benefits is a precondition for changing consumer habits. In addition, product labelling could contribute to improve information on *green products*.³ It is also very important that consumers have the feeling that a change in their purchasing behaviour results in a better environment (= *perceived consumer effectiveness*).

Mainieri et al (1997) identify three key factors fostering sustainable consumption (based on **Balderjahn, 1988**): (i) a positive attitude towards environmental issues, (ii) the belief in the power of self controlling purchasing habits, and (iii) the belief in the effectiveness of consumer purchase decisions.

In addition to the factors identified above, **Tanner and Kast (2003)** stress the importance of green marketing and education in order to strengthen positive attitudes towards green products. In order to improve the availability of sustainable products for everyone, supermarkets should enlarge their range of green products, in particular organically grown food and food with minimal conservation and packaging and certified origin. In order to satisfy consumers' demand for convenience, eco-

³ However, the authors also argue that consumers are very often confused about product labelling because of a multitude of labels. There is an urgent need to standardize labelling.

convenience products should be fostered, that is to say, products which are environmentally friendly and time saving.

The last factor discussed in this context is the product price. The influence that prices have on purchasing sustainable products is controversial. **Mainerie (1997)** and **Vermeier and Verbeke (2004)** claim that prices play an important role in determining whether somebody buys green products or not. On the contrary, **Tanner and Kast (2003)** conclude that prices and income do not play a significant role in green purchasing.

4.2 Decision making models

In order to understand how certain decisions are derived, this section presents three decision making models: **Batson's (1987)** model of pro-social behaviour, the **NOA (= needs, opportunities, abilities)** model by **Vlek and Gatersleben (1998)** and the revised **NOA** model by **Jager (2000)**. The understanding of the decision making process is important for identification of key elements responsible for decision-making. A systematic influence of those key elements could then be used to encourage consumers to behave more sustainably.

"Batson's Model of Pro-social Behaviour" applied to pro-environmental behaviour is described by e.g. **Lee and Holden (1999)**. Like **Duchin (2004)** and **Vermeir and Verbeke (2003)**, the authors regard pro-environmental behaviour as a combination of egoism and altruism. Lee and Holden transformed Batson's decision-making model for interpreting environmental issues in such a way that the model describes three behavioural options for how individuals can respond to the perception of needs for environmental improvement. The first is that individuals get a reward for certain behaviour or a punishment if they do not act, such as refunds for bottles or subsidies for organic farming or punishment in terms of fees. The second option is activated by egoistic motives, such that the individual's awareness of his/her own need (or that of others) for a better environment causes personal distress. In order to reduce this stress the individual becomes active. The last behavioural option is characterized by empathy, that is to say the individual does not only recognize others' needs but is able to put him- or herself in the position of people in need. By being able to imagine the feelings of people who are affected by environmental problems, the individual becomes actively directed by altruistic intentions. Figure 1 summarises these three ways.

To sum up, an individual becomes environmentally active either because he/she is forced to or in order to improve his/her own position or the situation of others, like the community. Whether the individual actually becomes active depends therefore on personal possibilities and the environment. In other words, the purchasing of green products is only possible if there is a supply of environmentally friendly products. Eventually the individual makes a decision on his/her behaviour based on the calculations of personal costs and benefits of an environmentally conscious behaviour.

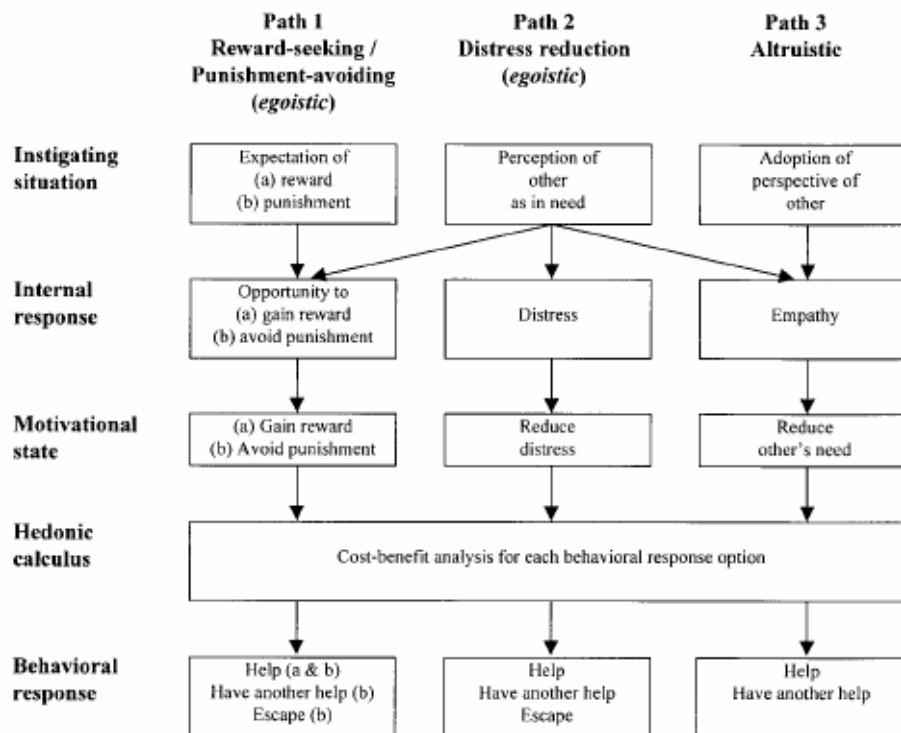


Figure 1: Batson's model of Prosocial Behaviour, 1987

In: Lee and Holden 1999

The NOA (needs, opportunities, abilities) model was developed by **Vlek and Gatersleben** (Vlek and Gatersleben In: Noorman and Uiterkamp 1998) to identify the driving forces in the decision making process on (sustainable) consumption. Because of the easy handling of the model, it is used by several studies to describe forces that affect (environmentally relevant) human behaviour. The report of the **OECD (2001)** has adapted the NOA model for sustainable food consumption. By doing so *needs* stand for nutrition and health, convenience and variety. The term *opportunities* comprises the external conditions, like food prices, information about products, and availability of goods and services. The last element in this model, the *ability*, describes the financial, temporal, spatial, cognitive and physical capability of households or individuals to consume foods and food-related services. The motivation to buy something is controlled by needs and opportunities (see Figure 2). In contrast, the behavioural control is influenced by opportunity and ability. Motivation and behavioural control together are responsible for consumers' intentions and in the end for consumer behaviour. A more detailed description of the interaction of needs, opportunities and abilities is given below when explaining the adapted NOA model of Jager (2000).

In order to show the practical use of this model, an example is given. Let us suppose that a hungry person who favours self-made foods (motivation) is going to the local shop (opportunity) to buy food. Hunger and the existence of a local shop motivate the person to go shopping for food. However, the person has a job and his or her lunch time is restricted. The individual has not enough time to drive home and prepare something. The ability represented by the restricted time and the opportunity of the local shop determine the behavioural control. This behavioural control can result in buying snack foods. Motivation and the behavioural control together influence a consumer's behaviour which would, in this case, result in the purchasing of snack food.

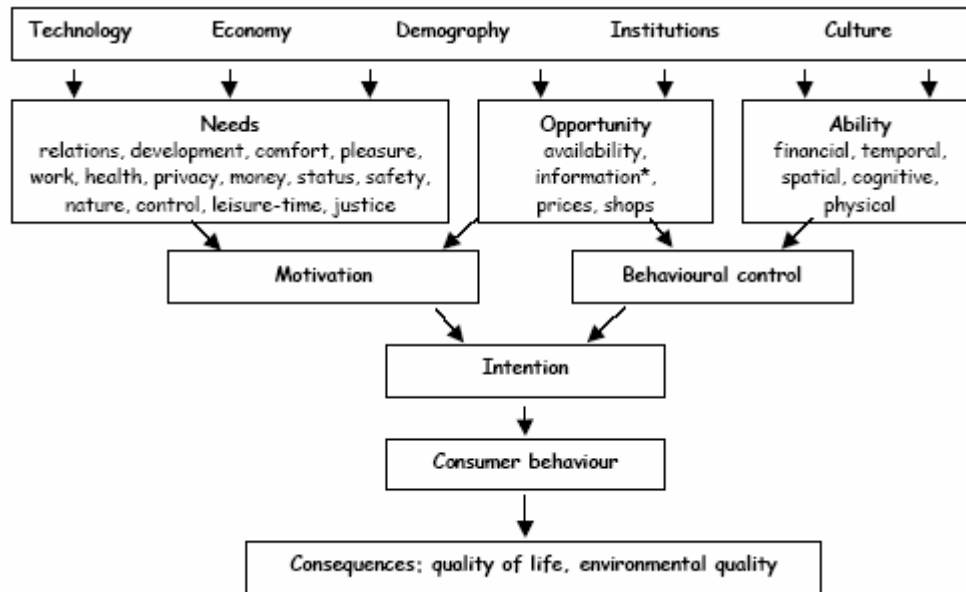


Figure 2: NOA Model of Consumer Behaviour

SOURCE: Gatersleben and Vlek, in OECD 2001

Jager (2000) models consumer behaviour by applying the NOA model in a larger system. He argues that the driving factors of human behaviour can be divided into macro-level and micro-level driving factors. *Macro-level factors* are equal for all individuals and refer to the natural and human environment people live in. They include technical developments, like the growing supply of goods and services, economic developments, like increasing disposable income for households, demographic developments, like the growing population and its growing demand for more goods and services, institutional developments, like the free market system and cultural developments, like the belief of people that they feel better by consuming more. The macro-level factors affect the individual's consumption habits by influencing the *micro-level driving factors*. Those differ between human beings and include *human needs and values, behavioural opportunities, consumer abilities and consumer uncertainty*. *Needs and opportunities* determine the motivation for consuming, whereas *opportunities and abilities* are responsible for the behavioural control, i.e. the feasibility of consumption. *Needs* are internal forces that are responsible for our behaviour, like physiological needs (hunger, thirst), safety needs, needs for subsistence, communication, leisure, freedom etc. If a non-satisfied need is confronted with an opportunity, which is able to satisfy the need, this would result in a motivation to use that opportunity.

Very often several opportunities are possible. **Jager (2000)** defines *human values* as "...beliefs about the personal or social desirability of certain behaviours and modes of existence." *Opportunities* combine all products and services that people can use in order to fulfil their needs. A single opportunity can satisfy several needs simultaneously, while different opportunities can also satisfy the same need. The more a consumer believes that a certain opportunity can satisfy one special need, the more the person is motivated to use this opportunity. The term *ability* stands for personal resources: physical resources, like personal health, permitted and licensed resources, like permits and licences one has for using certain opportunities (car), financial resources, social and cognitive resources, which refer to knowledge, skills, attitudes and norms necessary to understand the consequences of different choices.

The balance between ability and opportunity determine the behavioural control. Behavioural control generally indicates if the consumption of a certain good or service is possible or impossible, or rather which opportunity is more easy to consume. Finally, Jager also mentions *uncertainty*, especially uncertainty about future consequences of current human activities, which significantly influence human behaviour. If people have a low uncertainty tolerance, they will be more concerned about current behaviour than people with a higher tolerance.

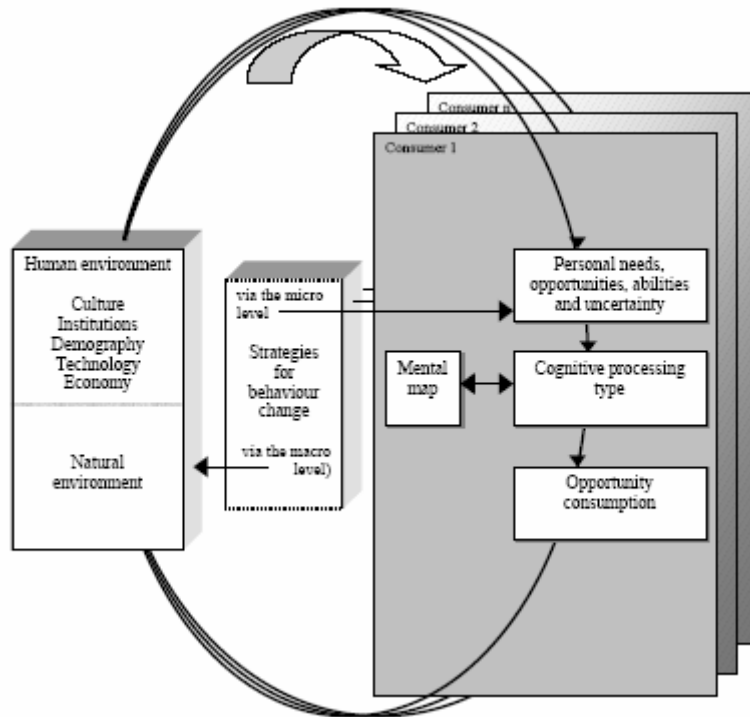


Figure 3: Consumer behaviour on the micro and macro-level

SOURCE: Jager 2000

Figure 3 summarises the connection between the macro and the micro-level factors that influence consumer decisions. It becomes apparent that the NOA model is part of the micro-level and directly influences the cognitive process. *Cognitive processing* decides about consumer behaviour and can be determined by deliberation, social comparison, imitation and habit formation (repetition). The mental map is working as memory and influences the cognitive process directly. In the end, cognitive processes are responsible for consumers' choices. However, one should not forget that consuming also has consequences. Consumption satisfies consumers' needs but also changes their abilities as well as the natural and human environment. That feedback loop is demonstrated in figure 3 by the arrow from 'opportunity consumption' through 'natural environment' back to 'personal needs, abilities and opportunities'.

Although the work of Jager is not focused on sustainable food consumption, it provides a very useful approach and framework for further research. Thus, it is possible to use his model and to adapt it to food consumption in order to reconstruct the motivators and barriers that lead to sustainable or non-sustainable food consumption

In addition, **Jager (2000)** provides strategies for behavioural changes in the context of stimulating sustainable development of consumer behaviour. First he points out that the driving forces of human behaviour should be changed. That implies the change of:

- the need satisfying capacities of opportunities
- the resource demands of opportunities
- the abilities of consumers (income taxes, education)
- the perspective people have on the preferred mode of need satisfaction

A precondition for the change of need satisfying capacity of opportunities is that the consumer is aware of the fact that the opportunity has changed. In terms of food that could mean a higher availability of organic foods in supermarkets. To change the ability of consumers implies, for example, the change of income or educational level. The last aspect in the list refers to the fact that the level of need satisfaction depends on a person's cultural background. While one individual's need for food is satisfied with chicken and vegetables, others' needs are satisfied with lobster and caviar.

Finally, **Jager (2000)** offers five general strategies for behavioural change through providing physical alternatives and arrangements, regulation and enforcement, financial-economic stimulation, social and cognitive stimulation and/ or changing values and morality. *Providing physical alternatives and arrangements* means to change the set of opportunities consumers have through technology innovation. This strategy has consequences on the amplitude with which opportunities satisfy certain needs. At the same time the physical resource demand of opportunities could be lowered through technical innovations. *Regulation and enforcement* limit or expand the capacity of behavioural opportunities a person has by means of laws and regulations. *Financial-economic stimulation* (economic incentives) controls behavioural opportunities by imposing fees or fines on undesired behaviour or providing subsidies and discounts for desired behaviour. Thus, farmers who produce organically should get subsidies. *Social and cognitive stimulation* should change consumers' perceptions of need satisfying opportunities by giving information, education, behavioural examples and advice. Jager acts on the assumption that "...specific behaviours are determined by cognitions and by social factors, such as social norms and customs." (**Jager 2000, p. 91**). Informing consumers about the negative impact of certain food products or, even better, of current consumption patterns is inevitable. A good example for stimulation consumers' food patterns through motivating people is the current campaign about healthy nutrition conducted by the Austrian funds called *Gesundes Österreich*.

The changing of values and morality strategy aims to alter life-styles from a selfish and egoistic to a more altruistic and cooperative style. It should also change people's conception of life quality so that welfare is not a function of quantities of goods and services consumed but of the existence of collective and environmental qualities. Influencing existing values and morality is not easy. However, educational systems, media and general campaigns can contribute to altering peoples' lifestyles.

5 Conclusions and outlook

The literature research on the topic of sustainable food consumption shows that there has been a lot of investigations on different parts of the question (due to its complexity), of which only a selection could be summarised here. Generally speaking, a status quo analysis in order to investigate current

and future trends is desirable, especially when considering the date of completion of the available data sets used in these studies.

With respect to open research questions, there is a huge potential especially in the domain of decomposing trends of several food consumption categories. In order to facilitate the choice of food categories, the reviewed studies constitute a good starting point. In general, the analysis of actual food choice behaviour is limited by two factors: the availability of statistical material (especially distinguishing sufficient food categories, and on the individual consumer level) and the significance of food related characteristics across socio-economic groups. Despite data problems, an accurate investigation has to separate food categories according to their environmental impact. It follows from sections 2.1 and 2.2 that the analysis should at least distinguish the categories with high environmental impacts like meat (poultry, beef and pork), fats and oils, sweeteners and bottled beverages, from more sustainable categories such as fruits, vegetables, milk products and potatoes. Only by using food categories that are relevant from the point of view of consumer decisions as well as due to their environmental impacts, is an interpretation of consumption patterns possible. Also the type of food preparation (frozen, canned or dried) plays a considerable role and should be addressed. To sum up, an accurate analysis of the sustainability of food consumption patterns must contain significant food categories as well as information about the level of processing of consumed foods, provided that data are available.

With respect to food disparities between different socio-economic groups, gender disparities were discussed most extensively, with differences mainly driven by men eating more meat than women. From the point of view of sustainability, more emphasis should be put on the influence of social class and educational level on food consumption trends in future research. The educational level is identified as the key variable for reversing non-sustainable food consumption trends. The influence of age is closely related to household structure, and both lead to differences in time constraints, convenience, health concerns and traditional values. A general conclusion on which household type is more sustainable than others cannot be drawn. This discussion underlines the complexity of the issue and the danger of concentrating on specific relations only.

The driving factors (price, convenience, taste etc.) of consumer decisions on purchasing *green products* instead of "conventional" products were the focus of several consumer surveys. However, the more interesting question would be the investigation of the factors behind consumers' decisions. More precisely, it would be useful to know what it is that drives consumers to choose low-priced and/or convenient products rather than high quality products. By first identifying the key factors that are responsible for decision making processes and secondly by influencing those factors in favour of sustainability, people are likely to change their consumption behaviour. The NOA model provides a good starting point for analyzing consumers' decisions. In addition, the work of Jager provides a lot of information about consumer behaviour. By using his findings and transforming them to food consumption, one could probably better understand the driving factors and find solutions. Studies about consumers' decision models particular for food choices are not very widespread and need a more thorough investigation.

6 References

- Alfredsson, E. C. (2002):** *Green Consumption- No solution for climate change.* Energy 29 (2004), 513–524.
- Austria Bio Garantie,** Gesellschaft zur Kontrolle der Echtheit biologischer Produkte GmbH, December 2005, Presseinformation. <http://www.abg.at/dynamisch/presse/index.php>
- Birch, R. (2004):** *Exploring the Consumption and related environmental impacts of socio- economic groups within UK.* In Huback, K. Atsushi, I., and Stagl, S. [eds.] (2004): International Workshop on Driving Forces of and Barriers to Sustainable Consumption, University of Leeds, UK.
- Bundes Ministerium für Land und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) (2003):** *2. Lebensmittelbericht Österreich: Die Entwicklung des Lebensmittelsektors von 1995 bis 2002.* Wien: BMLFUW.
- Blisard, N., Biing-Hwan, L., Cromartie, J. and Ballenger, N. (2002):** *America's Changing Appetite: Food Consumption and Spending to 2020.* Food Review. USDA Economic Research Service. 25 (1), 2-9.
- Carlsson-Kanyama A. (1998):** *Climate change and dietary choices—how can emissions of greenhouse gases from food consumption be reduced?* Food Policy 1998;23:277–93.
- Carlsson-Kanyama, A and Faist, M. (2000):** *Energy Use in the Food Sector: A data survey.* Thesis. Stockholm University, Department of Systems Ecology and Swiss Federal Institute of Technology (ETH Zürich), Department of Civil and Environmental Engineering.
- Diamantopoulos, A., Schlegelmilch, B., Sinkovics, R., Bohlen, G.M. (2003):** *Can socio-demographics still play a role in profiling green consumers? A review of the evidence and an empirical investigation.* Journal of Business Research, 56(4), 465- 480.
- Duchin, F. (2005):** *A Framework for Analyzing Scenarios about Changes in Diets.* Journal of Industrial Ecology, 9 (1-2), 99-114.
- Duchin, F. (2004):** *Sustainable Consumption of Food.* Thesis. New York, Rensselaer Polytechnic Institute, Department of Economics.
- Eberle, U., Fritsche, U. R., Hayn, D., Empacher C., Simshäuser U., Regaag, R. und Waskow F., (2005):** *Umwelt-Ernährung-Gesundheit- Beschreibung der Dynamiken eines gesellschaftlichen Handlungsfeldes.* Diskussionspapier Nr. 1, Institut für sozialökologische Forschung, Hamburg/Darmstadt/Frankfurt/Heidelberg/Köln.
- EEA (2005):** *Household consumption and the environment.* Copenhagen.
- Faist, M., Kytzia, S. and Baccini, P. (2001):** *The impact of household food consumption on resource and energy management.* International Journal of Environment and Pollution 15 (2), 183–199.
- FAO and WHO (2003):** *Diet, Nutrition and the Prevention of Chronic Diseases.* Geneva: WHO technical report service 916.
- Fond Gesundes Österreich,** December 2005, Themen: *Die Ernährungspyramide baut auf.* http://www.gesundesleben.at/index_.cfm?bid=3&tid=74&uid=401&sid=7919&tabelle=beitrag

- Gehlhar, M and Coyle, W. (2001):** *Global Food Consumption and Impacts on Trade Patterns*. In: Regmi, A. (edt.) (2001): *Changing Structure of Global Food Consumption and Trade*. USDA, Agriculture and Trade Report, WRS-01-1.
- Geoffrey, D. P. (1998):** *The changing food-at-home budget: 1980 and 1992 compared*. Monthly Labour Review, Bureau of Labour Statistics of the US, December 1998.
- Gerbens-Leenes, P. W. and Nonhebel, S. (2002):** *Consumption patterns and their effects on land required for food*. Ecological Economics 42 (1-2): 185-199.
- Gerbens-Leenes, P. W., Nonhebel, S. and Ivens, W. P. M. F. (2002):** *A method to determine land requirements relating to food consumption patterns*. Agriculture, Ecosystems and Environment 90, 47-58.
- Goodland, R., (1997):** *Environmental sustainability in agriculture: diet matters*. Ecological Economics 23 (3), 189-200.
- Gossard, M. H. and York, R. (2003):** *Social Structural Influences on Meat Consumption*. Human Ecology Review 10 (1).
- Haley, M. M. (2001):** *Changing Consumer Demand for Meat: The U.S. Example 1970-2000*. in: Regmi, A. (edt.) (2001): *Changing Structure of Global Food Consumption and Trade*. USDA, Agriculture and Trade Report, WRS-01-1.
- Hayn, D., Empacher, C., und Halbes, S. (2005):** *Trend und Entwicklung von Ernährung im Alltag. Ergebnisse einer Literaturrecherche*. Thesis: Institut für sozialökologische Forschung (ISOE). Frankfurt am Main
- Institut für Ernährungswissenschaften (1998):** *Österreichische Ernährungsbericht 1998*. Wien: Institut für Ernährungswissenschaften.
- Irala-Estevez De, J., M Groth, Johansson, L., Oltersdorf, U., Prättälä, R. and Martinez-Gonzalez, M. A. (2000):** *Systematic review of socio-economic differences in food habits in Europe: consumption of fruit and vegetables*. European Journal of Clinical Nutrition (2000) 54, 706±714.
- Jager, W. (2000):** *Modelling consumer behaviour*. PhD thesis, University of Groningen.
- Kramer, K. J., Moll, H. C., Nonhebel, S., Wilting, H. C. (1998):** *Greenhouse gas emissions related to Dutch food consumption*. Energy Policy 27 (1999), 203-216.
- Lee, J.A. and Holden, S.J.S. (1999):** *Understanding the determinants of environmentally conscious behaviour*. Psychology and Marketing, 16(5), 373-392
- Leitzmann, C. (2003):** *Nutrition ecology: the contribution of vegetarian diets*. Am. J. Clinical Nutrition 78(3): 657S - 659.
- Mainieri, T., Barnett, e. G., Valdero, T.R., Unipan, J.B. and Oskamp, S. (1997):** *Green buying: The influence of environmental concern on consumer behaviour*. The Journal of Social Psychology
- National Statistics (2004):** *Family Food: A Report on the 2002–03 Expenditure and Food Survey*. A National Statistics Publication by Defra. London: TSO.
- Noorman, K. and Uiterkamp, T.S. (1998):** *Green households? Domestic Consumers, Environment and Sustainability*. Earthscan publication (Ltd.), UK
- Norwegian Ministry of the Environment (1994):** *Sustainable consumption symposium report*. Oslo.

- Norwegian Ministry of the Environment (1995):** *Ministerial roundtable on sustainable consumption report.* Oslo.
- OECD (2001):** *Household food consumption: trends, environmental impacts and policy responses.* Paris: OECD (ENV/EPOC/WPNEP(2001)13).
- Payer, H., Burger, P. and Lorek, S. (2000):** *Food Consumption in Austria: Driving Forces and Environmental Impacts.* National case study for the OECD Programme on Sustainable Consumption. Vienna: Federal Ministry of Agriculture, Forestry, Environment and Water Management.
- Pimentel, D. and Pimentel, M. (2003):** *Sustainability of meat-based and plant-based diets and the environment.* American Journal of Clinical Nutrition, 78: 660 - 663.
- Pollack, S. L. (2001):** *Consumer Demand for Fruit and Vegetables: The U.S. Example.* In: **Regmi, A (ed.) (2001):** *Changing Structure of Global Food Consumption and Trade.* USDA: Agriculture and Trade Report, WRS-01-1.
- Regmi, A (ed.) (2001):** *Changing Structure of Global Food Consumption and Trade.* USDA: Agriculture and Trade Report, WRS-01-1.
- Regmi, A., Deepack, M. S., Seale Jr., J. L., and Bernstein, J. (2001):** *Cross- Country Analysis of Food consumption Patterns.* In: **Regmi, A (ed.) (2001):** *Changing Structure of Global Food Consumption and Trade.* USDA: Agriculture and Trade Report, WRS-01-1.
- Robinson, R. and Smith, C. (2002):** *Psychosocial and Demographic Variables Associated with Consumer Intention to Purchase Sustainable Produced Foods as Defined by Midwest Food Alliance.* Journal of Nutrition Education and Behaviour, 34(6), 316-325
- Roos, G., Johansson, L., Kasmel, A., Klumbienä, J, and Prättälä, R. (2001):** *Disparities in vegetable and fruit consumption: European cases from the north to the south.* Public Health Nutrition: 4(1), 35±43
- Reijnders, L. and Soret, S. (2003):** *Quantification of the environmental impact of different dietary protein choices.* American Journal of Clinical Nutrition 78(3): 664S - 668.
- Statistik Austria (2001):** *Verbrauchsausgaben. Hauptergebnisse der Konsumerhebung 1999/2000.* Wien
- Stieß, E. and Hayn, D. (2005):** *Ernährungsstile im Alltag: Ergebnis einer repräsentativen Umfrage.* Diskussionspapier Nr. 5. Institut für sozialökologische Forschung. Frankfurt am Main.
- Tanner, C. and Kast, S.W., (2003):** *Promoting Sustainable Consumption: Determinants of Green Purchases by Swiss Consumers.* Psychology and Marketing, 20(10), 883-902.
- Trichopoulou, A., Naska, A. and Costacou, T. (2002):** *Disparities in food habits across Europe.* Proceedings of the Nutrition Society (2002), 61, 553–558.
- Vermeir, I., Verbeke, W. (2004):** *Sustainable food consumption: Exploring the consumers attitude-behaviour gap.* Thesis. Gent University, Faculty of Economics and Applied Economics, 14p.
- White, T. (2000):** *Diet and the distribution of environmental impact.* Ecological Economics 34 (234), 145-153