Soraj Hongladarom *Editor*

Food Security and Food Safety for the Twenty-first Century

Proceedings of APSAFE2013

Springer

Food Security and Food Safety for the Twenty-first Century

Soraj Hongladarom
Editor

Food Security and Food Safety for the Twenty-first Century

Proceedings of APSAFE2013

Springer

Editor
Soraj Hongladarom
Department of Philosophy and Center
for Ethics of Science and Technology
Chulalongkorn University
Bangkok, Thailand

ISBN 978-981-287-416-0 ISBN 978-981-287-417-7 (eBook)
DOI 10.1007/978-981-287-417-7

Library of Congress Control Number: 2015936193

Springer Singapore Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer Science+Business Media Singapore Pte Ltd. is part of Springer Science+Business Media (www.springer.com)

Preface

The following volume is a collection of some of the papers presented at the First International Conference of the Asia-Pacific Society for Agricultural and Food Ethics, or APSAFE2013, which was held at Chulalongkorn University from November 28 to 30, 2013. The Asia-Pacific Society is a sister organization of the European Society for Agricultural and Food Ethics (EurSAFE), which has held a series of conferences regularly for the past few decades. As food and agriculture obviously are among the most important parts of our lives no matter where we live, ethical considerations of food and agriculture are then very important, and the issue has gained worldwide interest not only as a newly emerging academic discipline but also as an important issue in the globalized world of today where food travels across nations and cultures at amazing speed. What you have here is a fruit of a long collaboration effort involving many nations spanning the globe, effort of scholars, scientists, and philosophers who are concerned about food and agriculture in their various dimensions. These scholars came from a large variety of disciplines, and they look at the central topic through a large array of disciplinary lenses. Moreover, those who joined forces for the conference were not only scholars but also included members of the agribusiness sector, who clearly have a stake in the global deliberation on food. We also had the participation of the Food and Agriculture Organization (FAO), a United Nations organization that focuses on food security worldwide.

The conference was jointly organized by the Center for Ethics of Science and Technology and the then Office of the Commission on Agricultural Resource Education (OCARE), which has just assumed a new name, School of Agricultural Resources (SAR). The SAR is a new organization at Chulalongkorn University that concentrates on providing education to Chula students on agricultural and related topics. The Office of the UNESCO in Bangkok is also providing close collaboration. Funding for the conference is partially supported by a research grant from the National Research Council of Thailand.

The idea of establishing the Asia-Pacific Society for Agricultural and Food Ethics originated at a meeting organized by the UNESCO in Bangkok in December 2011. The President and Vice-President of the European Society, Prof. Matthias Kaiser

and Prof. Kate Millar, were present at the meeting, together with Dr. Soraj Hongladarom, Director of the Center for Ethics of Science and Technology, Chulalongkorn University, Dr. Kriengkrai Satapornvanit from Kasetsart University, and Dr. Pakki Reddi from India, both of whom had been collaborating with Profs. Kaiser and Millar on a project funded by the European Union on ethics of food production. Dr. Darryl Macer, Regional Advisor for Science and Human Science in the Asia and the Pacific, UNESCO, Bangkok, was also present.

It was resolved during the meeting that the Asia-Pacific Society for Agricultural and Food Ethics be established in order to provide a forum of exchange of research findings and networking among scholars and scientists working on the ethical implications of food and agricultural production. Agricultural and food ethics is an interdisciplinary field consisting mainly of applied ethics, sociology, political science, economics, food science, environmental science, and others whose main concern is the relation between food and agriculture on the one hand, and the socio-economic and cultural milieux in which food and agriculture find themselves on the other. Among the questions investigated in this field are: Are genetically modified food a viable alternative as a source of food for the present century? What are the ethical considerations surrounding the practice of aquaculture, such as safety issues, global justice, threats to the environment, and so on? Surely these questions are very important in today's interconnected world and need to be studied very closely.

It is for this reason that the Asia-Pacific Society for Agricultural and Food Ethics has decided to organize its first international conference, and the Center for Ethics of Science and Technology, Faculty of Arts, Chulalongkorn University, was deeply honored to have been formally invited by both the APSAFE and the EurSAFE to organize the meeting in November 28–30, 2013. The congress will represent the first attempt by scholars and scientists in the Asian and the Pacific regions to get together to share thoughts, insights, and research findings and to create and deepen networking among scholars in Asia and elsewhere.

More than 80 scholars and scientists from more than 20 countries across the globe came to share their research findings at the conference. This is highly satisfactory for us organizers because usually the first conference of anything typically has problems attracting participants because people do not know of the organization or the association that organizes the event before and naturally it takes time to build up the level of trust that is required before scholars can decide to invest their time and effort into traveling across continents to participate. Despite the obstacles a strong number of participants showed up, and they made acquaintances and collaborative effort with one another once they got to meet. Out of the 80 or so papers presented, a total of 27 papers were selected as parts of these proceedings.

The main theme for the November 2013 conference was the balance between food security and food safety. As is well known, the two concepts do not naturally go along with each other well. Enhancing one could diminish concern of the other. As the highly publicized baby powder milk scandal in China (where the chemical substance melamine was found in the milk) shows, the rush toward profit motive can result in very serious health risks for the consumers, and food is certainly life and death issue, not counting, of course, the problem of malnutrition and famine.

In any case, it was thought that a balance needed to be found between food security and food safety. As food production has become mechanized and industrialized, increasing food supply in order to meet the demand of the growing population has to be balanced with the use of technology to ensure safety for the consumers. Hence, there is no other way to go except to realize that food safety and security have to go together and both are clearly indispensable.

The November conference divided the main theme into four issues, namely, ethical considerations pertaining to the production of food, ethical considerations pertaining to the distribution and trading of food, environmental aspects including sustainability and other contextual issues, and food policy and regulatory issues in Asia and beyond. For these proceedings the papers are divided into two broad categories, namely, ethical issues surrounding production of food and those surrounding food distribution. Amartya Sen has famously said that food shortage problem is not due to that there is not enough food, but lack of proper distribution of food. This may or may not be wholly true, but in any case it points to the need for further research into ethical considerations of both production and distribution of food. The papers discuss both production and distribution in a variety of ways that merit close study and at least serve as a source of references and a springboard for further research on the issue.

The conference received tremendous help from all the staff of the SAR, most importantly Prof. Dr. Annop Kunavongkrit, who was the Secretariat of the conference and was a key person in making the conference a reality. Without his untiring effort and his special connection in finding local sponsors, it is very doubtful that the conference could ever be held. Apart from Prof. Annop all other members of the School of Agricultural Resources joined hands in making the conference a success. These include Dr. Kiattisak Duangmal, Dr. Supawan Visetnoi, Dr. Pimpinan Somsong, and many others. Special thanks are owed to every member of the SAR here. Furthermore, the conference also received help from the Faculty of Veterinary Medicine and the Center for Peace Resolution and Conflict Studies, Chulalongkorn University.

It is expected that the APSAFE Conference will be held for the second time some time in 2015 or 2016. Thus, the momentum of pushing forward scholarly reflection and scientific studies of the social, cultural, and ethical forces around food and agriculture will certainly continue for the benefit of us all in this interlocking and globalized world.

Bangkok, Thailand Soraj Hongladarom

Contents

Part I
Keynote Paper

Chapter 1
Can Food Science Reduce World Hunger?

Ken Buckle

Abstract The world has seen bewildering changes in population, food production, preservation technologies, world food trade, food safety challenges, climate change and ethical issues during the past 200 years. UN predictions indicate that at the current rate of population increase, world population may reach 9B by 2050, yet suitable arable land will likely decrease and population drifts to cities will see over 6B people in urban areas. Demands on food production and food preservation will be huge. Currently we can feed a population of about 7B, but food and feed losses during production and postharvest storage and transportation are unacceptable. Nearly 1B people are chronically hungry, and food-borne illnesses have not disappeared despite increases in the understanding of microbial physiology and the factors contributing to food-borne illnesses. The global distribution of food, and an increased desire for more exotic and 'less preserved' foods, has kept food microbiologists and public health officials busier than expected with significant numbers of consumers still affected by both morbidity and mortality from food consumption. Consumers' knowledge about modern foods has not kept pace with such developments. There are major decisions ahead for the food, feed and health industries, as well as education institutions and political systems, to make appropriate decisions to tackle such difficult questions. Can science and technology advances, including GM food production and 'modern' food preservation and storage technologies, keep pace and make an impact on the global food supply and the obesity epidemic? Are we up to the challenge?

Keywords Food security • Food waste • Postharvest losses • Food preservation

K. Buckle (✉)
Food Science and Technology Group, School of Chemical Engineering,
The University of New South Wales, Sydney, NSW 2052, Australia
e-mail: k.buckle@unsw.edu.au

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_1

1.1 Introduction

We are all 'experts' on foods as we consume them several times a day. The advent of the Internet, home/portable computers and smart phones and related technologies has provided a huge amount of information at the fingertips of consumers, most of whom know very little about the science and technology of food production, processing, packaging and food-borne illness. Yet their views and perceptions about foods, whether right or wrong, can have significant impacts on politicians and the policies they develop and process through government institutions.

Food is constantly in the news, whether it is stories about food waste or malnutrition, developments in processing technologies or genetic modification, court cases concerning deaths or severe illness from food consumption or governments developing national food plans to combat obesity.

Ethical issues about food are not new. Organisations such as PETA and Greenpeace constantly draw attention to issues about humane animal use, or production/modification of foods, that have a place in community debate, provided that facts are presented without bias and preconceived perceptions.

Currently we can feed more than 7B people, although the distribution is such that we have more who are overweight and obese than are chronically undernourished. This imbalance is one of the major challenges in the decades to come. Science and technology must have a major role in that debate, and consumers need to be better educated about modern foods to make appropriate and informed choices.

1.2 Food Security

1.2.1 Millennium Development Goals

The UN Millennium Development Goals were based on the UN Millennium Declaration, signed by world leaders in September 2000. They commit the international community to combating poverty, hunger, disease, illiteracy, environmental degradation and discrimination against women. Each of the eight goals has specific targets and indicators, and Goal 1 (to eradicate extreme poverty and hunger) included the following targets: to halve, between 1990 and 2015, the proportion of people whose income is less than $1 a day and to halve, between 1990 and 2015, the proportion of people who suffer from hunger.

1.2.2 Current Food Security Situation

The UN Food and Agriculture Organization (FAO) has defined food security in the following terms: 'Food security exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences

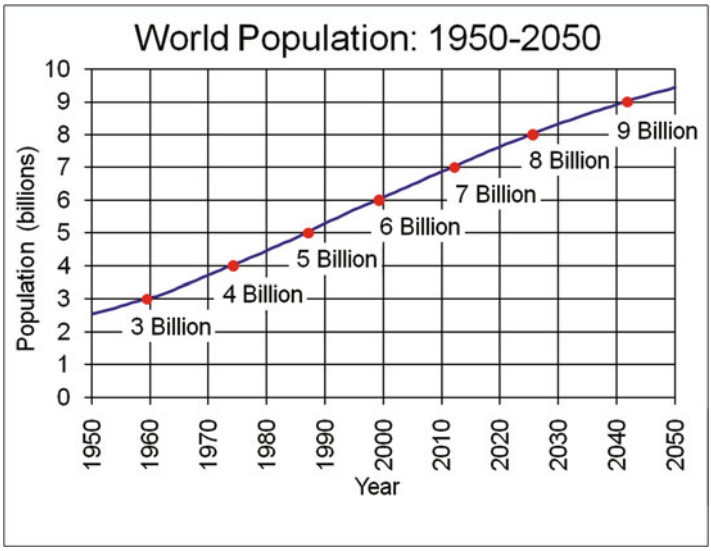

Fig. 1.1 World population growth 1950–2050 (Source: U.S. Census Bureau, International Data Base, June 2011 Update)

for an active and healthy life'. There is little doubt that for many people, food security is not available at all, or for extended periods, especially when crop failures occur as the result of catastrophic environmental conditions and/or when significant price hikes occur for basic food commodities.

World population has increased dramatically in the past 200 years, especially in the past 50 years (Fig. 1.1), with 7B reached in October 2011 and projections of 9B by 2050 and 10–11B by 2060. For the first time there are more people living in cities and urban areas than in rural areas. If 2011 fertility rates continue, the UN reported that by 2100 there would be a world population of 27B and significant population changes in Africa (1–3.6B), India (1.2–1.6B), China (1.3–940M), Nigeria (158–730M), Afghanistan (32–111M) and Australia (22–36M).

The global financial crisis of 2007–2009 resulted in significant increases in food prices, which soared again in the period 2010–2011. During the period January–March 2008, major food commodity prices were the highest for 30–50 years; the FAO Food Price Index increased from 6–9 % (2006) to 44–57 % (March 2007–March 2008), and grain reserves decreased from 115 days (1999–2000) to 53 days in 2007–2008. Rising food prices caused severe hardship, suffering and unrest and had significant social impacts with 100M moving deeper in poverty, there were riots in 23 countries, and governments restricted exports, decreased import tariffs and introduced price controls, consumer subsidies, food rationing and food stamps.

There is capacity to produce sufficient food for everyone in the world; nevertheless, in spite of the progress made over the past 20 years, about 870M people still suffer from chronic hunger, and among children, estimates are that over 170M under 5 years of age are chronically malnourished (stunted), over 100M are underweight,

Table 1.1 Number of undernourished (millions) in different regions

Region	1990–1992	2010–2012
Developed regions	20	16
Southern Asia	327	304
Sub-Saharan Africa	170	234
Eastern Asia	261	167
Southeastern Asia	134	65
Latin America and the Caribbean	65	49
Western Asia and Northern Africa	13	25
Caucasus and Central Asia	9	6
Oceania	1	1
Total	1,000	868

From FAO (2013a)

and 55M are acutely malnourished. Despite these grim statistics, the situation has improved over the past 22 years, especially in Southern, Eastern and Southeastern Asia (Table 1.1, FAO 2013a).

For developing countries as a whole, the prevalence of undernourishment has fallen from 32.2 to 14.9 % over the period 1990–2010, while the incidence of poverty has declined from 47.5 to 22.4 % and that of child mortality from 9.5 to 6.1 %. There are impressive gains, but over 12 % of the world's population is still chronically hungry, and there is still a long way from meeting Millennium Development Goal 1.

1.2.3 Can We Feed 9B by 2050?

In the next 50 years we will consume as much food as we have consumed for the past 500 years. While we can feed 7B people now, there is a lot of waste through spoilage and deterioration. Some countries such as Australia produce far more food (for ~60M people) than can be consumed by their inhabitants (~23M), but threats on the horizon include climate change and increased severity of natural disasters, mining threats to agricultural land and water and increased sales of agricultural land to offshore buyers.

But can we realistically feed 9B by 2050? Yes, but it will not be easy. Julian Cribb, in *The Coming Famine* (Cribb 2010), highlights many of the significant problems to be tackled in the decades ahead if this aim is to be achieved, including doubling the food produced using half the water (6B will live in moderate/severe water shortages by 2050) on far less land, which is degrading at about 1 %/year – the total city land area in 2050 at current predictions will be the size of China and contain >7B people; we must deal with the major problems of diminished oil and the need for additional energy sources, especially for peak loads, while phosphorus, an important component of fertilisers, is becoming scarce and much more expensive.

1.3 The Role of [Food] Science and Technology

Science and technology have made major impacts on developments in food preservation technologies over the past 300 years. The 1700s saw the beginnings of scientific agriculture and feed production. The industrial revolution of the 1800s saw the introduction of mechanisation of food processing and preservation to match increased urbanisation; the development of canning, freezing, chilling and specialised driers; the discovery of the microbiological basis of food spoilage and food and beverage fermentations and the discovery of vitamins and their role in human health. Developments in the 1900s, often the result of the impacts from major wars, saw further developments in drying, freezing, control of water activity (a_w), storage atmosphere, flexible packaging, food additives, irradiation and the introduction of 'novel' or nonthermal technologies to provide consumers with what they are seeking: foods that are high(er) in quality, are more 'natural' and less severely processed, contain fewer chemical preservatives and additives, are nutritionally healthier (less salt and sugar and saturated and *trans* fats and more fibre, calcium and phytochemicals) and are as safe or safer than traditionally preserved foods, which are not an easy task!

At the 12th World Congress of the International Union of Food Science and Technology (IUFoST) held in Chicago, USA, in 2003, Dr Ismail Serageldin, the IUFoST Distinguished Lecturer and at that time the Vice-President of the World Bank, outlined his seven-point answer to food insecurity:

- Increase food and feed production to increase productivity and sustainability
- Make greater use of technology, especially biotechnology and genetically modified (GM) foods
- Develop crops resistant to climate changes (e.g. increased drought and salt tolerance) and able to grow on more marginal soils
- Decrease postharvest and postslaughter losses
- Develop new-generation biofuels based on cellulosic grasses and wastes that will not compete for the same land, water and nutrients as traditional foods
- Agree to a fair international trading system to dampen price spikes
- Encourage public health campaigns to encourage healthy eating and reduce disease

These issues are still relevant and present challenges to all food technologists and those associated with food production, processing, distribution and to consumers.

1.3.1 Increase Productivity and Reduce Food Wastage

Some of the world's highest rates of population growth are predicted to occur in areas that are very dependent on agriculture (crops, livestock, forestry and fisheries) and where there are high rates of food insecurity; hence, growth in the agriculture

sector is one of the most effective means of achieving food security and hence reducing poverty. A key component of increasing agricultural productivity is to invest more funds in agricultural research and development that gave us the Green Revolution four or more decades ago. Increased yields, and crops able to grow on previously marginal soils, increase disposable income, providing greater access to food and education and social harmony.

Food wastage can vary enormously, from near zero to 100 % for different food commodities at particular times of the year, but can average 20–30 % or more for many key commodities. If wastage can be substantially reduced, we can feed hundreds of millions, if not billions, more people now. This is not easy but reductions can be made if there is the will by consumers, food producers and processors and governments.

A recent FAO report (FAO 2013b) is one of the first to analyse the impacts of global food wastage from an environmental perspective. Each year food that is produced but not eaten uses a volume of water equivalent to the annual flow of Russia's Volga River and contributes 3.3 Bt of greenhouse gases into the atmosphere, the third highest emitter after the USA and China. The environmental consequences (excluding fish and seafood) amount to about $750B annually (based on producer prices), equivalent to the GDP of Switzerland. Of the 6 Gt of total agricultural production, about 1.6 Gt of 'primary product equivalents' from 1.4 BHa of land are wasted, of which 1.3 Gt are edible parts of food. About 54 % of the world's wastage occurs upstream during production, postharvest handling and storage, while 46 % occurs downstream at the processing, distribution and consumption stages. Developing countries generally suffer more food losses during agricultural production, while food waste at the retail and consumer level tends to be higher in middle- and high-income regions (31–39 % of total wastage) than in low-income regions (4–16 %). The later a food product is lost along the agri-food chain, the greater the environmental consequences (FAO 2013b).

The report also highlights global environmental hotspots related to food wastage for consideration by decision-makers eager to reduce impacts, including: wastage of cereals in Asia, especially rice, due to the high carbon intensity of rice production methods (paddies are high emitters of methane) and rice wastage; wastage of meat which generates a substantial environmental impact due to land occupation and carbon footprint, especially in high-income areas; fruit wastage which is a hotspot for Asia, Latin America and Europe and vegetable wastage which is high in industrialised Asia, Europe and South and Southeastern Asia.

An FAO 'toolkit' (FAO 2013c) details three general levels where action is required: reduce food wastage overall, by better matching production to demand; when food surpluses are made, reuse within the human food chain through secondary markets or by donating food to vulnerable members of society, and only then use for livestock feed; and where reuse is not possible, recycling and recovery should be used via anaerobic digestion, composting or incineration with energy recovery.

While there is no Nobel Prize for food and agriculture, the World Food Prize (WFP) is regarded as its equivalent. Founded in 1986 by 1970 Nobel Peace Prize

Laureate Dr Norman Borlaug, the father of the 'Green Revolution' of the 1960s and 1970s in Mexico, Asia and Africa, the WFP is the foremost international award recognising the achievements of individuals who have advanced human development by improving the quality, quantity or availability of food in the world. The Prize recognises contributions in any field involved in the world food supply – food and agriculture science and technology, manufacturing, marketing, nutrition, economics, poverty alleviation, political leadership and the social sciences – and emphasises the importance of a nutritious and sustainable food supply for all people (WFP 2013). In a first for food science, the 2007 WFP was awarded to Dr Philip Nelson of Purdue University, for his group's pioneering work in developing bulk aseptic processing, storage and transportation technologies for fruit and vegetable products for ambient storage in containers ranging from 1 to 500 L flexible pouches up to 2–3 ML epoxy-coated steel tanks. We need more of this type of innovative, wide-reaching technology with global impact.

The 2013 Prize was jointly awarded to three scientists (Dr Marc van Montagu, Belgium, and Drs Mary-Dell Chilton and Robert Fraley, USA) for their independent, individual breakthrough achievements in founding, developing and applying modern agricultural biotechnology, making it possible for farmers to grow crops with improved yields, resistance to insects and disease and the ability to tolerate extreme variations in climate. The revolutionary biotechnology discoveries of these three individuals unlocked the key to plant cell transformation using recombinant DNA. Their work led to the development of a host of genetically enhanced crops, which, by 2012, were grown on more than 170 MHa around the globe by more than 17M farmers, over 90 % of whom were small resource-poor farmers in developing countries.

1.3.2 Develop Better Postharvest Technologies and Reduce Postharvest Losses

Despite advances in preservation and storage technologies, postharvest losses are still unacceptable. We need:

- Better preservation combinations to extend shelf life, maintain quality and prevent growth of food-borne disease and food-poisoning organisms, and especially simple but better traditional technologies adapted for the humid tropics.
- Minimal, low-cost, effective packaging.
- More novel, low-energy and nonthermal preservation technologies to supplement the high hydrostatic pressure and pulsed electric field preserved products currently in the market place.
- A campaign by scientists and those concerned about world hunger for a greater acceptance of GM foods, ingredients and technologies, crops that are higher yielding, more resistant to stress and pests, have better nutrient profiles and yield more functional and bioactive ingredients.
- Improved micronutrient fortification technologies with improved bioabsorption and bioactivity.

All require excellent R&D and targeted outcomes to get the biggest return for the minimum investment and, of course, the scientists and technologists, NGOs and governments that have the will and inspiration and money to make a difference.

The call to reduce postharvest losses of perishable crops is not new. The United Nations General Assembly in September 1975 held a special session focussed on world food challenges. Then US Secretary of State Henry Kissinger strongly recommended that FAO, in conjunction with the UN Development Program and the World Bank, set a goal for reducing losses, which was adopted by the General Assembly in the following words: 'The further reduction of postharvest food losses in developing countries should be undertaken as a matter of priority with a view to reaching at least a 50 % reduction by 1985. All countries and competent international organizations should co-operate financially and technically in the effort to achieve this objective' (Bourne 1977). Following this resolution a number of agencies expanded existing or initiated new programmes directed towards reducing losses in cereal grains, oilseeds and grain legumes. A 1978 report by the US National Academy of Sciences pointed out the need to consider losses other than the cereals, particularly roots and tubers, fruits and vegetables (NAS 1978). Since then other major reports (e.g. FAO 1981; Gustavsson et al. 2011) have shown that food losses are high (up to one third of food produced) but that there are still major gaps in the knowledge of where global food loss and waste occur.

The words of Marsh (2008) unfortunately are largely still true:

> Most efforts to reduce hunger concentrate on agricultural production. Food losses due to a variety of biological, chemical and physical forces are addressed much less frequently. Very encouraging work has been done at a country level, but with little international cooperation. An organised international postharvest effort could make the difference between meeting the Millennium Development Goal on hunger and falling short of that goal

Recently the Chicago Council on Global Affairs (2013) in an extensive report called for action to utilise the Millennium Challenge Corporation, the World Bank and regional development bank resources for rural infrastructure projects in developing countries *to "…*halve postharvest losses by 2023 *…."* Let us hope that more success is evident within the next decade than in the past.

1.3.3 Produce Healthier Foods and Beverages to Help Reduce Chronic Diseases and Poor Lifestyles

The food industry has made enormous strides in the past 100 years to help reduce food-borne disease, provide safe and wholesome foods at modest cost and provide a vast array of choices to enable a varied and satisfying diet. Nevertheless, the food industry can do more to help reduce dietary influences on chronic diseases such as cardiovascular and coronary heart disease, hypertension, diabetes, obesity, strokes and some cancers. It is not an easy task as even minor changes to a product's taste,

odour, flavour, texture or mouthfeel can lead to rejection or reduced sales in the market.

But changes are possible, as demonstrated by the 'Tick' scheme developed by the National Heart Foundation of Australia (NHF 2013), a not-for-profit charity that aims to reduce morbidity and mortality from heart attacks and related cardiovascular problems by encouraging healthier alternatives for families. The 'Tick' programme for over 20 years has encouraged the Australian food industry to modify products and processes to produce a range of healthier alternatives, containing less energy, sodium (salt) and saturated and *trans* fats and increased fibre, wholegrains, vegetables and calcium. The red 'Tick' on labels is permitted provided that the product(s) meet stringent compositional standards which are regularly checked. Manufacturers of products that fail to meet these criteria are encouraged to modify formulations and/or processes to meet the healthier standards. Since inception the 'Tick' programme has reduced fat and salt consumption by many tonnes, with considerable consumer benefits. Tick not only 'sign-posts' a healthier choice but also educates consumers about general nutrition via its communication initiatives in conjunction with the industry.

1.4 The Role of Education

Education is a key component in the fight against poverty, disease and hunger, and that is why government and nongovernment aid agencies place education as a top priority in the distribution of aid to the Third World. Australia's Agency for International Development (AusAID) claims that 'Education is essential to achieving the Millennium Development Goals and is an enabler of development' (AusAID 2013).

Australia is a lucky country with over 20 years of solid economic growth, and development aid has increased by about 50 % since 2006. The Australian Government has outlined a desire to provide 0.5 % of GDP for aid in the future, and it is important that this aid is targeted to achieve maximum and optimum outcomes. Australia's aid is targeted in the Asia Pacific region, and >$1.1B is proposed for education activities, the largest sector, in 2013–2014, with about two thirds on East Asia and the Pacific.

But in addition to child education, we need more trained food scientists, technologists and engineers and more investment in science and technology in the whole agri-food chain from production to consumption. We especially need consumers, and politicians, more educated about food issues, and the science and technology of food production, processing and storage. It is encouraging to see the huge expansion in food science and technology programmes in Thai universities in recent years.

1.5 Conclusions

Can [food] science and technology reduce world hunger? None of the answers to this challenge can be met by [food] science and technology alone, but it is equally clear that they cannot be met *without* knowledge and application of [food] science and technology. While some progress has been made since 1990, there is still a long way to go.

References

AusAID. (2013). *Education*. Australian Agency for International Development (AusAID). Available at: http://www.ausaid.gov.au/aidissues/education/Pages/home.aspx

Bourne, M. C. (1977). *Post-harvest food losses – The neglected dimension in increasing the world food supply*. Ithaca: Cornell University International Agriculture Mimeograph #53. ISBN 92-5-101028-5.

Chicago Council on Global Affairs. (2013). *Advancing global food security: The power of science, trade and business* (136 pp). Chicago: The Chicago Council on Global Affairs. Available at: http://www.thechicagocouncil.org/UserFiles/File/GlobalAgDevelopment/report/2013_Advancing_Global_Food_Security.pdf

Cribb, J. (2010). *The coming famine: The global food crisis and what we can do to avoid it* (264 pp). Melbourne: CSIRO Publishing. ISBN 9780643100404.

FAO. (1981). *Food loss prevention in perishable crops* (FAO Agricultural Services Bulletin No. 43). Rome: Food and Agriculture Organization of the United Nations.

FAO. (2013a). *FAO website*. Rome: Food and Agriculture Organization of the United Nations. http://www.fao.org

FAO. (2013b). *Food wastage footprint: Impacts on natural resources* (63 pp). Rome: Food and Agriculture Organization of the United Nations. ISBN 978-92-5-107752-8.

FAO. (2013c). *Toolkit: Reducing the food wastage footprint* (119 pp). Rome: Food and Agriculture Organization of the United Nations. ISBN 978-92-5-107741-2

Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., & Meybeck, A. (2011). *Global food losses and food waste: Extent, causes and prevention* (38 pp). Rome: Food and Agricultural Organization of the United Nations.

Marsh, K. S. (2008). A call to action on world hunger. *Food Technology, 62*(3), 128.

NAS. (1978). *Postharvest food losses in developing countries* (207 pp). Washington, DC: Board on Science and Technology for International Development, National Research Council, US National Academy of Sciences.

NHF. (2013). *Heart Foundation tick*. National Heart Foundation of Australia. Available at: http://www.heartfoundation.org.au/healthy-eating/heart-foundation-tick/Pages/default.aspx

WFP. (2013). *The World Food Prize*. Available at: http://www.worldfoodprize.org

Part II
Production and Consumption

Chapter 2
No Food Security Without Food Sovereignty

Hans van Willenswaard

Abstract While efforts are made to forge a balance between food security and food safety, due attention should be given to food sovereignty in the first place. Without attributing a central position to the values implied in food sovereignty, a balance between food security and food safety would result in policy development based on a false conceptual compromise which would not adequately address the challenges of the twenty-first century.

Keywords Food security • Sovereignty • Buddhist economics

2.1 Introduction

The major question explored in this paper is how a policy development framework for Asia and the Pacific can be conceived that would pave the way for empowerment of emerging independent small-scale farmers' networks that adhere to food sovereignty, in order to enable these networks to match the enormous influence that the mainstream business sector and nation-states exert on agriculture and food distribution policies. The paper argues that without this threefold 'balance of power', full food security and full food safety cannot be achieved.

As the quest for such a policy development framework is undertaken in the context of the Asia-Pacific region, and the paper is written from a Thai perspective, a contemporary view on the ethical construct of 'Buddhist economics' will be elaborated, within the limitations of initial explorations undertaken by the School for Wellbeing Studies and Research. The School for Wellbeing was established as a small-scale independent think tank and action-research platform in 2009 by three organisations: Chulalongkorn University and the Sathirakoses-Nagapradipa Foundation, both based in Thailand, and the Centre for Bhutan Studies, Thimphu, Bhutan.

H. van Willenswaard (✉)
School for Wellbeing Studies and Research, Suan Nguen Mee Ma Social Enterprise, 77, 79 Fuang Nakorn Road, Bangkok 10200, Thailand
e-mail: hans@schoolforwellbeing.org

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_2

2.2 Organisation Development in Thai Context: Green Market Network

The Sathirakoses-Nagapradipa Foundation (SNF) was established by Thai social activist and critic Sulak Sivaraksa in 1968. From the SNF foundation a cluster of independent organisations emerged: the Spirit in Education Movement (SEM), Ashram Wongsanit, the International Network of Engaged Buddhists (INEB) as well as a social enterprise named Suan Nguen Mee Ma in 2001. The social enterprise was an initiative that resulted from the *Alternatives to Consumerism* international conference and festival convened by Sulak Sivaraksa in Buddhamonthon – the centre of Thai Buddhism – near Bangkok, 1997, shortly after he received the Right Livelihood Award. One of the activities of the Suan Nguen Mee Ma social enterprise is the *Green Market Network*. The social enterprise also takes care of the secretariat of the School for Wellbeing.

The *Green Market Network* facilitates intensive networking between producers of organic food, responsible traders and ethical consumers, including 'green hospitals'. It supports consumer awareness with campaigns, training, publications and media relations.

> The paradigm shift that pro-organic advocates seek to promote is that organic products are not in fact too expensive, but that conventional food is too cheap because of 'externalities' and hidden government subsidies that enable non-organic food to be sold at lower prices. (van Willenswaard; in: Pierre Jacquet Ed., 2012)

The *Green Market Network* advocates that social return on preventive-health investments in organic food-producing rural and peri-urban communities, by means of guaranteed purchase by 'green hospitals' that also benefit from the healthy food supply for patients in the curative context, would be considerable. The savings by cost reduction on environmental degradation, deterioration of public health due to the hazards of industrial food production as well as often contaminated, low-quality, industrial food for consumption – and including mental health caused by lack of social cohesion and by work-related stress due to excessive urbanisation – would liberate resources to support '*organic food for all*' (poster presentation, IUHPE conference *Best Investments for Health*, Pattaya 2013). This would address in a largely uncharted way the growing incidence of non-communicable – or food- and lifestyle-related – diseases (WHO 2013).

In 2010 Vandana Shiva, ecological activist and advisor of the School for Wellbeing, advocated that the work pioneered by the *Green Market Network* should be upscaled to an international level. Her advice resulted in the *Towards Organic Asia* (TOA) programme administered by the School for Wellbeing. The TOA programme initiated the Young Organic Farmers' (YOF) movement in the Mekong region + Bhutan, initiated an action research and organised the international forum on *Innovating Alternative Markets* with Asia- and Pacific-wide participation (School for Wellbeing Report 2013).

2.3 Food Security, Food Safety and Food Sovereignty

Food security, as defined by FAO, 'exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life' (World Food Summit 1996).

Food safety encompasses actions aimed at ensuring that all food is as safe as possible. Food safety policies and actions need to cover the entire food chain, from production to consumption, according to the WHO. Contradictions between the aims of security and safety occur within the conceptual framework of food security.

During the World Summit on Food Security, November 2009, organised by FAO, the High-Level Expert Forum on How to Feed the World in 2050 was established. It concluded:

> (And) while agriculture will be forced to compete for land and water with sprawling urban settlements, it will also be required to serve on other major fronts: adapting to and contributing to the mitigation of climate change, helping preserve natural habitats, protecting endangered species and maintaining a high level of biodiversity. As though this were not challenging enough, in most regions fewer people will be living in rural areas and even fewer will be farmers. They will need new technologies to grow more from less land, with fewer hands.

Food security seems to be defined here in a context of an unchallenged sociopolitical system (continued economic growth defined by GDP, overall inequality), emphasis on 'resources' rather than on the farmers' population, prices determined by uncontrolled market mechanisms, irreversible rural-urban migration, unspecified technology needed for increase of production (not excluding genetic engineering, owned and protected by big corporations and the hidden agenda in the statement), in order to match unlimited consumption including biofuel and industrial use and a resulting research agenda prioritised by these policy assumptions.

The concept of *food sovereignty* has been formulated in the Nyéléni Declaration (Mali 2007):

> Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems. It puts the aspirations and needs of those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations. It defends the interests and inclusion of the next generation. It offers a strategy to resist and dismantle the current corporate trade and food regime, and directions for food, farming, pastoral and fisheries systems determined by local producers and users. Food sovereignty prioritizes local and national economies and markets and empowers peasant and family farmer-driven agriculture, artisanal – fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability. Food sovereignty promotes transparent trade that guarantees just incomes to all peoples as well as the rights of consumers to control their food and nutrition. It ensures that the rights to use and manage lands, territories, waters, seeds, livestock and biodiversity are in the hands of those of us who produce food. Food sovereignty

> implies new social relations free of oppression and inequality between men and women, peoples, racial groups, social and economic classes and generations.

Food sovereignty is guaranteed if producers have unobstructed access to their rights, including land rights; they can work together at human-to-human level and primarily at local and national scale: among producers' communities and with participating consumers in a context of intergenerational responsibility. Technology is appropriate and is generated among the producers with access to research facilities and fair influence on the research agenda. 'Food sovereignty' drives a global movement of small-scale farmers.

2.4 The Organic Agriculture Movement and La Via Campesina

Is it possible to integrate food security, food safety and food sovereignty in one policy framework? To a high extent that is what the *organic movement* stands for. Drawing on centuries of tradition and contemporary innovation, it formally manifested itself as the *International Federation of Organic Agriculture Movements* (IFOAM), established in Versailles, France, in 1972. After a 'romantic' pioneering stage, IFOAM gained recognition as a worldwide organisation guarding organic standards and regulating certification practices. The global market for organic food was estimated in 2012 at 44.5 billion euros (Organic agriculture worldwide. FiBL 2012).

The total organic area in *Asia* is nearly 2.9 million hectares. This constitutes 9 % of the world's organic agricultural land. Two hundred thirty thousand producers were reported. The leading countries are China (1.6 million hectares) and India (1 million hectares). *Oceania*/*Pacific* includes Australia, New Zealand and island states. Altogether, there are 7,222 producers, managing almost 12.1 million hectares. This constitutes 2.6 % of the agricultural land in the area and 38 % of the world's organic land (Organic agriculture worldwide. FiBL 2012). Asia, apparently, is characterised by small holders while the average farm size in Australia and New Zealand is much bigger.

Interestingly, in the last decade IFOAM moved from a primarily regulatory ('third-party' certification) towards a more value-driven global network. The growing application of Participatory Guarantee Systems (PGS) is based on self-organisation, often including producers and consumers alike, matching the needs of small-scale farmers (School for Wellbeing, TOA *Innovating Alternative Markets* Report 2013).

The four basic principles of IFOAM are:

- Health
- Ecology
- Fairness
- Care

Although food sovereignty became also a major concern of IFOAM and had been from the beginning, the need for economic viability in an alien economic landscape forced much of the organic movement into mainstream business models that sometimes contradict its principles. Therefore, the birth of La Via Campesina, 'the International Peasant's Movement', in 1993 was a welcome addition to self-organised institution building. More than IFOAM, La Via Campesina took an activist position, including a strong profile during the series of World Social Forum gatherings which started in Porto Alegre, Brazil, in 2001.

Twenty years after its establishment, recognition of La Via Campesina followed:

> Today, during a meeting between La Via Campesina and FAO's Director general Jose Graziano da Silva an agreement of cooperation was formalized which acknowledged the essential role played by small holder food producers. Their role was recognised as most important in the eradication of world hunger. The cooperation will focus on various key areas: strengthening peasant based agro-ecological food production, protecting small holders' rights to access land and water, as well as improving farmers rights over seeds in accordance with international and national seed laws. This cooperation's framework will lay special emphasis on the key role played by youth and women in food production as well as the need to improve their access to land and other productive resources. (FAO, Rome, 4 October 2013)

2.5 A Policy Development Framework Inspired by Gross National Happiness

A policy framework for sustainable development, with agriculture at its heart, cannot only be constructed by values and value systems. *Food ethics* require that relations between values regarding food production and consumption, and social structures must be clarified in order to operationalise improvement. This is why Helena Norberg-Hodge, author of *Bringing the Food Economy Home* (Norberg Hodge 2002), promotes localization:

> Localizing turns out to be fundamentally in the opposite direction to what the governments are currently promoting, which is the globalization. The latter has certain systemic characteristics. First of all, it is about separating producers and consumers and separating investors from what they invest in. That is already very dangerous. The investor over here doesn't even have any idea about how the money is affecting over here. That alone means structurally that you can't have a good ethical practice.
>
> Shortening the distances, so that you see the impact of what you do, both as a producer and as a consumer, and you know what has happened and what you are. Then you can be more ethical. What also happens in the shorter distances, is that businesses become more visible and accountable to society. And what starts to happen is that culture and ecological value can shape business, rather than businesses do now, shaping culture and ecology and shaping government. (Interview with Helena Norberg-Hodge, ISHES)

In the interview Helena Norberg-Hodge not only refers to the challenges of the tension between localization and globalisation. She distinguishes business, culture,

government and ecology as four interacting societal systems, competing for influence.

Here we may turn to the 'four pillars' underpinning Gross National Happiness, a leading philosophy brought about in Bhutan. Gross National Happiness (GNH) was coined by the King of Bhutan in 1974 and later included in the first constitution of Bhutan, 2008. It was shaped as a monitoring instrument for government policies. Communication on GNH with the world beyond Bhutan was supported by a series of international conferences ('GNH3' was organised in Thailand in 2007 and resulted later in for the *School for Wellbeing initiative*). This resulted ultimately in an academic and policymaker's dialogue in the framework of the United Nations on 'Wellbeing and Happiness: Defining a New Economic Paradigm' (Royal Government of Bhutan, http://www.2apr.gov.bt/).

The four pillars of GNH are (paraphrased):

1. Cultural integrity
2. Good governance
3. Equitable economic development
4. Environmental preservation

2.6 Threefold Development in Historic and Contemporary Perspectives

The four pillars of GNH have been compared (while observing due respect) with, at one hand, the Three Jewels of Buddhism (Buddha, Dhamma and Sangha) and at the other hand with the values of the French Revolution: freedom, equality and fraternity. Both have to be understood, from a twenty-first century perspective, within the all-encompassing challenge to actively care for nature (van Willenswaard, *Critical Holism* 2008). A justification for a search for resonance between these two foundations for a contemporary ethical framework can be found in the works of Dr. Ambedkar (1891–1956), who drafted the constitution of independent India, adopted in 1949. Dr. Ambedkar however makes clear that it was not the French Revolution that influenced him, but he recognised Buddhist insights in the core values freedom, equality and fraternity:

> Let no one however say that I have borrowed my philosophy from the French Revolution. I have not. I have derived them from the teachings of my master, the Buddha. I found that his teaching was democratic to the core. (Quoted in: Lionel WIJESIRI *BUDDHA DHAMMA*: *Liberty*, *equality*, *fraternity and Buddhism*)

More recently the principle of a threefold dynamics of values has been made understood by Philippine philosopher and activist Nicanor Perlas as a new balance of power between the state, the business sector and the civil society (Perlas 2000. And: School for Wellbeing Report, International Exchange Platform on *Re-thinking*

Property. Pathway to a Wellbeing Society scenario? at Chulalongkorn University, Bangkok (2011).

The combined perspectives offered by Buddhist philosophy, the values of the French Revolution, the four pillars of Gross National Happiness and the 'trisector' foundation of a 'wellbeing society' are explored here tentatively as a possible contribution towards an ethical framework enabling to match the challenge to guaranteeing 'organic food for all' in the twenty-first century in the Asia-Pacific.

2.7 The Wellbeing Society: Modes of Happiness and Property Regimes

Preliminary analysis in a research-development project of the School for Wellbeing Studies resulted in perceiving a distinction between three dimensions of happiness. Economic theory and practice are almost entirely based on happiness as *satisfaction* of needs, or 'utility' (Amartya Sen, *The Idea of Justice* 2009), while 'contentment' and 'happiness for transformation' remain largely unaddressed by economic dynamics. Directing economic activity towards the latter two dimensions of happiness: *contentment* and *altruism* – without neglecting the challenge to satisfy basic needs – would result in higher levels of happiness and wellbeing and lower levels of exploitation of human and natural resources than an economy driven by often artificially created surplus needs.

The School for Wellbeing Studies and Research also explored whether these three dimensions of happiness resonate with particular property regimes: is happiness as satisfaction corresponding with a preference for private property regimes? Are *contentment* and detachment from outer conditions, with collective or state ownership? And can one say that *happiness as fulfilment of meaning*, altruism (Matthieu Ricard *Happiness. A Guide to Developing Life's Most Important Skill* 2006), corresponds with a preference for common property? (Figs. 2.1 and 2.2).

The neoliberal worldview promotes a private property regime favouring not only individuals but also corporations which are attributed the same rights as 'free' individuals (Bakan 2003). While in communist or socialist worldviews, public property (ownership by the state) is placed central to uphold its model of a government-driven 'welfare state'. Global movements towards an alternative development path, in contrast to both regimes, promote increased recognition of the centrality of *common property*. A key presentation during the Bangkok *Re-thinking Property* exchange platform was made by Silke Helfrich of the *Commons Strategy Group*, a global network of 'commons' activists. She referred extensively to Elinor Ostrom, political economist, USA, and recipient of the 2009 Nobel Prize in Economic Sciences (Ostrom 2006).

The aim of this exploration of *resonance* between various levels of human behaviour, governance structures and policy development determinants is to uncover the deeper ethical principles and intrinsic logic of possible future scenarios and to

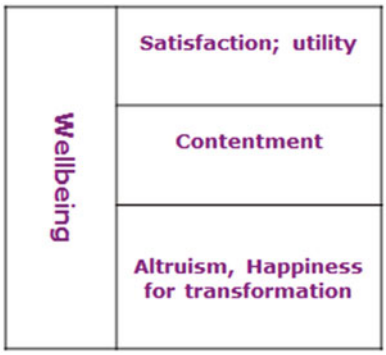

Fig. 2.1 Three basic dimensions of happiness, together constituting wellbeing

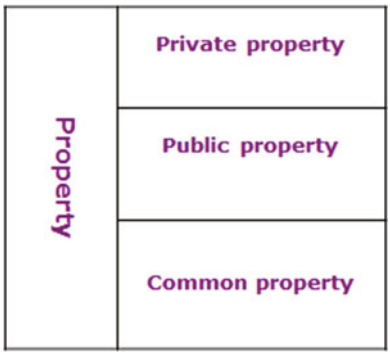

Fig. 2.2 Three basic property regimes

provoke articulating choices that can be made in public policy development in the Asia-Pacific.

2.8 An Alternative to Scenarios Driven by Economic Growth

None of the three property regimes can stand alone. However, in the present world economy, private property and public property regimes have merged into a *false compromise*: one interlocked system of 'state capitalism' (China) and 'capitalism supported by the co-opted state' (USA), which dominates the world. The system largely denies space for emerging civil society networks based on common property principles. Historically this space was prominent and well protected in traditional societies. An integrated approach to food security, food safety and food sovereignty requires that this space, enabling a civil society-driven economy, should be reclaimed and recreated, in order – not to replace them but – to keep private property and public property regimes in check: pushing them back within the boundaries of where they are meaningful and supporting sustainable development, poverty eradication and wellbeing of the planet. This could include a revival of the cooperative movement, detached from mainstream state-controlled or for-profit business models and

guided by community values, as signalled by Joel Magnuson in his book *Mindful Economics. How the US Economy Works*, *Why It Matters*, *and How It Could Be Different* – a timely message applicable to the Asia-Pacific.

To this end, the innovation of a civil society-driven 'wellbeing society' scenario would contribute to envisioning and realising an alternative development path. The effort would be similar to but different from attempts at various stages of modern history to formulating a 'third way' between state socialism and market fundamentalism. Most recently the 'third-way' approach was adopted by Tony Blair and Bill Clinton, advised by sociologist Anthony Giddens (1998, 2000). This attempt led to a takeover by neoliberal policies.

Earlier Thich Nhat Hanh searched for a 'middle way' between capitalism and communism (Ken Jones, INEB website).

Living models of welfare states that exemplify an intermediate 'social market economy' are the Scandinavian countries, Germany and the Netherlands. However, from sustainable development perspective and since the crisis of 2008, the social market economy model is also under pressure. In the USA the conflict of interests between social security promotion and the protection of wealth has sharpened dramatically around the ongoing credit-ceiling negotiations.

It is generally agreed that the Scandinavian model is not directly achievable in developing economies, including Thailand. However, the Asian Development Bank urges Asian countries to invest their financial reserves in social safety nets (Rhee 2011). The investments could target small-scale farmers' civil society networks. Providing social security beyond populism, and beyond income-focused poverty eradication drives that do not address systemic change, is extremely urgent in developing countries.

A possible uncharted impulse for this search for a *new* 'third way' would be the recognition of a change in paradigm from perceiving happiness as a *result* of economic growth to understanding and realising happiness as *a source*, a transformational force towards genuine progress: from satisfaction of needs to recognising happiness as 'cultural venture capital' creating altruism and the constitution of a meaningful society, within the boundaries of *sustainable development*. In this path common property would be the central mode of ownership, resonating with the 'altruistic' dimension of happiness. This is the quest for a *wellbeing society* scenario (School for Wellbeing Report 2012).

'Balance' in this context is understood as a dynamic process of 'threefolding' or 'trisector cooperation' engaging the market, the state and the civil society as equal partners in continuous negotiations: a process of consensus building leading to united care for the environment.

In summary: it makes well-founded sense to distinguish three scenarios – the state-driven, the business-driven and the civil society-driven society (Fig. 2.3).

In terms of ideology and economic theory, the three are connected with socialism, neoliberalism and the 'new' third way. Each approach has its own pathway to constructing social security: respectively, the welfare state, security by wealth and security by engagement with community.

Fig. 2.3 Towards a new third way

Further action research, including multi-stakeholder dialogue, is needed: evidence-based foresight can be generated to support the design of scenarios for the future. Public dialogue can articulate 'choices for life', as Nicanor Perlas stipulated, to be made.

In the field of agriculture, the three scenarios can be worked out in this line:

1. Public property and state farming is typical for the state-driven scenario. Natural resources including seeds and land are state owned; or producers are dependent on state subsidies.
2. Corporations develop and protect, through intellectual property legislation, their laboratory-developed seeds in combination with patented chemicals: typical for the business-driven private property scenario.
3. In the civil society scenario, common property ethics tend to become central. 'Networks of networks' of small-scale farmers improve production by mutual exchanges (Fig. 2.4).

More reflection is needed on the questions on what influence property regimes exercise on economic, social and cultural systems and vice versa and how this relates to *food ethics*.

An important challenge for the emerging *happiness economics* partnership, in which the School for Wellbeing plays a modest co-creating role, is to build an 'activist-academia bridge' and to support training for consensus-building leadership between sectors and between the diversity of stakeholder and actor groups; between urban consumer initiatives, social entrepreneurs creating mindful markets, and rural producers (urban-rural divide); between generations (youth and wisdom teachers); and between the diversity of bodies of research and their interest groups (including dialogues between different points of view regarding genetic manipulation). However, dialogue will only be fruitful if stakeholders are provided with equal opportunities to gather evidence by research.

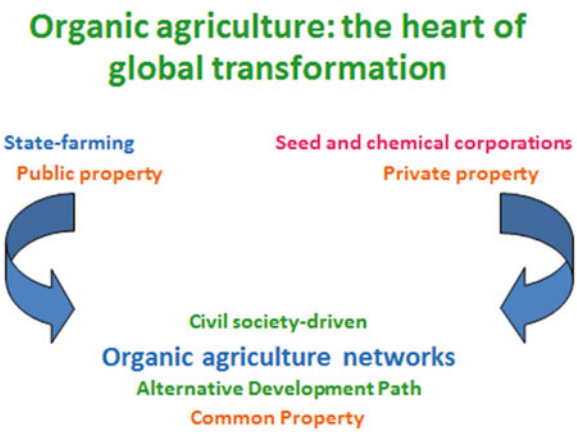

Fig. 2.4 Organic agriculture

2.9 The Joseph E. Stiglitz Analysis of the 2008 Crisis: Urban-Rural Divide in the 1930s

Nobel laureate Joseph Stiglitz, who spoke in Bangkok at the invitation of the School for Wellbeing, observed that migration of farmers and rural workers to the cities ultimately led to the Great Depression in the USA:

> At the beginning of the Depression, more than a fifth of all Americans worked on farms. Between 1929 and 1932, these people saw their incomes cut by somewhere between one-third and two-thirds, compounding problems that farmers had faced for years. Agriculture had been a victim of its own success. In 1900, it took a large portion of the U.S. population to produce enough food for the country as a whole. Then came a revolution in agriculture that would gain pace throughout the century – better seeds, better fertilizer, better farming practices, along with widespread mechanization. Today, 2 percent of Americans produce more food than we can consume. (Stiglitz 2012)

From the mainstream economics point of view, this reduction of manpower is seen as an enormous achievement towards efficiency. Industrial employment in cities is experienced as of higher standard than rural employment. This will remain so if policymakers do not make significant efforts to upgrade rural quality of life to prevent migration to the cities.

Higher productivity supported by government-corporate stimuli and based on a modern scientific/industrial paradigm leads on the long term to a fundamental disconnection between rural producers and urban consumers with unexpected side effects.

> **For the first time in human history**, **the number of overweight people rivals the number of underweight people**.… While the world's underfed population has declined slightly since 1980 to 1.1 billion, the number of overweight people has surged to 1.1 billion.
>
> … the population of overweight people has expanded rapidly in recent decades, more than offsetting the health gains from the modest decline in hunger. In the United States, 55 percent of adults are overweight by international standards. A whopping 23 percent of American adults are considered obese. And the trend is spreading to children as well, with

> one in five American kids now classified as overweight.… [O]besity cost the United States 12 percent of the national health care budget in the late 1990s, $118 billion, more than double the $47 billion attributable to smoking. (Global Issues 2010)

The shift from a rural economy to an urban manufacturing economy ultimately led to the collapse of the banks.

> What this transition meant, however, is that jobs and livelihoods on the farm were being destroyed. Because of accelerating productivity, output was increasing faster than demand, and prices fell sharply. It was this, more than anything else, that led to rapidly declining incomes. Farmers then (like workers now) borrowed heavily to sustain living standards and production.
>
> The underlying cause was a structural change in the real economy: the widespread decline in agricultural prices and incomes, caused by what is ordinarily a 'good thing' – greater productivity.
>
> The trauma we're experiencing right now resembles the trauma we experienced 80 years ago, during the Great Depression, and it has been brought on by an analogous set of circumstances. Then, as now, we faced a breakdown of the banking system. But then, as now, the breakdown of the banking system was in part a consequence of deeper problems. Even if we correctly respond to the trauma – the failures of the financial sector – it will take a decade or more to achieve full recovery.
>
> (…) the inability of the monetary expansion to counteract this current recession should forever lay to rest the idea that monetary policy was the prime culprit in the 1930s. The problem today, as it was then, is something else. The problem today is the so-called real economy. It's a problem rooted in the kinds of jobs we have, the kind we need, and the kind we're losing, and rooted as well in the kind of workers we want and the kind we don't know what to do with.
>
> The parallels between the story of the origin of the Great Depression and that of our (present) Long Slump are strong. Back then we were moving from agriculture to manufacturing. Today we are moving from manufacturing to a service economy. (Stiglitz 2012)

In Stiglitz's analysis there is 'no way back to manufacturing'. And significant investment in agriculture is even considered as a lesser contribution to healing the economy. There only seems to be a way forward: stimulus and investment towards a new era of a hard-selling service economy.

2.10 From Linear 'Development' to Cyclical Complexity

Whether such a linear development scenario, largely ignoring *agriculture as a possible area of wellbeing creation* (health, jobs, volunteerism, education, landscapes, ecovillages), would prove its benefits for the USA and economic recovery will have to be awaited. For developing countries it definitely should not be the major direction of investment. According to the chapter of the *UNEP Green Economy Report* on *Greening Agriculture* (edited by Hans Herren who received the Right Livelihood Award 2013):

> Agriculture (…) has tremendous potential to alleviate poverty. A large proportion of the rural population and labour force in developing countries is employed in agriculture. On

average, the contribution of agriculture to raising the incomes of the poorest is estimated to be at least 2.5 times higher than that of non-agriculture sectors in developing countries.

The World Bank (2010) reported that an increase in overall GDP derived from agricultural labour productivity was, on average, 2.9 times more effective in raising the incomes of the poorest quintile in developing countries than an equivalent increase in GDP derived from nonagricultural labour productivity (The Green Economy Report, UNEP 2011).

Increase in productivity driven by a reductionist, mechanistic, industrial paradigm may lead to the same effects induced by the agribusiness productivity boost in the USA of the 1930s that resulted from the Great Depression. Development experts often are not aware that their policy development theories are deeply biased by the expectation that developing countries will follow the same Western pattern of *inevitable rural dehumanisation*. This bias risks to becoming a self-fulfilling prophecy indeed.

By contrast, 'holistic' productivity growth should include: human-scale rural and permanent education, intelligent application of organic agriculture practices, decentralised and participatory research facilities, propagation of local seeds and biodiversity, community-supported public health services, care for the environment and landscapes (rewarded as paid environmental services) and ecovillage development combined with cross-cultural exchanges strengthening community resilience. Food security (quantity and quality) for urban consumers and development services towards 'greening' urban centres will result. Rural-wisdom-based social enterprises and rural-urban cooperatives will drive the economic trend.

As far as the concept 'organic agriculture' is being perceived to be too narrow to host this social-innovation movement, *agro-ecology* may be appreciated as a more suitable concept (Altieri 1995).

The linear trend of development inherent in the Stiglitz recommendation is prominent in modern thinking: there are only two desired directions of development: growth ('up') and moving forwards. Critical comments on reductionist growth scenarios easily lead to the reaction: does one want 'go back to Stone Age'? Does one reject science and technology? Does one want to move around in a circle without making progress?

Contemporary *cyclical development* combines *extreme complexity* (Peter Hershock, paper presented at Chulaongkorn University) with *extreme simplicity* of the circle.

Developed or industrialised countries, trying to overcome the present multiple crisis, discover 'developing countries' and 'new poverty' within their own boundaries. And developing countries are now largely governed from urban-industrial centres of power and guided by a seemingly inevitable techno-modernization bias: sucking rural masses to big cities and industrialising agriculture in order to make 'production more efficient'.

The new *service economy* can only be successful if it picks up the values, wisdom, human-scale economy and social resilience characteristic for organic rural communities of *agro-ecology* as a way of life. The service economy will be only

successful when it will be based not on a hard-selling urban-industrial growth paradigm where finance industry-driven service substitutes manufacturing, resulting in accumulation of wealth for the rich '1 %' (leaving 'We the 99 % behind'), but on a healthy agricultural foundation, on equitable socioeconomic development. Ill effects of the industrialization and corporatisation of the rural sector should be addressed at their causes: an unsustainable economic paradigm with maximising satisfaction of utility guiding its ethical orientation, instead of care, altruism and *genuine* service.

This is not 'going back' to the near-feudal rural culture of the 1920s or to the primitive 'jungle' as disregarded by Aristotle but going forwards to a transformed rural civilization which fully appreciates technology as long as it is sustainable and respects the integrity of nature. This is also no longer the 'forest' idealised by Tagore but a culture which integrates natural wisdom and modern science within an ethical framework typical for the wellbeing society. In this scenario not only agriculture but the development of meaningful ICT is crucial: connecting people and empowering their service-mindedness as well as strengthening their participatory role in democratic governance.

According to the UNEP *Green Economy Report* chapter on Agriculture, 87 % of small farms – defined as less than 2 ha – are based in Asia; in Africa they provide nearly all food production:

> These small farmers in the developing world produce the majority of staple crops needed to feed the planet's population (Altieri 2008). Their highest share is in Africa where about 90 per cent of all agricultural production is estimated to be derived from small farms, (Spencer 2002). In many instances their contribution is growing at the national level. While the issue is contested, there is substantial evidence that smaller farms have higher yields than large farms. (Green Economy Report, UNEP 2011)

In the agro-ecology approach, and the wellbeing society scenario, productivity will be increased by building 'networks of networks' of small farmers, who are connected by means of fair trade pacts with networks of networks of small-scale urban consumers' associations and medium-sized institutional consumers like hospitals, schools, offices, etc. *Social entrepreneurship* and *meaningful ICT* will be essential to make this cyclical complexity of agro-ecology interconnections work.

The scenario contrasting with this vision, representing mainstream development, is that small farmers will be bought out and their small holdings transformed into big plantations run by mega corporations who control the complete supply chain, including land ownership, seeds, fertilisers, wholesale and retail, supported by direct and indirect government subsidies. See the so-called *New Vision for Agriculture* a 'near-cartel' of chemical fertiliser, pesticide and seed companies, wholesale and retail giants established within the World Economic Forum and partnering with international agencies.

2.11 Buddhist Economics

In 1952, U Nu, Prime Minister of Burma, organised the Pyidawtha ('Happy Land') conference and the *Pyidawtha Plan* was published in 1954. It was in this framework of hoped-for construction of an independent, democratic Burma that E.F. Schumacher (1911–1977) was hired, in 1955, to advise the government of Burma as a UN consultant. The essay in which he reflected on his experiences – he had started to take Buddhist meditation courses – was titled *Buddhist Economics* (Wint 1966).

> 'Right Livelihood' is one of the requirements of the Buddha's Noble Eightfold Path. It is clear, therefore, that there must be such a thing as Buddhist economics. Buddhist countries have often stated that they wish to remain faithful to their heritage (…).
>
> All the same, such countries invariably assume that they can model their economic development plans in accordance with modern economics, and they call upon modern economists from so-called advanced countries to advise them, to formulate the policies to be pursued, and to construct the grand design for development, the Five-Year Plan or whatever it may be called. No one seems to think that a Buddhist way of life would call for Buddhist economics, just as the modern materialist way of life has brought forth modern economics.

In the same period of the ultimate publication of E.F. Schumacher's book *Small is Beautiful. Economics as if People Mattered* in 1973 (including the earlier *Buddhist Economics* article), the young King of Bhutan, Jigme Singye Wangchuck, upon his ascendance to the throne at the age of 17 – following the early death of his father – expressed his strong reservations towards modern western economics with the saying '*For the people of Bhutan Gross National Happiness is more important than Gross National Product'*. Simultaneously in Europe the Club of Rome launched its research report *The Limits to Growth*. The book of E.F. Schumacher has been translated into 27 different languages and in 1995 was named by the London Times Literary Supplement as one of the hundred most influential books written after World War II.

Remarkably, E.F. Schumacher was the President of the Soil Association in UK from 1970 to 1977 and emphasised the importance of organic agriculture as a central factor in an alternative approach to economics. From this perspective he actively supported the establishment of the *International Federation of Organic Agriculture Movements* (IFOAM) in 1972 in Versailles, France.

Earlier Thich Nhat Hanh strived in Vietnam 'to create a third way of creative nonviolence beyond communism and capitalism'. He coined the term 'engaged Buddhism'. The International Network of Engaged Buddhists (INEB), founded by Sulak Sivaraksa in Thailand, plays an active role in shaping an alternative development path. Sulak Sivaraksa is a staunch supporter of the Assembly of the Poor, Thailand, a pioneering member of La Via Campesina. INEB partners with like-minded groups with roots in diverse traditions in a common effort to shape 'engaged spirituality' towards sustainable development.

2.12 Conclusions

- Food security should not only address 'health' in general but in particular non-communicable (lifestyle- and food-related) diseases and their causes.
- Engaged spirituality and Buddhist economics: are 'ethics-driven' movements that address the root causes of poverty, inequality and injustice.
- From this insight, resonating with contemporary social analysis, global development efforts need a '*new' third-way* perspective.
- Policy development negotiations between the state and the business sector to compromise food safety in order to achieve food security are a *false compromise*. Food sovereignty should be seen as the central issue to safeguard food security and food safety in an ultimate framework of human security.
- '(….) in most regions fewer people will be living in rural areas and even fewer will be farmers. They will need new technologies to grow more from less land, with fewer hands.' This statement should not be taken as an inevitable trend determining the priorities of the research agenda. The creation of meaningful rural employment and strengthening of community spirit guided by food sovereignty should be the leading goal.

References

Altieri, M. A. (1995). *Agroecology: The science of sustainable agriculture*. Boulder: Westview Press.

Altieri, M. A. (2008). *Small farms as a planetary ecological asset: Five key reasons why we should support the revitalisation of small farms in the global south*. Penang: Third World Network.

Bakan, J. (2003). *The corporation: The pathological pursuit of profit and power.* Canada (Penguin), US (Free Press, Simon and Schuster) and UK (Random House).

Changyong Rhee interviewed in article by Martin Abbugao, *Asia lacks social benefits despite growth: ADB.* Chief economist 23 August 2011.

FAO. (1996). *World Food Summit*. 13–17 Nov 1996, Rome.

FAO. (2009). *World summit on food security. A high-level expert forum was established on how to feed the world in 2050.*

FAO. (2013). *FAO will cooperate with La Via Campesina, the largest movement of small-scale food producers in the world.* Rome, news article, October 4, 2013.

FiBL. (2012). *Forschungs Institut fuer Biologische Landbau*. Organic agriculture worldwide. Ackerstrasse 113, Frick, Switzerland.

Giddens, A. *The third way. The renewal of social democracy* (1998) and *The third way and its critics* (2000). Related to 'new labour' and the *welfare-to-work* programmes initiated in the UK by Richard Layard.

Global Issues. (2010, November 21). *Social, political, economic and environmental issues that affect us all*. http://www.globalissues.org/article/558/obesity#NumberofPeopleOverweightorWithObesityRivalsWorldsHungry

IFOAM. http://www.ifoam.bio/pt/organic-landmarks/principles-organic-agriculture. Retrieved February 23, 2015.

IUHPE. (2013). Conference *Best investments for health.* Pattaya, Thailand. Poster presentation of School for Wellbeing Studies and Research.

La Via Campesina. http://viacampesina.org/en/. Retrieved February 23, 2015.
Magnuson, J. (2008). *Mindful economics. How the US economy works, why it matters, and how it could be different*. New York: Seven Stories Press. Joel Magnuson is associated with the Buddhist Economics Research Platform.
Norberg Hodge, H. (2002). *Bringing the food economy home: Local alternatives to global agribusiness.* Interview on her film *The economics of happiness* by Institute for Studies in Happiness, Economy and Society (ISHES). http://ishes.org/en/interview/itv01_03.html
Nyéléni Declaration (Mali). (2007).
Ostrom, E. (2006). *Linking the formal and informal economy: Concepts and policies* edited with B. Guha-Khasnobis & R. Kanbur. Oxford: Oxford University Press. (Paperback published in 2007)
Perlas, N. (2000). *Shaping globalization. Civil society, cultural power and threefolding*. Pasig City: Center for Alternative Development Initiatives.
Ricard, M. (2006). *Happiness. A guide to developing life's most important skill*. New York: Little Brown and Company.
Royal Government of Bhutan. *Wellbeing & happiness: Defining a new economic paradigm*. http://www.2apr.gov.bt/
School for Wellbeing, Report. (2011). *International exchange platform on re-thinking property* at Chulalongkorn University, Bangkok.
School for Wellbeing, Report. (2012). Suan Nguen Mee Ma social enterprise, Bangkok.
School for Wellbeing, TOA Report. (2013). *Asian forum on innovating alternative markets.*
Sen, A. (2009). *The idea of justice*. Cambridge, MA: Harvard University Press.
Spencer, D. (2002). The future of agriculture in Sub-Saharan Africa and South Asia: W(h)ither the small farm? In *Sustainable food security for all by 2020*. Proceedings of an international conference, September 4–6, 2001, Bonn, Germany. Washington, DC: International Food Policy Research Institute.
Stiglitz, J. E. (2012, January). *Vanity fair*. http://www.vanityfair.com/politics/2012/01/stiglitz-depression-201201
UNEP. (2011). *The Green Economy Report*. Chapter *towards a green economy.* Coordinating Author: Dr. Hans R. Herren, President, Millennium Institute, Arlington, VA.
van Willenswaard, H. (2008, November 24–26). "*Critical holism*"*: A new development paradigm inspired by gross national happiness.* Paper for Thailand Research Fund and the Fourth International Conference on GNH, Thimphu, Bhutan.
van Willenswaard, W. (2012). Changing food systems, changing people. In P. Jacquet, R. K. Pachauri, & L. Tubiana (Eds.), *Towards agricultural change*? (pp. 58–60).
WHO. (2013). *Draft action plan for the prevention and control of noncommunicable diseases 2013–2020.*
Wijesiri, L. (n.d.). *BUDDHA DHAMMA: Liberty, equality, fraternity and Buddhism* (website).
Wint, G. (Ed.). (1966). *A Handbook.* Published by Anthony Blond Ltd., London. In 1973 it was collected with other essays by E. F. Schumacher in *Small is beautiful: Economics as if people mattered*.
World Bank. (2010). *Agricultural growth and poverty reduction: Additional evidence*. Washington, DC: World Bank.

Chapter 3
Ethical Values of Food Safety

V. Balambal Ramswamy

Abstract Food is the basic need of all living beings. Much food comes from agriculture, animals, birds and fish. The economic condition of the people is revealed through the food they eat. Safety awareness is lacking in the poorer class. There is change in the eating habits of the people due to western influence. To lead a healthy life, food safety is necessary.

This paper deals with the safety of food in production, marketing and consumption. Importance is to be given to clean water, milk, vegetables, fruits, meat, safety of cooked and raw food, environmental cleanliness and neatness in the kitchen. The role of the government and NGOs; importance of Food Safety and Standards Act of 2006 and its late implementation; banning of harmful edibles; preventing adulteration in various food stuffs; harm in using chemicals in food stuff; problems in the implementation of the Act; consumers' role; importance of ethical values in food safety; role of media; consumer awareness and training programmes for officials; poor lifestyle of the slum and village people due to poverty, ignorance and illiteracy; personal hygiene; different types of eating joints; absence of food safety; remedial measures; importance of home food; and others are also dealt with. The National Food Security Act passed on 31 August 2013 will come into force in due course. It is an improvement over the previous act. Food safety is given priority in this act.

Keywords Food safety • Ethics • Regulations • Adulteration

3.1 Introduction

Food ranks first in the three basic needs of the people. Everyone needs food, in adequate quantity and of adequate quality, to survive and maintain health. India is a developing country, and majority of the people do not even have one full meal a day. Even what they take cannot be guaranteed for safety. Clean drinking water and food stuff should be available to the marginalized people of the society. What little food

V. Balambal Ramswamy (✉)
Department of History, University of Madras, Chennai, Tamil Nadu, India
e-mail: drbala50@hotmail.com; drbala50@gmail.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_3

they could get should be clean and neat. Ethics should be followed in the production and distribution of food at home and outside.

In India in yesteryears, the best bride was the best cook. One who satisfied the palate was considered to be a worthy person in a family. But the trend is changing. No doubt Indians are good cooks and love good food. Men also know how to cook. *Mahabharata* an Indian epic makes mention of the two best men cooks Nala and Bheema.

This paper analyses the need for safe and sufficient food for all; the role of NGOs and the government in dealing with the production and distribution of safe food and food materials, especially to the slum and village people; ethical values to be followed by the producers and consumers; and remedial measures. Legal measures taken by the government strengthen the concept of food safety.

3.2 Food Practices

Food practices of rich and upper middle classes have changed a lot. As in most of the nuclear families, both the parents work with no elders at home, easy and fast food have taken a lead. The fast food joints are very handy to such families. But it is to be found out how clean these joints are and the quality of the food available there. The neatness of the servers and cleaners is very important. The poorer section of the society face hurdles due to their economic condition. Especially poor men, they slog and get wages, but soon a major part goes for liquor and cheap food. Women also work hard for the family. Slums and villages lack hygienic environment.

3.3 Food Availability

India is a thickly populated agricultural country. Many are below the poverty line. Poverty and illiteracy cause ill health. Unemployment and underemployment affect the poorer class. The lack of basic sanitation causes diseases. They could not even have one square meal a day which reflects on their health. Many of them do not even know about food safety. Obesity is very common amongst the richer section of the society, the reason being the use of fatty food. The middle class is able to manage food, but the safety of their food is questionable. Food practices of earlier generations slowly give way to new. The younger generation has switched over to fast food and roadside joints which are not safe.

3.4 Food Safety

Food safety is a scientific discipline describing handling, preparation and storage of food in ways that prevent food-borne illness. This includes a number of routines that should be followed to avoid severe health hazards. Food safety does not mean the safety of home food alone, it also means the safety between industry and the market and between the market and the consumer. In considering industry to market practices, food safety considerations include the origins of food including the practices relating to food labelling, food hygiene, food additives and pesticide residues, as well as policies on biotechnology and food and guidelines for the management of governmental import and export and inspection and certification systems for foods. In considering market to consumer practices, the usual thought is that food ought to be safe in the market, and the concern is safe delivery and preparation of the food for the consumer.

3.5 Facts About Food

Survival is impossible without food. Different kinds of food are available at home as well as outside. The financial condition of a person could be known from the food one eats. Food must be tasty, of good quality and safe. There are innumerable hotels suitable to the financial condition of the eaters. The poor go for cheap joints for cheap food. The rich go to higher standards; the middle class visit generally average standard hotels and occasionally big ones. The western contacts and influence have brought new recipes. But there is no equal to hygienically made home food.

Safe food should be nutritious and supply energy to the consumer. Unsafe food can cause ill health and transmit disease from person to person as well as serve as a growth medium for bacteria that can cause food poisoning. In developed countries there are intricate standards for food preparation, whereas in lesser-developed countries the main issue is simply the availability of adequate safe water, which is usually a critical item (Shiklomanov (2000), "Appraisal and Assessment of World Water Resources" (PDF). *Water International* 25 (1). International Water Resources Association, pp. 11–32).

To help the poorer students in schools in Tamil Nadu, the Midday Meal Scheme was introduced. Each child is given free food not only to feed them but to reduce dropouts in schools. Many parents send their children to school to get one square meal. On the darker side, there are complaints about distribution of unsafe food with rotten vegetables in an unhygienic environment. Periodical checkup of the standard of cooked food, neatness of the dining hall and kitchen and strict action against the defaulters are important.

3.6 Regulations

The government of India passed the Prevention of Food Adulteration Act and Rules in 1954 with an aim to ensure unadulterated food availability. The Act and Rules have prescribed some minimum standards which are to be followed *scrupulously* by the vendors.

Later the central government enacted the Food Safety and Standards Act, 2006 (34 of 2006), and it has come into force throughout the country on 5 August 2011 by repealing the Prevention of Food Adulteration Act of 1954 and seven other orders specified in the Second Schedule of the Act 34 of 2006. It insisted that all traders engaged in food business conformed to the provisions of the Act.

Following that, the Tamil Nadu Government brought Food Safety and Drug Control under one administration called the Food Safety and Drug Control Administration Department. Necessary officials are appointed and training was given to officials.

3.7 Functions of the Department

The functions of the department would include taking steps to ensure that food supplied to people is safe, issuing licences to micro and small traders and other commercial establishments engaged in food business, preventing the sale of food products hazardous to public health, creating awareness of food safety and conducting surveillance. To get the Food Business Operator licence, all restaurants and hotels, snack bars, cafes, school and office cafeterias and cafes within hospitals have to comply with a series of stringent guidelines including specific hygiene practices.

The Commission on Food Safety, Tamil Nadu, has arranged orientation training for the Food Safety Officers in ten batches. The training for the first batch was inaugurated by the Commissioner on 28 January 2013 in the Institute of Public Health, Poonamallee in Chennai, Tamil Nadu. To receive complaints from the Public/Food Business Operators, a helpline has been created. Any complaints under this Act can be made to the Office of the Commissioner of Food Safety in Chennai, the state capital.

The Food Safety and Standards Authority of India (FSSAI) has proposed to lay down a trap to intercept manufacturers involved in production or marketing of adulterated food items. To encourage inflow of information from all stakeholders regarding adulterated/unsafe food, the FSSAI has proposed to introduce a scheme of rewards for whistle-blowers and informants from the funds being made available to the state governments under a centrally sponsored scheme (*Unavulagam* – food safety). In this regard, Section 95 of the Food Safety and Standards Act, 2006, has a provision for rewards to be given to the whistle-blowers who provide any relevant information on food adulteration.

3.8 Commitments of the Food and Food Material Producers

All commercial establishments and traders engaged in food business should obtain licences under the Act to start or continue their trade. The traders should ensure quality and hygiene in the food sold by them. The premises of the food establishments should be safe and hygienic.

They should not sell food products past their expiry dates and adulterated, substandard or banned food products. Employees engaged by them should maintain hygiene.

3.9 Details in Packages of Food and Food Materials

Each packed food item should contain the mandatory label declarations printed on it, as required by the Prevention of Food Adulteration Act, 1954. If it is not there, the officials have the right to confiscate such food packets.

The details needed are the following:

- The name, trade name or description of food contained in the package.
- The name of the ingredients used in the product.
- A distinctive batch number.
- The month and year in which the commodity is manufactured.
- The month and year up to which the product is best for consumption.
- Vegetarian food symbol (if it is vegetarian food).

3.10 Drinking Water

Water is a prime need of the people. The poor fill up their hunger with water if they could not afford food. But due to climate change, construction of multistoried buildings, etc., water scarcity becomes a problem. Drinking water is in much demand. People pay for drinking water. Village women walk long distance to fetch water, and in the urban slums, women wait for drinking water in lorries or open pumps to get water. The safety of such water is questionable. As the sewage pipes and drinking water pipes in cities and towns are laid underground side by side, if there is any damage to one, water gets polluted, especially in the rainy seasons. Adequate precaution is to be taken by the local authorities in the supply of safe drinking water.

Due to utter necessity, many drinking water manufacturing package units have been started in India. These units are expected to supply clean unpolluted safe drinking water to the public on payment in sealed cans and bottles. It has become a lucrative business in cities and towns. These units are to be approved by the Bureau of Indian Standards (BIS) (*The Hindu*, 17 January 2013). Knowing the utter need of drinking water, the package units started selling water in plastic cover also for

one rupee. Even the village and slum dwellers buy these water covers to quench their thirst. During festivals, the water packets are in great demand. But the safety of the water is questionable. The public are not aware of the distinction between approved and unapproved companies and often buy the cheaper products. There should not be any compromise in allowing the fake units to supply drinking water as it reflects on the health of the consumer. Many unlicensed units which cheated the public with unsafe water were banned.

3.11 Banned Products

The government bans the products which are injurious to health. The use of betel leaves is good for health. But *pan masala* and *gutkha* containing tobacco as ingredient are very harmful. People who use these become addicts. Ultimately, they end up with cancer.

The Tamil Nadu State Tobacco Control Cell had submitted a proposal for a ban on *gutkha* and *pan masala* as early as in 2001, but the measure was bogged down in litigation. The government had then invoked the Prevention of Food Adulteration Act for notifying a 5-year ban, but the Supreme Court ruled that only the Centre had the power to issue such notifications under the law. The ill effect of using these products was very much realized by the state government. Especially the poorer section of the society suffered a lot. Hence, to prevent its use, the Chief Minister of Tamil Nadu on 8 May 2013 has announced in the state assembly that the manufacture, storage, sale and distribution of *pan masala* and *gutkha* containing tobacco as ingredient will be banned in Tamil Nadu. Based on the announcement, the Tamil Nadu Commissioner of Food Safety and Drug Administration Department has given a circular to his subordinates for better legal implementation of the plan. However, what makes the present ban legally tenable is that it relies on the Food Safety and Standards Act, which has provisions to prevent tobacco and nicotine from being used as ingredients in any food product. The State Food Safety Wing and the Tobacco Control Cell are likely to implement the ban. It was welcomed by the antitobacco groups in the state like Adyar Cancer Institute.

The ban will be now implemented under the provisions of the Food Safety and Standards Act, which specifically states that no food product should contain tobacco and nicotine as ingredients. Besides running the risk of having their products seized by officials, offenders have to face between 6 months and 3 years in jail. Officials in the state say that the implementation will be done jointly by the office of the Food Commissioner and the State Tobacco Control Cell.

Madhya Pradesh was the first to ban *gutkha* and *pan masala* after the rules and regulations under the Food Safety and Standards Act were notified. Kerala, Gujarat and Mizoram followed soon. West Bengal joined the group very recently. In spite of the regulation, the chewing items are continued to be used by many. Unless one makes up his own mind, knowing the harm it would cause, nothing could change the practice.

3.12 Ethical Values of South Indian Food

Contrary to the use of *pan masala* and *gutkha*, the South Indian practice of taking *tambulam* (fresh betel leaves and pasty calcium with areca nut) after a good meal helps a lot in digestion of food taken. It has no addition of tobacco.

The Sage of Kanchi Sri Sankaracharya has analysed the daily food taken by the vegetarian South Indians and its ethical values. The meal taken with cooked rice (*sadam*), i.e. *kuzhambu* (gravy), *rasam* (juice or soup) and buttermilk, reminds of a Hindu spiritual path from confused inaction to a clear flow of action and finally to the realized bliss of unity. A feast or function will be complete only after all the guests have taken *tambulam*. It signifies a contented meal, hospitality, a friendly get-together, sharing and a digestive component after a heavy meal (Ra. Ganapathy, *Sollinn Selvar Sri Kanvhi Munivar* (The Sage of Kanchi, the Expert of Words)).

3.13 Adulteration

It is sickening to notice adulteration in almost all products. The defaulters show good samples but sell low quality. Some shops use faulty weighing machines. Some adulterated products are given below.

3.13.1 Idli Batter

The most favoured breakfast items of the South Indians are *dosa* and *idli*, prepared with the batter of ground rice and *dal*. South Indians have been preparing them in a stoneware instrument called *wural* (manually operated grinder) until the last two decades. Then came the wet grinders, tabletop grinders and many more sophisticated grinders. The refrigerator helps to store the batter prepared in wet grinders for a week even. In the *wural*, the batter was prepared freshly and kept for a maximum of 2 days. This homemade preparation was clean and safe. The mechanization is not very safe.

As women now buy the batter from shops which produce a large quantity of batter, the safety of the product is not guaranteed. It has to withstand climatic and storage conditions. The quality also depends on the personal hygiene of the food handlers, quality of the rice, water used and condition of the grinder too.

A Chennai-based NGO, namely, 'CONCERT', conducted a survey and found that more than half of samples of batter – branded and not – bought from different shops contained bacteria associated with faecal matter. Most of the samples answered the tests for the presence of hydrogen sulphide producing bacteria in it. This could cause food poisoning.

This drew the attention of the government to look into the quality of the batter throughout the state. Massive raids were conducted throughout the state on 14 February 2011 to check the quality of the idli-dosa wet flour. Another unit functioned without licence, and the officials seized 164 kg of unhygienic batter prepared by it.

FSSAI has to carry out special vigilance during festive occasions like Diwali and Pongal as the crowd is attracted towards all food items without knowing its safety.

3.13.2 Milk

Milk is important for children and elders. White Revolution has made an easy access to milk. Both private and government organizations are engaged in collecting and selling milk and milk products. As milk is a much needed commodity and it loses its quality in no time, it should be supplied safely to the consumers. Different varieties of milk are in the market. Though the officials check the quality of the milk, adulteration continues in many ways.

To check milk adulteration and create awareness amongst people, the Food and Drug Administration (FDA) launched a month-long awareness campaign from the World Milk Day (Zee News, Last Updated: Friday, June 01, 2012, 16:14).

A report by the FSSAI in January 2013 found that most of the country's milk was watered down or adulterated with products – including fertilizer, bleach and detergent – used to thicken the milk and help to give it a white, frothy appearance. India is the world's largest milk producer, where the drink is used for religious rituals and is a source of protein for hundreds of millions of vegetarians. FSSAI has also found that 13 % of all food in India failed to meet its standards. It is the duty of the officials to stop adulteration in food items, especially in milk.

3.13.3 Tea

Indian tea is of high quality and very much needed in foreign countries. It earns good foreign exchange. But some exporters do not follow business and food ethics in supplying the same sample quality shown to the buyers. It becomes very embarrassing to the government when such illegal activities are processed by the exporters. After passing of the Act, importers can now rest assured about the quality of Indian tea. The Tea Board of India has put in place a system of random testing of teas meant for exports to ensure that only the varieties that comply with the standards set by the Food Safety and Standard Authority of India enter global markets.

This measure comes at a time when Indian tea is facing competition in the world market from Kenyan tea (22 June 2013). Greedy manufacturers compromise with quality which results in low quality of food and in turn, bad health. If they follow some ethical standards, India could feel proud of her merchandise.

3.13.4 Papad and Toor Dal

Periodical checkups and surprise inspections also take place after the passing of the Act. Many shops are visited and products checked by the officials. Health officers too check hotels and food products in shops.

Once the officials visited a provision shop in a city and found the *papad* packets did not have the mandatory data on the cover of the pack. The *papad* packets were taken as food sample and sent for analysis to the state-owned food analysis laboratory. Upon analysis, the *papad* packets were found to be manufactured in violation of Rule 32(a), (b), (e), (f), and (i) and 42zzz(17) of the Prevention of Food Adulteration Rules, 1955. And hence, the sample was reported to be misbranded. The sellers of those *papads* faced imprisonment (*The Hindu*, 3 *Nov. 2012*, *Madurai*). The same thing happened in another shop for *toor dal* packet (*The Hindu*, *14 March 2013*).

3.13.5 The Apple Story: A Case Study

Fruits are perishable goods and the sellers are cautious that they do not meet with any loss. Hence when they buy loads of apples, mangoes, etc., from far off places, they use chemicals for keeping them in good condition during transport and to ripen. But such fruits are not good for health. The details collected from fruit sellers give a shock to the researcher.

The following is a case study of a fruit seller. There are similar cases from all over India:

Before dawn every day Bhim joins hundreds of wholesale traders at Delhi's Azadpur Mandi, a sprawling, chaotic market where trucks are loaded with fruits and vegetables. His own trade is in rosy red apples, laced with calcium carbide.

Traders cannot buy fruits such as apples or mangoes when they are already ripe, because these would go to waste during the bumpy, unrefrigerated journey from the orchards. Instead, they buy the fruits and later ripen them with calcium carbide, a substance colloquially known as 'masala', or 'spice'. Using the white powder reduces a ripening process that normally takes weeks to a matter of hours. Traders are also tempted to polish or dip fruits in artificial colours to make its appearance fresh for sale. The ones that shine are the rotten ones. They look good to the eyes, but end up bad for the stomach.

Bhim says he has been adding chemicals to his apples for years to artificially ripen them after a long journey from the Himalayan foothills, despite being told that it causes cancer. As far as he knows, no one has ever died from eating his produce. So he cannot understand why the authorities are pestering him now and why he has to pay so many bribes to keep his business afloat. Wider enquiries proved that this practice will continue forever as no one wants to harm his sales, although the Food Safety and Standards Authority of India (FSSAI) has banned the use of calcium

carbide as it is carcinogenic. Officials also leave it unnoticed as they know that they could not stop the practice. They also accept bribes.

It is not the case with apple alone. To ripen costly mangoes in various parts of India, this practice is being followed. Actually, it results in unsafe and less tasty fruits. The same thing is with vegetables grown with chemical fertilizers. Very few go for organic things. Researches on these food products prove that the use of chemicals results in various diseases, especially cancer. From rat poison found in vegetables and Diwali festival sweets laced with caustic soda to batches of moonshine liquor that kill scores of the people at a time are samples of unsafe practices to preserve food items. If people are keen on food safety, correct measures are to be followed with what they consume.

3.13.6 KFC

There are anywhere between 50 and 60 lakh eateries in the country. Food safety has been a perennial challenge in India with frequent cases of food adulteration and food poisoning. In October 2012, an outlet of KFC in Thiruvananthapuram was shut down temporarily by the Kerala food safety authority after worms were found in a chicken dish.

3.14 Safety Awareness

It is the duty of the parents and teachers to inculcate in the minds of the children the importance of safe food, healthy environment and hygienic practices in day-to-day life. Even a simple meal should be neat and safe. Outside food kept in bad condition cause sickness and food poisoning. Hand washing is important before and after food intake. Vessels are to be clean. Fresh food is to be consumed. Food kept in refrigerator for many days should not be eaten. Clean drinking water is a must for good health.

Adulteration is to be avoided. Poverty tempts sellers to add diluents such as water to make more quantity. Cheap cooking oil is mixed with expensive oil, tea waste is mixed with new tea and anything from urea to blotting paper is added to thicken the food sold at festivals.

In 2008 in China six children died and nearly 300,000 fell ill from drinking powdered milk laced with melamine, an industrial chemical used to give misleadingly high readings in protein tests. Two people were executed in 2009 for their role in the scandal. Such severe measures are not followed in India. Corruption and bribery help the defaulters to carry on their food business successfully. Food safety is often worse in poorer areas where ignorance and the temptation to make a quick buck are greater. Poor people do not care much about the quality. Whatever is cheaper, they will buy it. An awareness is to be created in them on food safety.

3.15 Problems of Enforcement

The state and central governments enact many laws for food safety. The laws are very good, but the implementation is very weak. Enforcing India's food safety laws is a tough task. Enforcement officials are not sufficient in number and action. Clever traders come out easily through loopholes. Bribery and corruption make matters worse. Many eating joints have not registered. Even assessing the scale of India's food safety problem has been controversial. After the FSSAI published its survey on milk adulteration, many state governments spoke out to deny the scale of the problem in their region. Sometimes the food samples given to the lab for test may not be the real ones. Clever and greedy manufacturers cheat the lab and officials in no time. Even when found guilty, they know how to come out. FSSAI is still in the process of upgrading laboratories with modern technology and training its staff.

3.16 Conclusion

Despite all mishaps, India's food safety record is much better than yesteryears, largely because there is a growing awareness of the issue. Indians are becoming more safety conscious thanks to higher literacy rates, licensing, clearer food packaging and a modernizing of retail sector. Media also play a great role in exposing the defaulters as well the government. Basic ethical values of food safety are to be followed in production, marketing and consumption of food and food materials. The defaulters are to be punished as it involves the life and health of the people. The National Food Security Act passed on 31 August 2013 will come into force in due course. It is an improvement over the previous Act. Food safety is given priority in this Act.

References

Case Study.

Food Safety and Standards Act, 2006 (34 of 2006).

Ganapathy, Ra., *Sollin Selvar Sri Kanchi Munivar* (Sage of Kanchi, The Expert of Words), G.O.(Ms) No. 347 Health and Family Welfare (AB2) Department dated 22.12.2011.

Health & Family Welfare Department, Government of Tamilnadu – Home Page.

Helpline Cell No. 9444042322, Commissionerate of Food safety and Drug Administration, Chennai.

Interviews with sellers, buyers, family and officials.

Prevention of Food Adulteration Act 1954.

Shiklomanov, I. A. (2000). Appraisal and assessment of world water resources (PDF). *Water International* 25(1), pp. 11–32. International Water Resources Association.

The Hindu (English Daily). 3 Nov., 2012, Madurai, 17th January, 2013, 14, March, 2013, 22nd June, 2013.

The National Food Security Act of 31, August, 2013.
Unavulakam, Food safety – Blog.
Wikipedia-Adulterated food.
Williams, M., & Banerji, A, *Poor in India starve as politicians steal $14.5 billion of food*. New Delhi, Mon Feb 13, 2012 12:49 pm IST (Reuters).
World Health Organisation. *Prevention of food borne disease: Five keys to safer food*. Retrieved 2010-12-10.
Zee News, Last Updated: Friday, June 01, 2012, 16:14.

Chapter 4
Current Situation on Food Additives in Thailand: Use and Awareness

K. Duangmal, P. Hempattarasuwan, and P. Somsong

Abstract Processing of agricultural raw materials is a key selection to extend shelf life and increase value added of food products. This process also increases food availability and food distribution. Several factors including good quality raw material, appropriate processing, use of food additives, good manufacturing practice (GMP) in food factories and appropriate and acceptable packaging for each food product should be considered in order to obtain products with good quality. The addition of food additives, substances that are incorporated into processed food for functional purposes, has been proven to extend shelf life and/or to enhance food quality. However, these food additives must be added within a specified dosage and the justified purpose. The use of food additives in Thailand must be complied with Food Act, B.E. 2547. The addition of substances into processed food in order to conceal damage or spoilage occurring in foods or to deceive consumers is forbidden by food regulations. This paper is aimed to present the analysis on the amount of food additives in some certain products by the Thailand National Food Institute and information on the result of food product analysis sampling from central and regional areas of Thailand by Thai FDA in 2012. The obtained data indicates the overdose of food additive in some sample of food products. Moreover, the adulteration of other forbidden substances in food product was also detected. To prevent consumers from risks of misuse and overdose of food additive along with the adulteration, the information on food additive should be widely available; therefore, action on raising consumer awareness of the link between food additives and food quality together with strong implementation of government policy should be taken.

Keywords Food additive • Consumer awareness • Food quality • Food safety

K. Duangmal (✉)
Department of Food Technology, Faculty of Science,
Chulalongkorn University, Bangkok 10330, Thailand
e-mail: kiattisak.d@chula.ac.th

P. Hempattarasuwan • P. Somsong
The Office of the Commission on Agricultural Resource Education (OCARE),
Chulalongkorn University, Bangkok 10330, Thailand

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_4

4.1 Introduction

Processing of agricultural raw materials is a key selection to extend shelf life and increase value added of food products. The process serves also to offer more food choices and availability. In order to obtain good quality products with good consumer acceptance, several factors should to be considered. These factors include good quality raw material, appropriate processing, use of food additives, good manufacturing practice (GMP) in food factories, as well as appropriate and acceptable packaging for each food product. Food additives have long been around in food preservation and food processing since the ancient time. With the advent of the new era of food industry, in the second half of the twentieth century, more food additives have been introduced. The use of food additives has been proven to extend shelf life and/or to enhance food quality. However, these food additives must be added into allowed food products within a specified dosage and the justified purpose. The substances that are not allowed by food regulation are not counted as food additive and cannot be added into the food. Instead, it is considered as *food adulteration* as they possess toxicity or lack of any technical-functional purposes. Therefore, it is evident that the use of food additives in food industry implies a need for ethical consideration.

4.2 The Use of Food Additive and Analysis

Food additives are substances that are incorporated into processed food for functional purposes. Each food additive must provide some useful and acceptable functions to the food such as keeping quality, processing facilitation, increasing nutritional value and enhancing consumer acceptance. However, the addition of substances into processed food in order to conceal damage or spoilage occurring in foods or to deceive consumers is forbidden by food regulations (Lindsay 2008). The use of food additives in Thailand must be complied with Food Act, B.E. 2547. This standards and regulation issued and governed by Thai FDA should be in compliance with CODEX Alimentarius.

Food additives can be divided into several categories including acids, bases, buffer systems and salts, chelating agents, antioxidants, antimicrobial agents, intensely sweet nonnutritive and low-calorie sweeteners, polyhydric alcohol texturisers and reduced-calorie sweeteners, stabilisers and thickeners, fat replacers, masticatory substances, firming texturisers, appearance control and clarifying agents, flour bleaching agents and bread improvers, anticaking agents, gases and propellants (Lindsay 2008). Each additive has its own International Numbering System (INS) which has been commenced by the Codex Committee on Food Additives and Contaminants (CCFAC) to identify and declare the additive in the ingredient lists as an alternative to the specific name that can be lengthy (Codex Alimentarius 2013). The use of food additives must be within a specified range in a certain type of food.

The underdosage does not provide a satisfied effect neither enhance the product quality nor to retard spoilage. Oppositely, the overdosage contributes to chronic or acute adverse health effects of the consumers. Thus, the overdosage use of food additives and other nonfood grade chemicals in foods is the main issue that should be given more concern.

There are many scales of food production existing in Thailand (public limited company, limited company, community enterprise and household-level processing). According to the Factory Act, B.E. 2535, "factory" means a building place or vehicle which uses a machine from five horsepowers or an equivalent thereof or more or which employs seven workers or more with or without any machine for manufacturing, producing, assembling, filling, repairing, maintaining, testing, improving, altering, transporting, keeping or destroying anything in accordance with the type or kind of factory as provided for a ministerial rule (Department of Industrial Works 1992). Thus, those whom belong to the above condition have to ask for a licence in order to run a business. However, there are still high numbers of household-level processing that the scale is smaller than the above indicated condition.

Typically, the use of food additives in companies registered under Factory Act, B.E. 2535, and the products under Food Act, B.E. 2522 (Thai Food and Drug Administration 1979), has been strictly controlled by food regulations. Their products are mandatorily monitored by random sampling plan for quality and safety check by Thai FDA and the competent authorities in the export destination countries. In contrast, the use of food additives in a household-level processing, especially community enterprise and "one village one product" (OTOP), needs to be given concern. Although some products under "OTOP" brand name are produced under community product standard controlled by the Ministry of Industry (Thailand), the products are prone to be under risks as the community product standard has a weak enforcement. This has let some food producers in the small scale to neglect the safety issue on the use of food additives. It might be primarily attributed to lack of knowledge in the selection of food additives and the amount allowed to be used. Or, possibly, it might be due to the lack of quality control during processing. Otherwise, the producers merely think about the appearance and shelf life of their food products without considering whether the product is safe to consume.

This paper presents the results of food additive analysis under five categories, namely, antimicrobial agents, antioxidants, salts, intensely sweet nonnutritive sweeteners and food colours (Table 4.1). The data were collected from the analysis reports of the Thailand National Food Institute by which they were analysed using the qualified in-house method (National Food Institute 2013). Five samples of each target food products were collected by randomly sampling from open-market and street vendors in the year 2012–2013 and analysed for the presence and amount of food additives. The results are shown in Table 4.1. Surprisingly, some additives are found in the food samples belonging to the category that such additive is not permitted. Moreover, the result of the analysis of the presence of borax—chemical that is forbidden to be added into food—is shown. The presence of borax could be considered as food adulteration. The result will be discussed along with other five food additive categories.

Table 4.1 Survey result of food additive used in different food products

Classifications	Name	INS	Product/maximum level	Results	
				No. of surveyed sample	No. of sample containing additive (amount of additives)
1. Antimicrobial agent	Potassium nitrate	252	Name: dried seasoned pork Categories: – Maximum level: not allowed	5	4 (19.75, 6.46, 9.83 and 400.47 mg/kg)
			Name: chicken sausage Categories: cured meat Maximum level: 500 mg as sodium nitrite	5	5 (48.70, 50.63, 17.17, 16.67 and 42.98 mg/kg)
	Benzoic acid	210	Name: chilli sauce Categories: food preserved with acetic acid Maximum level: 1000 mg as benzoic acid	5	5 (10.52, 14.76, 19.50, 21.46 and 150.79 mg/kg)
			Name: fruit juice Categories: fruit juice, drinks Maximum level: 200 mg as benzoic acid	5	0
	Sorbic acid	200	Name: fresh rice noodle Categories: – Maximum level: not allowed	5	1 (131.14 mg/kg)
	Propionic acid	280	Name: shrimp paste Categories: fishery products Maximum level: GRAS	5	3 (206.35, 1,369.32 and 572.34 mg/kg)
2. Antioxidants	BHA	320	Name: chili paste Categories: – Maximum level: not allowed	5	1 (57.06 mg/kg)
	TBHQ	319	Name: cookies Categories: – Maximum level: not allowed	5	0

3. Salts	Sodium polyphosphate	452(i)	Name: frozen prawn Categories: frozen product Maximum level: 5,000 mg per kg	5	5 (6,000[a], 3,600, 4,600, 6,200[a] and 4,300 mg/kg)
			Name: smoked salmon Categories: frozen/chilled product Maximum level: 5,000 mg per kg	5	5 (5,592.80[a], 5,147.10[a], 5,719.30[a], 6,293.40[a] and 5,925[a] mg/kg)
4. Nonnutritive intense sweeteners	Sodium cyclamate	–	Name: dried plum Categories: dried fruit Maximum level: not allowed	5	5 (277.49, 141.47, 130.35, 325.81 and 92.11 mg/kg)
	Saccharin	–	Name: osmosed fruit Categories: osmosed fruit Maximum level: not allowed	5	3 (19.61, 75.44 and 99.59 mg/kg)
			Name: fresh fruit Categories: fresh fruit Maximum level: not allowed	5	0
5. Food colours	Sunset yellow FCF	110	Name: orange juice Categories: drinks Maximum level: 70 mg per kg	5	0
			Name: seasoned sauce (suki) Categories: sauce, general food seasoning Maximum level: 200 mg per kg	5	2 (7.77 and 8.51 mg/kg)
	Ponceau 4 R	124	Name: seasoned sauce (suki) Categories: sauce, general food seasoning Maximum level: 50 mg per kg	5	1 (15.18 mg/kg)
			Name: dried shrimp Categories: processed/dried meat Maximum level: not allowed	5	1 (37.13 mg/kg)

(continued)

Table 4.1 (continued)

Classifications	Name	INS	Product/maximum level	Results	
				No. of surveyed sample	No. of sample containing additive (amount of additives)
	Tartrazine	102	Name: orange juice Categories: drinks Maximum level: 70 mg per kg	5	0
			Name: pickle mango Categories: fresh and pickle fruit/vegetable Maximum level: not allowed	5	5 (25.68, 82.47, 116.13, 116.48 and 26.98 mg/kg)
	Sudan red	–	Name: dried chilli Categories: dried food Maximum level: not allowed	5	0

Source: Data were collected from the analysis reports of Thailand National Food Institute (2013)
[a]The amount found exceeds maximum level

4.2.1 Antimicrobial Agents

The additives in this group refer to chemical preservatives with antimicrobial activities which play an important role in spoilage prevention and safety assurance of many foods. Some of the chemicals in this group are sulphites and sulphur dioxide, nitrite and nitrate salts, sorbic acid, propionic acid and benzoic acid (Lindsay 2008). The use of chemicals in this group is quite common in various foods to extend the product shelf life. However, the appropriate dosage for each product type is required. The presence of nitrite, benzoic acid, propionic acid and sorbic acid in certain food products is summarised in Table 4.1. The presence of nitrite calculated as sodium nitrate was found in all chicken sausage samples; however, it did not exceed the limit (500 mg/kg, expressed as sodium nitrite). The presence of nitrite was also detected in four out of five dried seasoned pork samples. Unfortunately, nitrite is not allowed to be used in this type of dried pork product. The amount of benzoic acid found in all chilli sauce samples was acceptable as it was within the allowed range. The presence of benzoic acid could not be detected in all fruit juice samples. Sorbic acid was found in only one out of five samples of fresh rice noodle. Again, this additive is not allowed to be used in fresh noodle. This may be possible that it is the intention of the irresponsible producer to keep this noodle longer than its regular shelf life. Propionic acid that is normally allowed to be used in fishery products, except fresh and frozen ones, were found in three out of five samples of shrimp paste ranging from 206.35 to 1369.32 mg/kg. Some additives that are exempt from the usual Food Act but are classified under generally recognised as safe (GRAS) are generally acceptable to be added into foods. However, they should not be added in a large amount as they affect the product sensorial properties. Moreover, regular consumption of these chemicals can cause detrimental effect on one's health.

4.2.2 Antioxidants

Antioxidants refer to the ability of chemicals to inhibit oxidation reaction. They generally comprise of compounds that interrupt the free radical chain reaction involved in lipid oxidation and those that scavenge singlet oxygen (Lindsay 2008). The chemicals in this group are normally added to oils and products containing lipids to retard lipid oxidation. Fortunately, from the sampling, none of the cookie samples contained TBHQ. This is rather a good sign that the producers may introduce an alternative extending shelf life method instead of using synthetic chemicals in the food category that such additive is not permitted. However, the presence of BHA in Thai chilli paste was detected, even at the amount of 57.06 mg/kg of product. This result indicated that consumers are under a risk of having food belonging to the category that such additive is not permitted.

4.2.3 Salts

Salts refer to chemicals having the ability to bind water. Compounds in this group include alkaline phosphates and polyphosphates. They are normally used in frozen prawn and fishery products in order to bind water and maintain the product shape. Here, polyphosphate salt was detected in all frozen shrimp samples and smoked salmon samples. The amount of polyphosphate salts in two out of five frozen shrimp samples was beyond the upper limit, and at the same time, the amount in all five samples of smoked salmon was also higher than the upper limit. This information points that the producers intend to increase the weight of frozen products by adding more water during the process. This deceiving behaviour is completely unfair to consumers.

4.2.4 Nonnutritive Intense Sweeteners

These compounds refer to a group of substances that evokes a sweet taste or enhances the perception of sweet taste. Examples are cyclamate and saccharin. It must be noted that cyclamate and saccharin are not allowed to be added unless for the exported food products. However, we can see that the dried prune samples and pickled fruits sold within the country contained saccharin and sodium cyclamate. It might be possible that the food producers may not know that these nonnutritive intense sweeteners are not allowed to be added. Fortunately, there was no detection of these sweeteners in fresh-cut fruit.

4.2.5 Food Colours

Food colours are normally added into foods in order to enhance consumer acceptance. In the market, food colours can be found in either synthetic or natural form. The use of the synthetic one, especially nonfood grade, has a higher chance to contain heavy metal contamination. The results, Table 4.1, show that some synthetic colourants were found in analysed food samples. According to Thai Food Act B.E. 2547, the notification 281, colourants are not allowed to be added to many food categories such as pickle/osmosed fruit, fresh-cut fruit, processed meat, smoked meat and dried meat (Food Act 2004). However, the analysis results showed the presence of Ponceau 4 R and tartrazine in dried shrimp and pickled mango, respectively. These colourants, according to the regulation, are supposed not to be found. This may indicate lack of responsibility of some food producers. Fortunately, Sunset Yellow FCF was not detected in orange juice, while Sudan I, Sudan II, Sudan III and Sudan IV were not detected in powder chilli. Ponceau 4 R and Sunset Yellow FCF were found in two out of five samples of suki sauce but the amount detected was within the acceptable limit. The presence of colourants in food samples indicates

that the food producers still use colourants in food beyond rules and regulations. We do hope that these colourants have not been intentionally added into foods.

In Thailand, the problem associated with the use of prohibited substances in food has long persisted. This is called "food adulteration" which is considered in the aspect of food producers' ethic. Since the consumers who are exposed to these substances appear to have chronic health problems and may be a cause of death, the prohibition of the use of these substances is not only about the regulations by Thai FDA but it also relates to an ethical aspect in food. For example, to enhance food texture, only the approved food additives that perform technical-functional purpose of firming texturisers can be added into certain foods. In order to improve crispness and firmness of fermented salt-brined pickles, acidic alum salts can be added. Yet, the banned substances, borax, have been unexpectedly found in certain processed meat products sold in the market such as meatball, fishballs, sausages and some sweets to increase their springiness (Ministry of Public Health 2013). Fortunately, the survey results in Table 4.1 showed the absence of borax in meatballs, sausages and pork products.

4.3 Raising Consumer Awareness and Implementation of Government Policy

To protect the customers and to raise quality standard of food products, Thai FDA have sampling plan for monitoring the food qualities (Food and Drug Administration 2013; Settaudom 2004). The samples were checked for microorganisms and chemicals as shown below.

Checklist of microorganisms	
1. Total plate count	4. *S. aureus*
2. Coliforms	5. Yeast
3. *E. coli*	6. Mould
Checklist of chemicals	
1. Pesticide/insecticide	8. Aflatoxin
2. Borax	9. Polar compounds in frying oil
3. Formalin	10. Synthetic dye
4. Salicylic acid	11. Amount of acetic acid in vinegar
5. Bleaching agent	12. Free mineral acid in vinegar
6. Nitrate/nitrite	13. pH of canned bamboo shoot
7. pH of drinking water/ice	

The sampling was done in both the central and regional area of the country. Data of the food product analysis monitoring by Thai FDA in both the central and regional area in the year 2012 is shown in Table 4.2. The target number for the central area and regional area was about 22,000 samples and 12,367 samples, respectively. Surpassingly, the collected number for the samples was notably higher than the target plan. This result indicates that the monitoring unit in Thai FDA is quite active and taking a proactive approach. The percentage of the samples that did not meet the

Table 4.2 Summary of food product analysis in the central and regional area, 2012

Sampling	Target number	Collected number	Percentage of sample collected	No. of result received	No. of sample			Percentage		
					Meets the standard	Does not meet the standard	Not concluded	Meets the standard	Does not meet the standard	Not concluded
Central										
Sample collected from the producers and retailers	4,000	4,001	100.03	3,376	2,931	445	–	86.82	13.18	–
Policy project	680	680	100.00	527	471	56	–	89.37	10.63	–
Standard quality monitoring	2,720	2,723	100.11	2,325	2,107	218	–	90.62	9.38	–
Special case/emergency case	600	598	99.67	524	353	131	–	67.37	32.63	–
Preliminary test of food safety project	–	7,659	–	7,659	7,003	656	–	91.43	8.57	–
Imported at food and drug inspection port	18,000	19,018	105.66	17,682	17,379	293	–	98.29	1.66	–
Policy project	7,700	7,259	94.27	6,077	5,850	227	–	96.26	3.74	–
Special case/emergency case	300	1,255	418.33	1,101	1,096	5	–	99.55	0.45	–

Preliminary test	10,000	10,504	105.04	10,504	10,433	61	–	99.32	0.58	–
Total	22,000	30,678	139.45	28,717	27,313	1,394	–	95.11	4.85	–
Regional										
Collected sample from the producers and retailers	5,437	13,018	239.43	12,979	11,632	1,190	39	89.62	9.17	0.30
Preliminary test of food safety project	–	163,138	–	163,138	155,123	8,015	–	95.09	4.91	–
Imported at food and drug inspection port	6,930	2,550	36.80	2,550	2,542	8	–	99.69	0.31	–
Standard quality monitoring	430	182	42.33	182	177	5	–	97.25	2.75	–
Preliminary test	6,500	2,368	36	2,368	2,365	3	–	99.87	0.13	–
Total	12,367	178,706	–	178,667	169,297	9,213	39	94.76	5.16	0.02
Community enterprise product										
Community enterprise product	2,590	2,476	95.60	2,339	1,921	418	–	82.13	17.87	–

Source: Data adapted from Food and Drug Administration (2013)

standard was around 10 % for samples collected from producers and retailers in the policy project and the standard quality monitoring but the percentage was quite high, up to 32 % in samples collected in the special/emergency case. The percentage of the community enterprise products that did not meet the standard was also high, about 18 %. Table 4.3 shows the analysis report of food samples collected from the producers and retailers in 2012. It appeared that the percentage of sampling samples under many categories that did not meet the standard was quite high up to 30–40 %. Most of them failed to meet the standard as they contained the overdose of food additives or food samples belonging to the category that such additive is not permitted.

From the authors' point of view, this information will be more useful if it is publicised through various media. Higher impact could be reached when a large population involves. The language should be both informal and academic writing depending on population. Evidently, the appearance of food product alone does not indicate whether the use of food additives is under the Food Act or not. The promising way to prevent consumers from risks of misuse and overdose of food additives along with the adulteration can be done, on top of the strong implementation of government policy, through raising consumer awareness of the link between food additives and food quality. Last but not the least, the ethic of food producers—the most important in food additives and food safety cycle—must be evoked. The production of good quality and safety foods through using qualified food grade additives could promote food safety of the country and good health for the whole population.

Suggested roadmaps that should be raised up are as follows:

3.1 Education regarding the use of food additives should be integrated among all related sectors in the education system either at school or university level. The university should have a major role in the collaboration and lead the right direction. Consumers should be educated more on the benefit and drawback of food additives and also the alternative way of preservation without using food additives.

3.2 Information regarding the use of food additives should be publicised either in magazine columns, newspapers or television and media. Information on the debate whether food additive can be used in some certain foods should also be provided. Moreover, the information and data must be presented in fact without bias. The channels for broadcasting should be increased.

3.3 There should be a necessity to provide an accurate and comprehensive knowledge on food product quality due to the use of additives to the food producers. Consumers should have more choices and be able to make a decision in choosing food not only based on their preference but also on knowledge of quality and safety.

3.4 Strong implementation of government policy could be done through various aspects such as more frequent sampling and analysis of food sample, increasing punishment for breaking laws and setting up a campaign on food additives and food safety.

3.5 The ethic of food producers should be evoked. The ethical issue on the use of food additive should be realised and kept being informed through seminar/workshop and advertisement.

Table 4.3 Analysis report of food samples collected from the producers and retailers in 2012

Activity/product	Target number	Collected number	Percentage of sample collected	No. of result received	No. of sample		Percentage		Detected substances/ microorganisms in the sample that does not meet the standard
					Meets the standard	Does not meet the standard	Meets the standard	Does not meet the standard	
Food safety policy project									
1. Pork	120	120	100	120	80	40	66.67	33.33	Salbutamol
2. Meat (prawn/pork/chicken/ entrails)	80	80	100	78	77	1	98.72	1.28	Semicarbazide: SEM 1.1 μg/ kg
Standard quality monitoring									
1. Pastries	30	30	100	30	16	14	53.33	46.67	Benzoic acid and sorbic acid
2. Fresh noodles	30	30	100	4	2	2	50	50	Sulphur dioxide 30.7 mg/kg and benzoic acid 1,128 mg/kg
3. Drinks	60	60	100	52	48	4	92.31	7.69	MPN coliform, *E. coli*, benzoic acid, yeast and mould
4. Meat products (chicken/ fish/Chinese sausage/sour pork sausage/sausage/ meatball/Moo Yor (Thai-style pork bologna)/Kai Yor (Thai-style chicken bologna)	120	120	100	56	18	38	32.14	67.86	Sorbic and benzoic acid, sodium nitrite and phosphorus (calculated as phosphate eq.), Ponceau 4 R, phosphorus (calculated as phosphate eq.), benzoic acid and phosphorus (calculated as phosphate eq.), benzoic acid and Ponceau 4 R, benzoic acid and tartrazine, benzoic acid and sodium nitrate, sodium nitrite and Ponceau 4 R

(continued)

Table 4.3 (continued)

Activity/product	Target number	Collected number	Percentage of sample collected	No. of result received	No. of sample		Percentage		Detected substances/ microorganisms in the sample that does not meet the standard
					Meets the standard	Does not meet the standard	Meets the standard	Does not meet the standard	
5. Ready-to-eat food									
5.1 Meat products, e.g. Moo Tub (dried seasoned pork), Moo Yong (shredded dried pork), Moo Sawan (sweet fried sun-dried pork), Moo-Pan (crispy sliced pork), baked pork, seasoned crispy fish, fish tofu, seasoned squid, crispy prawn roll, imitation crab stick)	40	40	100	9	6	3	66.67	33.33	*S. aureus* and sorbic acid
5.2 Chilli paste	30	30	100	30	27	3	90	10	Sorbic acid
5.3 Cookie, biscuit, cracker, crispy toasted bread	80	80	100	80	80	0	100	0	–
6. Low-acid food in a closed container	30	30	100	30	30	0	100	0	–
7. Century egg (alkaline-preserved egg)	30	30	100	29	24	5	82.76	17.24	Lead
8. Sweet and sour dried fruit	120	120	100	115	76	39	66.09	33.91	Sodium cyclamate, cyclamate, saccharin, sorbic acid, benzoic acid
9. Instant food (curry paste)	50	50	100	38	26	12	68.42	31.58	Benzoic acid

10. Sauce									
10.1 Selected type of sauce	30	30	100	30	27	3	90	10	Sorbic acid
10.2 Sauce in a closed container	70	70	100	70	56	14	80	20	Sorbic acid
11. Colour-containing food									–
11.1 Food that must not be colour added	80	80	100	75	64	11	85.33	14.67	–
11.2 Tea (ready-to-drink powder)	30	30	100	30	30	0	100	0	–
11.3 Food that is high risk of overdosage of added colour such as ready-to-eat food and candy	80	80	100	80	67	13	83.75	16.25	Tartrazine, brilliant blue FCF, azorubine, erythrosine and Ponceau 4 R
12. Dried vegetable and dried fruit	130	130	100	116	107	9	92.24	7.76	SO_2 and lead
Special case	400	470	117.5	407	273	134	67.08	32.92	Tartrazine, fat, bacteria, sodium nitrate, protein, azorubine, saccharin, Ponceau 4 R, salbutamol, sibutramine, fenfluramine, caffeine, sulphur dioxide
Complaint case	200	128	64	117	80	37	68.38	31.62	Sibutramine, foreign matter such as insect parts, colloid, iron, zinc, caffeine, tartrazine, MPN *E. coli*, iodine, *Clostridium* spp., benzoic acid, yeast, MPN coliform, SO_2, sorbic acid, MPN coliforms, *E. coli*, arsenic

Source: Data adapted from Food and Drug Administration (2013)

4.4 Conclusions

Food choices for consumers in the future should be balanced on food appearance and also food quality and safety. This cannot be reached without the cooperation among three parties—government, food producers and consumers—in a good balance. Action to increase consumers' knowledge and awareness together with the strong implementation of government policy and the ethic of food producers need to be pushed. We could not guarantee that this aim can be reached unless education for both consumers and producers on the appropriate use of food additives with ethical aspect is widely promoted and taken into action.

References

Codex Alimentarius. (2013). *List of active codex committees*. http://www.codexalimentarius.org/committees-and-task-forces/en/. Retrieved November 9, 2013.

Department of Industrial Works. (1992). Factory Act, B.E. 2535. Published in the Government Gazette, Volume 109, Part 44, dated 9th April B.E.2535. Bangkok: Cabinet and Royal Gazette Publishing.

Food Act. (2004). Notification of the Ministry of Public Health No. 281 B.E. 2547. RE: Food Additive. Thailand. Bangkok: Cabinet and Royal Gazette Publishing.

Food and Drug Administration. (2013). *Health products analysis report 2012*. http://elib.fda.moph.go.th. Retrieved September 10, 2013.

Lindsay, R. C. (2008). Food additives. In S. Damodaran, K. L. Parkinn, & O. R. Fennema (Eds.), *Fennema's food chemistry* (4th ed., pp. 689–749). Boca Raton: CRC Press.

Ministry of Public Health. (2013). *Food safety*. http://www.fda.moph.go.th/project/foodsafety/foodsafety46f10.htm. Retrieved July 13, 2013.

National Food Institute. (2013). *Food analysis results*. Bangkok. http://fic.nfi.or.th/foodsafety/comefood.php. Retrieved July 13, 2013.

Settaudom, C. (2004). *Food safety law and regulation* [PowerPoint presentation]. Thai FDA. http://www.foodadditives.org/pdf/cochran%20present.pdf. Retrieved November 17, 2013.

Thai Food and Drug Administration. (1979). Food Act, B.E. 2522. Published in the Government Gazette, Volume 96, Part 79, page 1 dated 13th May B.E.2522. and Government Gazette, Volume 119, Part 102, page 66 dated 8th October B.E.2545.

Chapter 5
The "Monsantonization" of Agriculture

Tomás Agustín González Ginestet

Abstract Taking McDonald's as an exemplar, George Ritzer analyzes the rationalization of society based on the efficiency, predictability, calculability, substitution of human for nonhuman technology, and control over uncertainty. The theory of "The McDonaldization of Society" can perfectly adapt to the agriculture sector and its green revolution led by the "miracle seeds" and by the agrochemical and seed corporations (such as Monsanto). While the benefits of globalization go to the seed and chemical corporations through expanding markets, the costs and risks are born exclusively by the small farmers and landless peasants. The high social, health, and ecological costs of the globalization of non-sustainable agriculture are a clear evidence of the "irrationality of rationality" that contrasts to the "benefits" that GMOs, herbicides, insecticides, and fertilizers are supposed to bring to the world. Not in vain, there is a critical awakening in society about the spread of this rationalization of globalization, asking for more local and traditional practices, which is putting in evidence the "irrationality of rationality." Some expressions of this strong bottom-up movement are those coming from the organic movement, NGOs, agricultural federations, local communities, and indigenous movements, among others.

Keywords Globalization • Agriculture • Sustainability • Transnational corporations • Monsanto

One of the first ideas that come to our mind *about the globalization* is the interdependence of countries, the connection among the people, the break on time and space, and the rise of big companies such as McDonald's and Coca-Cola. As well-known brands by almost everybody, they represent in a symbolic way one view of globalization reflected very clear in the theory of George Ritzer about the "The McDonaldization of Society." Taking the fast-food company McDonald's as a starting point, the theory analyzes the rationalization of society based on the efficiency, predictability, calculability, substitution of human for nonhuman technology, and

T.A.G. Ginestet (✉)
Albert-Ludwigs-Universität Freiburg, Freiburg im Breisgau, Germany
e-mail: tomas_ginestet@hotmail.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_5

control over uncertainty. This theory of globalization can be perfectly adapted to other sectors of life and industry, as it could be with agriculture and Monsanto. Here, the rationalization is also applied to the systematic method of GMOs, fertilizers, and herbicides used by many producers in the world, convinced about the great benefits that their main provider (Monsanto) ensures as McDonald's does. However, there is a critical awakening in society about the spread of this rationalization of globalization, asking for more local, traditional, and antique methods, which is putting in evidence the "irrationality of rationality."

In the paper *The McDonaldization of Society*, George Ritzer (1983) describes the rationalization of society, and so of globalization, as the one that emphasizes efficiency, predictability, calculability, substitution of human for nonhuman technology, and control over uncertainty. Efficiency would be finding the best or optimum means to any given end. Predictability is conceived by the fact that people want to know what to expect when they enter a given setting or acquire some sort of commodity. Calculability is understood in developing a series of quantifiable measures that it takes as surrogates for quality. Substitution of human for nonhuman technology implies using rational technologies to limit individual independence and the ability to think and act in unpredictable ways. Last but not least, control is determined by rational systems set up to allow for greater control over the uncertainties of life. For each of these features, Ritzer gives a lot of examples of everyday life and, of course, based on the prototype of McDonald's: the repetition of the exact and same hamburger in any (replicated) branch of the world, the fast and efficient delivery process, the step-by-step and mechanic method of producing the food, etc.

This theory of the rationalization of society in the globalized world can also be sustained in the process of agriculture globalization, by the green revolution led by the "miracle seeds" and the agrochemical and seed corporations. Here, the objective is the same as before: looking forward to the efficiency, predictability, calculability, substitution of human for nonhuman technology, and control over uncertainty. Under the pretext of fighting the pests, helping the producers and farmers, and increasing food production and food security, the rationality in the agriculture sector seems to be a key component in its successful development around the globe by the same method of producing and a commercial and legal framework led by few and huge multinational agrochemical corporations.

The rationalization of the agriculture sector can also be described as the privatization of the seed sector. In the publication *Seeds of Suicide*: *The Ecological and Human Costs of Globalization of Agriculture*, Vandana Shiva and Afsar Jafri (2002) explain that the privatization of the seed sector has induced three major changes in agriculture. First, it has led a change in cropping patterns of farmers' varieties, from mixed cultivation based on internal inputs to monoculture of hybrids based on external inputs. Second, it has changed the culture of agriculture. Instead of growing food and maximizing ecological security and food security, fanners have been induced to grow cash crops for high profits, without any assessment of the risk, cost, and vulnerability factors. Third, the shift from a public system approach to a private sector approach in agriculture has also meant a reduction in public sector low-interest loans and extension and an increased dependence on high-interest

private credit, pushing sales of seeds and agrochemicals as a substitute for information and extension.

As Shiva and Jafri explain, for 10,000 years, farmers and peasants have produced their own seeds from their own land, selecting the best seeds, storing them, replanting them, and letting nature take its course in the renewal and enrichment of life, based on the strategy of conserving and enhancing genetic diversity. The "miracle seeds" of the green revolution transformed this common genetic heritage into private property, protected by patents and intellectual property rights. A shift from a fanning system controlled by peasants to one controlled by few key multinational agrochemical and seed corporations and international agricultural research centers. The growth of marketed seeds is thus the main objective of developing the seed "industry," because farmers own seeds that do not generate growth in financial terms. Thus, seeds were transformed into a costly input to be purchased, for which countries had to take international loans to diffuse the new seeds and farmers had to avail of credit from banks to use them.

So, the theory of rationality described by Ritzer is very clear in the globalization of agriculture, at least in the "good" things that the system tries to show: efficiency (fighting pests, producing more, increasing food production and security), predictability (same method, same products, same brands), calculability (more net production, more sales, more profits), substitution of human for nonhuman technology (transgenic seeds and herbicides/fertilizers over human critical aptitude), and control over uncertainty (miracle seeds against hunger and starvation).

Being McDonald's a symbolic representation of the rationality in the globalized world, Monsanto is the perfect and suitable prototype for the impact of globalization in the agriculture sector. But, who is Monsanto? In comparison to the well-known McDonald's and its Golden Arches and Big Mac, Monsanto is quite known within the agriculture sector, being almost like the "big brother" of the new world agricultural order. In the book *The World According to Monsanto: Pollution*, *Politics and Power*, Marie-Monique Robin (2010) gives a detailed explanation about the beginnings, development, and hegemony power of this big transnational company (TNC) producer of genetically engineered seed and of the herbicide glyphosate, with 20,600 employees, revenues of $11.822 billion, and facilities in 71 countries (2011). Roundup is the best-selling herbicide in the world since the 1970s, which would be Monsanto's Big Mac.

However, the power of Monsanto resides mainly that it owns 90 % on the patents for all genetically modified organisms (GMOs) grown in the world, the fact for which it became the world's largest seed company imposing them, with 250 million acres covered in 2007. The same situation happened before, when Monsanto reinforced its monopoly in the international PCB (polychlorinated biphenyls) controversial insecticide market, guaranteed by a patent that enabled it to sell licenses almost everywhere in the world. As Robin affirms, "The second green revolution is led by Monsanto, that it has nothing to do with food security. Its only aim is to increase Monsanto's profits, and the company has succeeded in imposing its law around the world, that it is patent law. Once it has established ownership of genetically modified seeds as the norm, it will be able to collect royalties. The patenting of life is a continuation of the first colonization."

Going back to Ritzer's theory, he concludes warning that the glitter of the accomplishments and promises of the rationalization of society has served to distract most people from the grave dangers posed by progressive rationalization. In Ritzer's words, this effect should be named the "irrationality of rationality," as a seemingly inevitable by-product of the process and an overarching label for all the negative effects, inefficiencies, and unpredictabilities that rationalization have on the individuals who live, work, and are served by them. A clear example of this is described by Robin with the case of India, which in 2010 became the world's second-largest wheat producer (74 million tons), with the following cost: exhausted soil, a worrying decline in water reserves, widespread pollution, the spread of monocultures at the expense of food crops, and the exclusion of tens of thousands of small farmers who have moved to slums because they could not adapt to an extremely costly model of farming.

While the benefits of globalization go to the seed and chemical corporations through expanding markets, the costs and risks are born exclusively by the small farmers and landless peasants. Non-sustainable pest control strategies offer chemical or genetic fixes while reducing diversity, which is the biggest insurance against pest damage. The high social, health, and ecological costs of the globalization of non-sustainable agriculture are a clear evidence of the "irrationality of rationality" that contrasts to the "benefits" that GMOs, herbicides, insecticides, and fertilizers are supposed to bring to the world.

In a transformalist view of globalization, as Ritzer said, what is needed is not a less rational society, but greater control over the process of rationalization involving, among other things, efforts to ameliorate its irrational consequences. Despite the power of the TNCs and their respective lobbying strategies among states and institutions, a strong and critical bottom-up movement is emerging in a contest way to the hegemony of the "rationalization" in the agriculture sector. This is the case of the organic movement, NGOs, agricultural federations, local communities, indigenous movements, etc. They are all convinced that pest devastation shows how vulnerable the agricultural systems are and that an ecologically resilient agriculture shift is needed, in the sense that ecological problems need ecological solutions. In summary, as Shiva and Jafri stated, "the freedom of the seeds and freedom of organic farming are simultaneously a resistance against the monopoly of corporations. The seeds of suicide need to be replaced by seeds of prosperity, and those seeds are in our hands."

References

Ritzer, G. (1983). The McDonaldization of society. *Journal of American culture*, 6, 371–379.

Robin, M. (2010). *The world according to Monsanto. Pollution, politics and power* (pp. 2–30 and pp. 307–318). New York: The New Press.

Shiva, V., & Jafri, A. (2002). Seeds of suicide: The ecological and human costs of globalization of agriculture. In S. Vandana & B. Gitanjali (Eds.), *Sustainable agriculture and food security. The impact of globalization* (pp. 1–25). New Delhi: Sage.

Chapter 6
Rural Infrastructure and Gender Inequality in Agribusiness Development (A Case of Batu, East Java Province, Indonesia)

Ayu Kusumastuti

Abstract The objectives of the present study are to identify utilization of rural infrastructure related to gender condition, to describe gender of agribusiness development, to describe the social, economic, and environmental impacts of rural infrastructure that influence gender condition, and to describe the response and adaptive capacity of the community.

The research uses a qualitative research method with qualitative data analysis approach and impact assessment. The researcher tries to evaluate rural infrastructure projects that have correlation with the gender phenomenon in Batu City, East Java, Indonesia. The research was conducted on two main areas, the sloping or hilly areas and the flat land of Batu City. The qualitative data analysis approach is a processes of describing phenomena, classifying the data, and seeing how its concepts are interconnected.

Utilization of rural infrastructure, check dam irrigation, and micro hydropower have progressively legitimated gender inequality. The utilization that derives from location, physical condition, capacity and function, stakeholders, planning process, and financial mechanisms produce marginalization, subordination, stereotype, and double burden in time allocation, access, control, roles, and benefits of agribusiness development between a man and a woman farmer. The social, economic, and environmental impacts of utilization infrastructure present positive, negative, direct, and indirect affects that influence gender inequality. The response of people to gender inequality of the rural infrastructure is implied in elicited and emitted responses. An elicited response tends to develop gender mainstreaming, responsiveness, and advocacy program. An emitted response tends to be failure of the program to develop gender equality in agribusiness development. Adaptive capacity tends to mean a man farmer is more adaptable than a woman farmer. Women generally have fewer assets and access in agriculture, so they are more vulnerable. The phenomenon is related to *subordinate adaptation*. Women take a secondary role as an active strategy to adapt to gender structure.

A. Kusumastuti (✉)
Social and Political Science Brawijaya University, Malang, Indonesia
e-mail: asti.infinity@gmail.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_6

Keywords Rural infrastructure • Gender • Agribusiness • Impact • Response • Adaptive capacity

6.1 Introduction

To enhance the development of agribusiness, rural infrastructure is needed as a physical instrument to facilitate the development. The rural infrastructure delivers some mechanisms to reach the agriculture development and to establish the subsystems that should be accomplished by rural development. Roads, electricity supply, telecommunications, and other infrastructure services are limited in all rural areas, although they are an important key to stimulate agricultural investment and growth (FAO 1996). Supply of the basic infrastructure is an essential need for rural development, especially to reach agricultural development. It can facilitate those in agribusiness to accomplish economic growth in a rural area. Access for technologies in a rural infrastructure is a concern in gender behavior. It is mostly men who dominate the utilization of agriculture technologies in Batu.

A set of feasible productions and intrinsic functions of the infrastructure is important to explore infrastructure condition, capacity, and managerial aspects. The social behavior of the people forms the impact and dynamics of the community to respond and to adapt the rural infrastructure. Social behavior focuses on gender dynamics in access, control, and role between a man and a woman farmer. Gender condition produces gender division of labor in agricultural activities. Men are dominant in productive and public activities, and women are dominant in domestic activities such as meeting subsistent needs and the mothering of children.

This research represents a slice of several focus studies: rural infrastructure, access to gender behavior, and agribusiness context.

6.2 Gender Equality and Agriculture Development

As stated by the Commonwealth Secretariat (2001) gender can be defined as a set of characteristics, roles, and behavior patterns that distinguish women from men. These characteristics are constructed not biologically but rather socially and culturally. The sex of an individual is biologically determined, whereas gender characteristics are socially constructed, a product of nurturing, conditioning, and socio-cultural norms and expectations. These characteristics change over time and vary from one culture to another.

Many countries have their first commodity in agriculture, placing women in a weak position in productivity, providing less access to natural resources and assuming less capability. Cultural biases prevent women from active participation in group training and extension meetings, and the most important factor is in having access

to agriculture models such as land, water, and credit. Men have predominantly staffed these services and only 15 % of extension workers are women (FAO 1996). As mentioned by Razavii and Miler in Commonwealth Secretariat (2001), three aspects of women's roles that produce a double burden are the productive role, referring to subsistence production undertaken by women, the reproductive role, referring to the childbearing and child rearing responsibilities, and the community management role, which refers to activities undertaken by women to ensure the provision of resources to the community.

Infrastructure refers to services drawn from the set of public works that traditionally has been supported by the public sector, although in many cases these infrastructure services are produced by the private sector. Water supply, sanitation, transportation, electricity, telecommunications, irrigation dams, regulated markets, and banks are some of the examples of infrastructure that generate services (Venkatachalam 2003).

The rural infrastructure has public characteristics. It can be accessed by several communities that are related to this sector. Check dams for irrigation and micro hydropower for electricity are public resources to which people can have access. Men and women have equal accessibility to utilize the technology to increase their wealth.

Andersen and Shimokawa (2006) found that agribusiness becomes the starting point for rural people to enhance their economic development. As mentioned by Ogato et al. (2009), gender-neutral crop production and management of agriculture do not have the same advantages for rural male and female farmers (Fig. 6.1).

Agricultural development is essential for economic growth, rural development, and poverty alleviation in low-income developing countries. Gender equality in

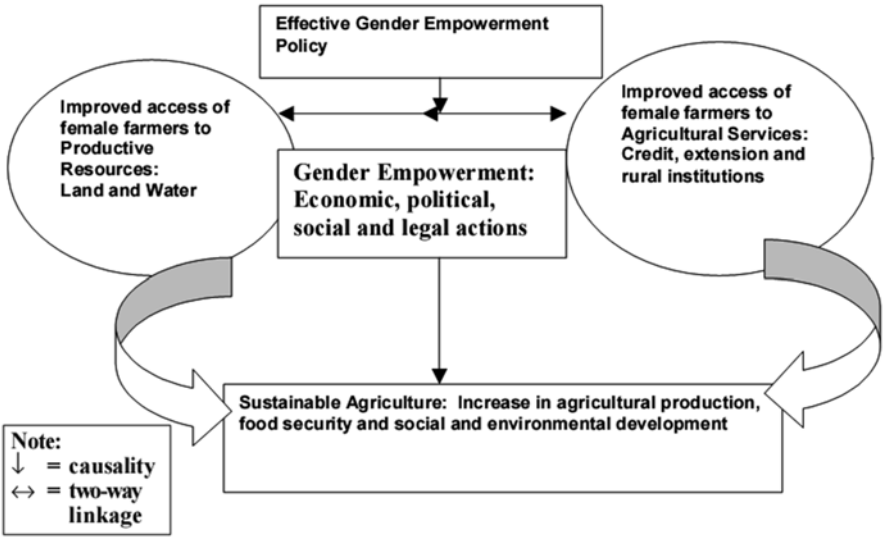

Fig. 6.1 Relationship between gender and sustainable agriculture (From Ogato et al. 2009)

agribusiness development is needed to preserve sustainable agricultural and rural development. With equal participation of men and women in agribusiness development, the number of people participating, both women and men, will increase to make balanced decisions and processes and to develop an equitable gender arrangement.

6.3 Methods

This research uses the qualitative approach to understand rural infrastructure, gender, and agribusiness phenomena by classifying, connecting, and describing. The results of the qualitative method are narrative data about perceiving human behavior, comprehending background, and explaining conclusions (Taylor and Bogdan 1984). The qualitative approach is conducted by qualitative data analysis and impact assessment. Qualitative data analysis is related to processes of describing phenomena, classifying data, and seeing how the concepts interconnect (Dey 1993). As mentioned by Strauss and Corbin (1990) as analytical procedures, qualitative data analysis is related by categorizing data, annotating, and reviewing the main analytical procedures involved (Becker and Geer 1982). Miles and Huberman (1984) discussed category associations and data mapping, and Sayer (1992) stipulated discussing the linked data. Impact assessment analysis is another qualitative analysis in which the researcher assesses the impact of infrastructure. The analyses consist of studies to determine baseline, impact prediction, and identify wider economic impact (Morris and Therivel 2009).

Qualitative data are collected with in-depth interviews, focus group discussion, and observations and documentation in the hilly land and the flat land of Batu City. Selection of informants is conducted by purposive sampling with a snowball technique. Informant determination is directed to find a key informant or a certain social situation that holds much information according to the research focus.

6.4 Result and Discussion

6.4.1 Batu, East Java Province, Indonesia

Batu City is located in the East Java Province, Indonesia, having 19.909 ha or about 0.42 % of the total land space. Batu City undergoes a cycle of double seasons, the rainy and the dry season. In 2010, Batu City was divided into three districts (Batu, Junrejo, Bumiaji), 24 villages/sub-districts, 231 communities (RW), and 1,092 neighborhoods (RT).

On a topographic basis, Batu City can be divided into two main parts, sloping or hilly parts and the flat land. The hilly land of Batu City is categorized as being 850 to 1,500 m above sea level. Tulung Rejo village, which has check dam irrigation,

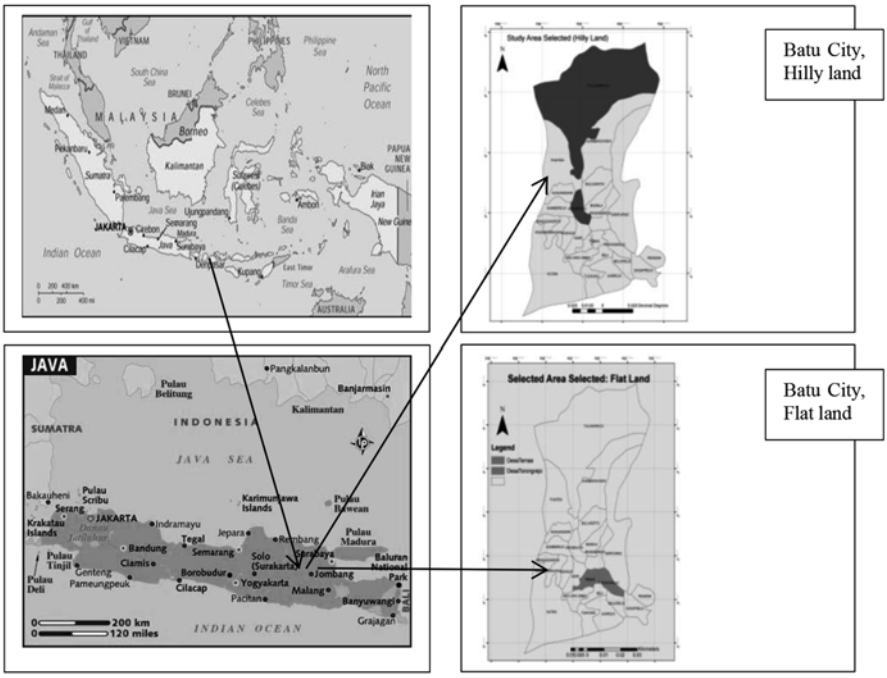

Fig. 6.2 Study area, Batu City, East Java, Indonesia, divided into two areas: hilly land and flat land

and the Sidomulyo villages, a location for micro hydro power, provide a rural infrastructure for agribusiness. There are in total 509 farmer workers, with 414 men and 95 women. The percentage of women is 18.66 % and that of men 81.33 %. Men handle all the productivity, and women have roles in processing products, but the power of the men has also occupied this subcategory.

The flat land of Batu City is categorized as 600 to 840 m above sea level. There, Torongrejo village has check dam irrigation and Temas village has micro hydropower. There are 328 male workers, about 92.13 % of the total farmers. There are 28 women workers or about 7.86 % of the total farmers. Male farmers occupy more than 20 ha of land and women farmers less than 15 ha. The lesser participation of women in economic agriculture activities is related to their physical strength in performing crucial tasks in the harvesting process (Teng 2011) (Fig. 6.2).

6.4.2 Location and Gender Impact

Location theory addresses the importance of who produces goods, the location, and why. Von Thunnen in Rosenberg (n.d.) stated the optimal location between city and farm. In the Von Thuneen model, concentric rings of agricultural activity develop

Item / Topo-Graphy	Rural Infra-structure (farm production)	Location (Travel time to Market)	Gender Time Allocation per day	Gender Impact	Gender Status
Hilly Land of Batu City	Check Dam Irrigation & Micro hydro power	Long time (Far location will increase travel time)	• Men → spend in productive role and social activity • Women → spend in productive, reproductive, social activity	Men have much time to travel in long time to market because their time allocation is longer than women.	Legiti-mated gender inequality
Flat Land of Batu City	Check Dam Irrigation & Micro hydro power	Short time (Near by location will decrease travel time)	• Men → spend in productive role and social activity • Women → spend in productive, reproductive, social Activity	Woman has a chance to reaching market in short time because their time allocation per day still can be divided.	Legitimated gender equality

Fig. 6.3 How location of infrastructure toward market affects gender status

around a city. Once produced, perishable goods need to reach the market as soon as possible. Therefore, this production is located in the rings close to the city. Animal husbandry production is located outside the rings of the central city.

Based on location and distance relative to the market, the rural infrastructure in the hilly land is further away than that in the flat land. Although the road and transportation infrastructure have been well realized, the distance and time allocation to reach the market is another consideration for accessibility to the market system. With proximity, the farmer in the flat land has easy access to the market. Therefore, a shorter distance to the market system can reduce travel time and facilitate women being involved in sales activities in market without spending much travel time. Thus, an accessible location provides easy access of women to economic sources, with travel time between farm production and the market being a consideration. The shorter travel time will be useful for a woman who spends much time in reproductive, productive, and social roles (Fig. 6.3).

6.4.3 Physical Condition of Rural Infrastructure

The physical condition of the rural infrastructure in Batu City can be divided into two characteristics, the hilly area and the flat area. Because of the different topography of the land, the physical conditions of check dam irrigation and micro hydro power have a different appearance.

Functional specification is one method to observe the physical condition of the infrastructure based on whole system design analysis. Whole system design (WSD) is a process through which the interconnections between sub-systems and systems are actively considered. Solutions are sought to address multiple problems by means of one and the same solution (Stasinopoulos et al. 2009) (Fig. 6.4).

Functional specification, that consists of the physical condition of the rural infrastructure, implies that many kinds of service, operating conditions, target specification, and program requirements that are addressed to improve agribusiness development are directed just to men. In the hilly land of Batu City, women do not have access to control and to participate in rural infrastructure provision as this is related to work with machinery, work which men are more suitable than women to control. In the flat land, women are given a chance to control and access irrigation resources. They can access check dam irrigation because it has been developed in a small capacity. Women are associated with softness and refinement. So, if there is a kind of small work that does not really require male effort, it will be handed to women. Based on functional specification rules and physical conditions, the rural infrastructure in Batu can influence gender development.

6.4.4 Capacity and Function of Rural Infrastructure

Capacity and function in the *whole system design approach* can be derived in conceptual design. Conceptual design is a system that provides abstract solutions which are expected to satisfy the requirements of the users from all functional, economic, technological, and service provisions (De Jong 2009).

Check dam irrigation in hilly land has been established with a large capacity. The water regulated with a check dam can irrigate several villages in Batu City, such as Punten, Bulukerto, Pandanrejo, Bumiaji, and Sumbergondo. Because of its capacity, the dam requires the power of men as operators who have the nature do important work and influence many people. The patriarchy culture insists that this big work is suited to men. Thus, men are more preeminent than women.

The function of a check dam in flat land is to reduce channel erosion and set up the flow of water for an irrigation network. The check dam functions as a supporting barrier in hilly land to slow the velocity of channel flow. Because it has a small capacity, the number of fields that have been irrigated also are small. Rural infrastructure in flat land shows different tendencies. Although gender inequality and patriarchy culture are still dominated by men, women are able to access and control the rural infrastructure. Women in flat land can access the rural infrastructure because the physical condition of land require a lesser capacity. With small capacity and less responsibility, it is assumed that women can control rural infrastructure.

The function of micro hydropower in hilly land and in flat land is to supply electricity in Batu City to develop manufacturing industries. The functions of both are to light rural roads. The functions of capacity and hydropower are to create and to develop processing products of agriculture that is directed to

Rural Infrastructure in Hilly Land and Flat Land of Batu City (Functional Specification)		
Boundaries	System of interest	: check dam irrigation and micro hydro power
	Wider system of interest	: farming water supply
	Operating environment	: village / district
	Wider environment	: region
Service Specification	Service requirements →	Providing service for production and processing of horticultural product.
	Customer requirements →	Increasing agriculture product with adequate irrigation and maximize processing product.
	Performance requirements→	Reliability, adequately
Operating Condition Specification	Woman in hilly lamd does not have an access to control and to participate in rural infrastructure provision. It related to machinery work in which men more appropriate to control than women. Women in flat land is given chance to control and access irrigation resource. They can access check dam irrigations, because it has capacity to develop in small capacity and the technology that they use is safer for women.The job is appropriate with men workmanship. Women do light activity.	
Target specification	Improve service water and utilization of renewable energy for agribusiness development.	
Program requirement	Improve service water and renewable energy for agribusiness development through check dam irrigation and micro hydropower by considering gender equality.	

Fig. 6.4 How physical condition of rural infrastructure affects gender condition

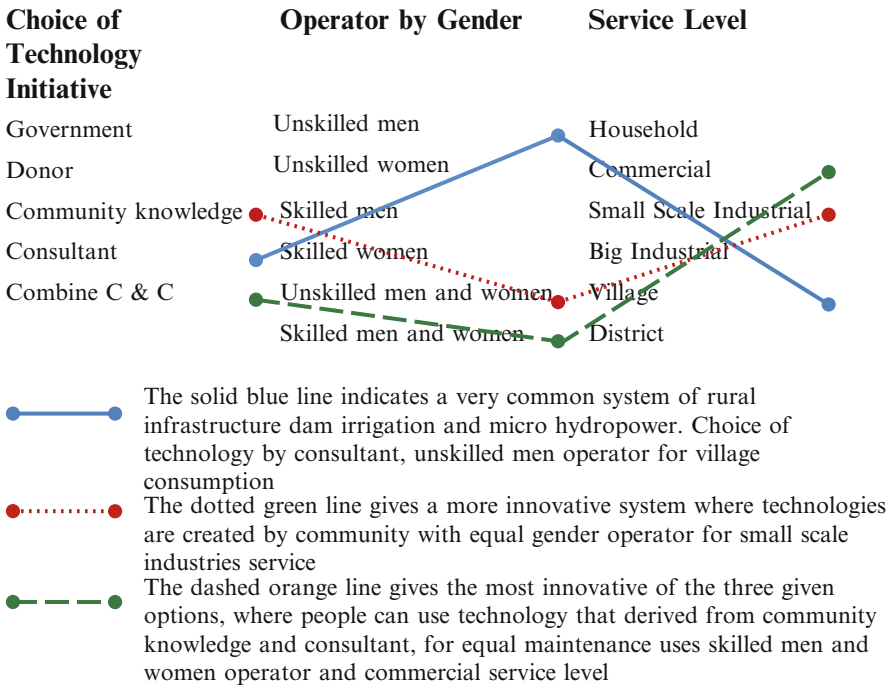

Fig. 6.5 Morphological method system of rural infrastructure: dam irrigation and micro hydropower

women's work. In fact, the utilization of micro hydropower is not directed to the work of women. Working on electricity machines is suitable for men. A gender stereotype has been produced in this capacity and function for electricity machinery in rural areas.

Rural infrastructure in the hilly land of Batu City is still far from agribusiness goals, and it also indicates gender gap. Based on whole system design, the conceptual system drives to improve service water and renewable energy for agribusiness development with gender equality consideration. To conceptualize a design, the researcher used a morphological method for generating multiple alternatives. The morphological method is an analytical method to create alternatives.

The task is to design a new type of rural infrastructure check dam irrigation and micro hydro power. To start with, three basic functions are defined: the choice of technology, the type of operator to maintain it, and the level of service. In Fig. 6.5, the solid blue line indicates a very common system of rural infrastructure: dam irrigation and micro hydropower. The dotted green line shows a more innovative system. The dashed orange line indicates the most innovative of the three given options.

6.4.5 Stakeholder Analysis of Rural Infrastructure Development

The stakeholder is a person who is responsible for the infrastructure project. Stakeholders consist of institutional and community members, who have different tasks for one goal for infrastructure development. There are ten actors of rural infrastructure utilization in hilly and flat land. The first actors are a group with a direct interest in the project. The second level are the intermediate role and intranet portal project. The third group are external stakeholders who are not involved or affected, but have influence for or against the opinions.

Men and woman farmers are primarily stakeholders who have direct interests in the project. The public company of Jasa Tirta and the Department of Energy Mineral Resources becomes the second stakeholders with a role in an intranet portal project. They maintain the project development regularly based on the government's program. Potentially, construction, consultant, and contractor companies become second stakeholders with negative impact. Private sectors usually earn profit for the project; they are not doing the project properly. Land owners, local government, international funding, NGOs, and mass media can try to achieve the goals of a project, but sometimes there are obstacles such as resistant people, conflict between donor institutions, and mass media that create public opinion about disagreement within the project.

Although men and women become primary stakeholders who try to achieve the goals of a project, women still become decision makers secondarily after men. In gender terms, women will indicate subordination. Subordination is revealed when women are excluded from social production and become legally subordinated to men.

6.4.6 Planning Process of Rural Infrastructure

Infrastructure development needs a planning process to lead the project. The public infrastructure planning process (Goodmen and Hastak 2006) consists of several phases: establishment of goals and objectives, problem identification and analysis, solution identification and impact assessments, formulation alternatives and analysis, and recommendations, decisions, implementations, operations, and management, including monitoring and evaluation.

From all processes of the infrastructure planning process, utilization of rural infrastructure in flat land is better than in hilly land. Utilization of flat land is adequate to all planning processes from objectives until evaluation.

This process does not involve women in all phases. Women are considered less able to perform a variety of public activities. There is no space for women to contribute to the implementation and evaluation of an infrastructure. Women become marginalized by the existence of the agricultural system. Anita Van Velzen (1994)

said that marginalization was a process in which relationships between women and men change in such a way that women were increasingly cut off from having access to vital resources, which became monopolized by men.

On the other hand, the planning process of infrastructure implies gender responsiveness. Reducing natural disaster, increasing the irrigation system, and developing electricity are several goals that create equal participation of men and women. Increasing the irrigation system is expected to improve men's farming production activity. Developing a electricity system is expected to improve the ability of women in processing products of horticulture. Reducing natural disasters related to environmental sustainability is related to eco-feminism philosophy. The philosophy of ecofeminism sees a human being from the ecological approach and as holistic. The human being is holistically structured, in agreement with other natural environments and humanity, braiding and creating harmonious patterns between one person and others. A human being is not only created in harmony with nature but also with other human beings, including harmonious relationships between women and men (Fatimah and Lasiyo 2004). In term of gender equality, both areas in Batu City still show gender inequality and marginalization of women, although the planning process of infrastructure implies gender responsiveness.

6.4.7 Financing Mechanism of Rural Infrastructure

An international donor is one of the financial institutions that impose specific allocations for promoting gender equality and empowering women. This goal is internationally recognized as a common set of objectives to be achieved by 2015 in The Millennium Development Goals (MDGs). Agencies and donors have recently renewed their efforts to alleviate poverty in developing countries. But the gender policy statement of a donor is not accompanied by implementation. Beneficiaries of an infrastructure project are more widely accepted by men than women. The status role of men in agribusiness is dominated by agriculture productivity. When check dam irrigation and micro hydropower energy structures have been built, the benefits are widely welcomed by men who dominate productivity in agricultural work.

The new utilization of an irrigation system is widely accepted by the man, who is the first actor of agriculture productivity. New institutions and participation are dominated by men because it is assumed that they are more worthy of care than women. Women are given supporting tasks in the implementation process, such as spraying. The planning and decision making of irrigation regulation are still dominated by men. Men can control the infrastructure continually because they have access to information. The information can be sourced to connect economic resources. Men know more about public infrastructure than women. Because of this information, men can access and control all the interests of agriculture production.

The regulation of the Ministry of Agriculture No. 02/Permentan/OT.140/1/2012 about guidelines for management of social assistance agriculture ministry for fiscal year 2012 implies that social assistance in agriculture should apply to gender

mainstreaming, allowing women to participate, to access, to control, and to get benefits from all programs. Gender mainstreaming is still not integrated into various infrastructure programs. Although there are different roles and statuses in agribusiness work, conditions in the flat land are more gender equitable than in the hilly land. Woman and men can be together to access, to control, and acquire benefits. The financial mechanism from the government can assist people who get a project. Assisted by an official agent of agriculture, gender awareness is built in more widely. A woman farmer can join in to be a decision maker of the agriculture infrastructure program.

Analysis in gender inequality reveals that equal participation of women in economic resource activities is rather lacking, which has a negative impact on growth. Gender inequality experiences can occur in four processes (Murniati and Nunuk 2004): marginalization, stereotyping, subordination, and double burden.

6.4.8 Gender Analysis of Agribusiness Development

Men and women have different burdens. The double burden still belongs to the women predominantly. Women not only participate in the domestic sector but also in public and social sectors. They are surrounded by a patriarchy culture and gender inequality that produces marginalization, stereotypes, subordination, and the double burden (Fig. 6.6).

Allocation Time	Women	Men
Productive activity (farming/public)	Women do farming activity, like seeding, spraying, pulling out the grass, manufacture process and seller. The activity supports farming and doing implementation activity of farming	Men do farming activity like land cultivating, regulator for irrigation system, manufacture process and seller. The activity is primary and be the first decision maker of agriculture product.
Reproductive activity (child care/domestic)	Women in charge of caring for children and providing food	-
Social activity	Social gathering activity like: pengajian (religious activity), arisan (economy activity and gugur gunung (environmental activity)	Social gathering activity like: pengajian (religious activity), arisan (economy activity and gugur gunung (environmental activity)

Fig. 6.6 Gender of allocation time analysis

The allocated time of the woman in public activity supports her husband on the farm in such work as seeding, spraying, pulling grass, manufacturing, and selling. They also fill domestic roles. Allocation time of men in public activity dominates in the public agriculture sector. Men do farming activities such as cultivating the land, regulating the irrigation system, and the manufacturing process and selling. This activity is primary and men are to be the first decision makers of agriculture products. Per day, they perform public activity from 7 a.m. until 2 p.m., or longer, depending on the situation in the fields. In Batu City, based on allocation time per day, gender inequality exists in the double burden. The double burden is seen when the allocation time of woman per day is used for several activities. Men are associated with public activity, which has the primary role and status. Relationships between men and women change in such a way that women have less access than do men to vital resources.

The profile of access, control, role, and benefits of the agriculture sector will help to identify gender gap. The gender gap in agribusiness activity can be determined in three aspects: modal productivity, processing products, or the manufacturing and market system. The access, control, role, and benefits between men and woman in flat land are more equitable than in hilly land. In hilly land, agriculture production is occupied dominantly by men. Women have limited access to water, land, infrastructure, and modal. In flat land, although agribusiness work is dominated by men, the number of women who have access, control, roles, and benefits are approaching equal conditions. They have control and benefits in modal technology and skills. They also have access, control, roles, and benefits in modal networking and skills.

Although the level of women's accessibility in flat land is higher than in hilly land, gender inequality is still preserved through many processes that cause women's participation in economic production to not experience qualitative growth. The status expectations theory explains how gender is related to power influence. The theory assumes that males enjoy higher social status than females. Both men and women typically enter groups with expectations that men will behave more competently than women, who move into a group toward task achievement. Therefore, an individual woman attempts to counteract the members of both sexes who will reject them as inappropriate (Meeker and Weitzel-O'Neill 1985, in Chafetz 2006).

In hilly land, there are several factors threatening gender inequality: norms, culture, ethics, social stratification, and self-factor. Culture in Batu is monopolized by masculinity and patriarchy. Men are more appropriate than women for public activity; the woman's role is in domestic activities. The demography factor is one factor that determines gender inequality in the hilly land of Batu City. The birth rate is high because many farmers are married young; the average age are 18, and they already have children. The women carry out the domestic role in their house. Domestic roles such as reproductive activity are assumed as a secondary activity in the social system. Huber (1991) focuses on the negative impact of high fertility rates on the relative status of women. It emerges as a new stereotype that women have a weak image that is only appropriate for domestic work and childcare. Guttentag and Secord (1983) discuss the effects of skewed sex ratios on women's opportunities to marry when they cannot participate in the labor forces. The self-factor becomes

another constraining factor in increasing gender equality. Women feel that they are not important as public decision makers. In the social system of the study area it is assumed that women have weaknesses as public decision makers. The level of the economy and the level of education become opportunities to increase gender equality.

In the hilly land many women have less knowledge about gender equality. The relationships of men and woman are still *taken for granted*. They assume that the role and status of men and women are parts of the destiny that they have to follow. Economic level becomes one factor to increase gender equality, economic power, or the extent to which women produce economic surplus, especially controlling the products or income derived from their labor. Blumberg (1984) said that the more economic resources women produced and controlled, the lower was the level of gender stratification. Most women work to support their husband; they do not have economic power and resources. With fewer economic resources, they are subordinate in policy, planning, and implementation of the agriculture program. All these macrostructural systems cause women to lack confidence in themselves. Culture, environment, technology, and economic, demographic, and political systems are developed by the male side. In general, the condition of the hilly land of Batu City is still influenced by gender inequality in the agricultural sector.

In flat land the conditions tend to be different. Several gender inequality factors influence gender inequality. As in the hilly land, gender inequality is influenced by norms, culture, society response, demography, economy, education, and the self-factor. However, the number of factors threatening gender inequality is less in flat land than in hilly land. The number of opportunities of gender equality factors is better in the flat land. Norms, culture, ethics, demography, and self-factor are still the first constraints on increasing gender inequality. But, society's responses about gender are different than the response of society in the hilly land. In the flat land, the people's response is *not taken for granted* with gender role status. Men and women work together in the agriculture program, although there is still gender subordination in agricultural work. Many farmers have gender awareness including a balanced coordination between men and women in agriculture programs. Men and women have the same opportunity to produce an economic surplus and to reach a level of education.

Conditions in the flat land are more gender equitable than in hilly land. The characteristics of society and gender awareness in agricultural work are different between hilly land and flat land. The hilly land has traditional community characteristics, and one of these traditional society characteristics is collective action. Parson (1960) said that collective action was a social relationship marked by individual action orientation related to what was assumed to be well by social values and norms in society. Society will be obedient to social values and norms that are in society for a collective purpose. As in Batu City, the society characteristic tends to be obedient to social norms and social values about the relationship of men and women.

The flat land condition tends to have a different situation: the gender situation is more developed than in hilly land. The cause of the society characteristic shows a

modern society. The modernity phase as mentioned by Giddens (1990) is the shifting of social relationships and transferring of information specifically through space and time. The new social relationship is developed in the flat land areas in Batu. New social interactions are created between men and women who have a balanced relationship. According to Giddens' theory, modern characteristics can change social interactions among people and create renewals that are adopted by society and instituted as new social values.

6.4.9 Impact, Stakeholders' Response, and People's Adaptive Capacity

6.4.9.1 Impact

Wolf, in Morris and Therivel (2009), defines social impact as an estimating and appraising of the condition of society organized and changed by the large-scale application of high technology. The development of check dam irrigation in hilly land is not involving the community as a user. Management of the infrastructure is just focused on the coordination between donor, private construction, and government. On the other hand, a social impact that occurs is decreased crimes. People believe that as micro hydro power makes road lighting possible, it decreases the number of thefts. Utilization of infrastructure is also improving social cohesion with the number of meetings that they have taken. On the other hand, the meetings just accommodate male coordination. When women are subordinated by men, they have fewer economic opportunities. Agribusiness just pays attention to the workmanship of men and marginalizes women. Improving the access of female farmers to productive resources such as water and land can play a significant role in enhancing sustainable agriculture (Ogoto et al. 2009).

Economic impact can be derived in every step of a project that consists of construction, operation, and the maintenance process. Every step has economic benefit to income generation and local economy development. The scope of the economic impact of check dam irrigation and micro hydropower can be explained in direct or indirect expenditure (Moris and Therivel 2009). Direct economic impact occurs in local and nonlocal employment and labor supply. Wage level results from the number of laborers hired. Further impact of utilization infrastructure can increase local economic development.

Environmental impact prediction can occur in the construction phase, in operation, and post operation. The characteristics of impact can be positive, negative, direct, or indirect. Environmental awareness becomes the most significant aspect that should be determined in infrastructure utilization, based on observations that several impacts occur in the environment directed to habitat and biodiversity threats. The development of infrastructure was supposed to consider plants, habitats, and biodiversity in the environment, not only developing an infrastructure for human benefit but also sustaining the lives of the planet and ecosystems. The paradigm of

human nature is superimposed on the anthropocentrism paradigm. Ecocentrism is or would be radically egalitarian for such objects as rivers, lakes, and the source of value in nature (Brown 1995). The paradigm of anthropocentrism should be eliminated with ecocentrism and the ecofeminist paradigm for sustainable environmental interactions.

6.4.9.2 Stakeholder Response

Response is the ability to manage threats on a range of issues depending on the level and severity of morbidity experienced. Based on interviews, several stakeholder responses to face gender inequality in agriculture were gathered. Stakeholder response is one important way to know how public policy has developed the regulations and rules to solve the inequality gender factor for sustainable agribusiness development.

Government as a decision maker has responses through their policy and regulation of problems that occur in society. The gender empowerment policy in agriculture has the compliance of social empowerment and agriculture service. Women are organized and given some access to credit, extension, and training, for example. But gender empowerment agriculture policy in Batu still does not meet the aspects of legal, political, and productive resources. Ogato et al. (2009) mentioned the principal empowerment of the gender empowerment model consists of adequate *legal empowerment* in legislative reform, *political empowerment* with politic advocates, *social empowerment* for organized female farmer, *productive resources* to produce agriculture output with land and water, and *agriculture service* to support production and management for agriculture products.

The private sector in agribusiness work gives the same chance to men and women workers to participate in the economic resource of agribusiness, but the level chance of men and women differs. Men have the main role of agribusiness activity and women are secondary supporters. Gender stereotype and subordination still occur in private work in agribusiness. Men have the strong and dominant gender characteristic.

Responses from NGOs are mostly concerned with equal rights of men and women. The basic principles of the equality is similar to the Victorian era belief in sex differences. Both genders need to change, women by assuming more of the rational, competitive, and adventurous attributes of men, and men by taking on the peaceful and nurturing attributes of women (Taft and Gillman, in Chafetz 2006). It is similar with the NGO response that they will bring the conditions in which women can be main actors, the conditions being women can work in a public area and men can be allowed to do domestic jobs. There is no gender stereotype, which limits them to change their role and status. Furthermore, a woman who is in the disadvantaged group is encouraged to explore herself in accordance with her will and talent. Every woman has equal rights, the same as the others, men who have the right to grow.

6.4.9.3 People's Adaptive Capacity

Adaptation can be referred to as changes and modifications that enable a person or group to survive in a given environment. This is the core of the theoretical construct in the field (Mc Elroy in Wiley 1992). There are two main analytical modes in adaptive capacity (Hardesty and Little 2002) of individual action that are designed to improve their productivity and group action, achieved by interactive behavior of an individual with other individuals, which are usually constructed by the rules of reciprocity. Men are more adaptable in agribusiness work than women. They still can maximize the existing agriculture work given to them. Credit, land, and infrastructure are available to men's interest.

The differences in role, resource, and power between men and women in agribusiness produce inequality and vulnerability for women. Women have performed social adaptation. The women have shown adaptation abilities such as helping a husband to create a processed product, become a peasant, create a small business enterprise, and conduct agribusiness training; these are subordinate adaptations. Subordinate adaptation is a woman's strategy to adapt to the gender structure.

In the hilly land a woman has a weaker adaptation than the men. Women are likely to be more vulnerable. Women adaptation in gender shows the acceptance of culture condition. Schwalbe in Risman (2004) suggested that there were other generative processes that inequalities create and produce in everyday life. Some of the processes are subordinate adaptations. The adaptation of people in the flat land tends to be similar. There are inequality situations between men and woman in the production of agriculture. Besides agriculture, women try to improve their economic resources in other sectors, whereas in the hilly land, women try to obtain the economic resource in agriculture. In the flat land, women try to obtain economic resources other than agriculture.

Men in the study community have largely been able to adapt to agribusiness development. Men typically become the main actors of agribusiness, have more powerful information about agriculture, and have better finances and the responsibility for producing valuable public crops. Based on status expectation theory (Ridgeway and Correl in Risman 2004), women are expected to make have less contribution to task performance than men, unless they have some other externally validated source of prestige.

6.5 Conclusion

1. Utilization of rural infrastructure, check dam irrigation, and micro hydropower progressively legitimates gender inequality.
2. Based on topographic area, utilization of rural infrastructure in the flat land is more gender equitable than in the hilly land. Although in the general situation there are areas with gender inequality in the rural infrastructure, the flat area tends to be more gender responsive.

3. Gender condition in Batu shows gender inequality in time, access, control, benefit, and roles between men and women in agribusiness development.
4. The social, economic, and environmental impact of utilization infrastructure presents positive, negative, direct, and indirect impacts that produce gender inequality. Cohesion is developed only by male domination and produces gender bias as indirect impact; the local employment and agribusiness sector are dominated by men and will cut off a female farmer from having economic resources. On the other hand, management of the infrastructure is dominated by men in power.
5. The response of people toward rural infrastructure in gender development has many variations. Government response tends to be more concerned with gender mainstreaming programs. Private response also tends to be concerned with a gender-responsive program. NGO response tends to focus on gender advocacy programs.
6. Men are more adaptable than women in the gender structure of agriculture. Women generally have fewer assets and access in agriculture, so they are more vulnerable. This phenomenon is related to *subordinate adaptation*. Women have an active strategy to adapt toward gender structure.
7. Based on the topographic area, women's adaptation in agriculture shows different tendencies. People in flat land, especially for woman subordinate adaptation, tend to adjust with agriculture work. Women's subordinate adaptation in hilly land not only adjusts to agriculture work but also identifies other sources, such as the service sector; this is the result of modernity and different urban development characteristics between the two areas.

References

Andersen, P. P., & Shimokawa, S. (2006). *Rural infrastructure and agricultural development* (Annual Bank conference on development economics). Tokyo: Cornell University. Retrieved October 26, 2011.

Becker, H., & Geer, B. (1982). *Participant observation: the analysis of qualitative field data*. London: Allen & Unwin.

Blumberg, R. L. (1984). A general theory of gender stratification. In R. Collins (Ed.), *Sociological theory, 1984* (pp. 23–101). San Francisco: Jossey-Bass.

Brown, C. S. (1995). Anthropocentrism and ecocentrism: The quest for a new worldview. *The Midwest Quarterly, 36*(2), 191–191. Retrieved from http://search.proquest.com/docview/195705622?accountid=13771.

Chafetz, J. S. (2006). *Handbook of the sociology of gender*. Houston: University of Houston Department of Sociology.

Commonwealth Secretariat. (2001). *Gender mainstreaming in agriculture and rural development: A reference manual for governments and other stakeholders*. London: Commonwealth Secretariat, Marlborough House Pall Mall. Retrieved February 8, 2012.

De Jong, L., Zuidgeest, M., Olthof, M., & Tax, N. (2009). *Functional design*. Yogyakarta: Management of Infrastructure and Community Development.

Dey, I. (1993). *Qualitative data analysis: A user-friendly guide for social scientists*. London: Routledge.

Fatimah, S., & Lasiyo. (2004). *The philosophy of Eko-Feminism's critique to the concept of husband leadership in family* (Program Studi Ilmu Filsafat). Yogyakarta: Postgraduate Program GadjahMada University.

Food and Agriculture Organization of the United Nations. (1996). *World food summit*. Rome: FAO.

Giddens, A. (1990). *The consequences of modernity*. Palo Alto: Stanford University Press.

Goodmen, A. S., & Hastak, M. (2006). *Infrastructure planning handbook: Planning, engineering and economics*. New York: McGraw-Hill.

Guttentag, M., & Secord, P. (1983). *Too many women? The sex role question*. Beverly Hills: Sage.

Hardesty, D., & Little, B. J. (2002). *Assessing site significance: A guide for archaeologists and historians*. Lanham: Altamira Press.

Huber, J. (1991). Macro-micro links in gender stratification. In J. Huber (Ed.), *Macro-micro linkages in sociology* (pp. 11–25). Newbury Park: Sage.

Map, S. C. (2008). *Human rights and social justice in a global perspective*. New York: Oxford University Press.

Miles, M., & Huberman, M. (1984). *Qualitative data analysis*. Beverly Hills: Sage.

Morris, P., & Therivel, R. (2009). *Methods of environmental impact assessment* (3rd ed.). New York: Routledge.

Murniati, A., & Nunuk, P. (2004). *Getar gender: Wanita Indonesia dalam Sosial, Politik, ekonomi, Hikin dan Hak Azasi Manusi*. Magelang: Yayasan Indonesia Tera.

Ogato, G. S., Boon, E. K., & Subrameni, J. (2009). Improving access to productive resources and agricultural services through gender empowerment: A case study of three rural communities in Ambo District, Ethiopia. *Journal of Human Ecology, 27*(2), 85–100. Retrieved February 8, 2012.

Parson, T. (1960). Pattern variable revisited: a response to Robert Dubin. *American Sociological Review, 25*, 467–483.

Risman, B.J. (2004, August). Gender as a social structure: theory wrestling with activism. *Sage Publication: Gender and Society*, *18*(4), 429–450. Retrieved June 18, 2012.

Rosenberg, M. (n.d).The von Thunen model: A model of agricultural land use. Retrieved December 29, 2013, from http://geography.about.com/od/urbaneconomicgeography/a/vonthunen.htm

Sayer, A. (1992). *Method in social science: A realist approach*. London: Routledge.

Stasinopoulos, P., Smith, M. H., Hargroves, K., & Desha, C. (2009). *Whole system design: An integrated approach to sustainable engineering*. London: Earthscan.

Strauss, A., & Corbin, J. (1990). *Basic of qualitative research: Grounded theory procedures & techniques*. Newbury Park: Sage.

Taylor, S. J., & Bogdan, R. (1984). *Introduction to qualitative research methods: The search for meanings* (2nd ed.). Toronto: Wiley.

Teng, L. W. (2011). Gender and livelihood: A case study of the Mah Meri and the oil palm plantations of Carey Island. *Asian Journal of Women's Studies, 17*(2), 66–95.

Van Velzen, A. (1994). *Who is the boss? Marginalization and power in Food-Processing Household Enterprises, West Java, Indonesia*. PhD thesis, Masterdam University.

Venkatachalam, L. (2003). *Infrastructure and agricultural development in Karnataka state*. Bangalore: Agricultural Development & Rural Transformation (ADRT) Unit Institute for Social and Economic Change Nagarbhavi. Retrieved October 26, 2011.

Wiley, A. S. (1992, September). Adaptation and the biocultural paradigm in medical antrophology: A critical review. *Medical Anthropology Quarterly, New Series, 6*(3), 216–236. Retrieved June 18, 2012.

Chapter 7
Use of Indigenous Filipino Food Ingredients in Processed Meat Products

Emelina A. Lopez, Maria Salve D. Chavez, and Marie Karen M. Dumangas

Abstract The main objective of this research is to standardize processed meat recipes which made use of Filipino food ingredients to come up with quality products that align to food safety and security. Sources of the original recipes were the grand prize winners of the annual meat processing contest conducted by the Animal Products Development Center – Bureau of Animal Industry from 1998 to 2007. The products are Buffalo Meat Loaf, Carablossom Burger, Chevon Supreme, Jack Burger, and Pork Veggie Dumplings. Among the factors used for choosing these products are popularization of meat commodity, availability of raw materials, and production cost. The original recipes used household measurements (cup or teaspoon), and some were not properly processed and packaged. Therefore, measurements were converted to weights (kg or g), and processing and packaging of each product were standardized to sustain their quality and safety throughout their storage life and in preparation for bigger scale processing. Sensory evaluation in laboratory scale was conducted using the 5-point intensity scale for the descriptive test and 9-point hedonic scale for the acceptability test. The most acceptable product formulation was subjected to shelf life study through microbiological analysis (total plate count) and sensory evaluation. The canned products were tested for commercial sterility. Value-adding food in processed meat products with Filipino indigenous ingredients can be economically advantageous especially in the countryside where agricultural products abound. Most of all, these products are alternative ways of preparing safe and quality foods aside from the common menu that Filipinos are accustomed to.

Keywords Indigenous ingredients • Processed meat products

E.A. Lopez • M.S.D. Chavez • M.K.M. Dumangas (✉)
Department of Agriculture, Bureau of Animal Industry,
Animal Products Development Center, A. Fernando St.,
Marulas, Valenzuela City 1441, Philippines
e-mail: apdcmarulas@gmail.com; apdc@manila-online.net

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_7

7.1 Introduction

The Philippines is blessed with a fertile soil that supports the growth of many agricultural products that can be available year-round although some are seasonal. The country is also home to various food animals that can be sources of meat. It just takes creativity and ingenuity together with science to utilize these rich resources and come up with value-added foods such as processed meat products with Filipino indigenous ingredients. These food formulations will result to products that are not only nutritious and safe to eat but are also low cost and, thus, can be made affordable to the general public. This can also help alleviate poverty through opportunities in agro-processing, specifically meat processing.

In this study, processing and packaging of five products were standardized, namely, Buffalo Meat Loaf, Carablossom Burger, Chevon Supreme, Jack Burger, and Pork Veggie Dumplings. Among the factors used for choosing these products are popularization of meat commodity, availability of raw materials, and production cost. The original recipes were grand prize winners during the annual meat processing contest held in 1998–2007 at the Animal Products Development Center – Bureau of Animal Industry. One of the criteria for the contest is the use of indigenous ingredients. The main objective of this research is to standardize processed meat recipes which made use of Filipino food ingredients to answer food safety and security. The specific objectives are as follows:

- To standardize processing procedures
- To determine the shelf life

7.2 Materials and Methods

The measurements of ingredients used in the original recipes were household measures (in cups or teaspoons). They were converted and expressed in weight (kg or g) to achieve uniformity and quality in every production.

Fresh meat materials and other ingredients were purchased from local sources. The products were prepared according to the original procedures. Modifications were made in areas where they were inappropriate for commercialization and where food safety could be compromised.

The cooking time of ready-to-eat products was standardized. For Buffalo Meat Loaf and Pork Veggie Dumplings, the internal temperature of the cooked product was measured by inserting a 2 mm probe meat thermometer. It should reach 72 °C. Temperature of the cooking medium was also measured. For the canned product, Chevon Supreme, thermocouples were inserted into the geometric center of three cans following closure of the container. The amount of heat which the product received was monitored using CTF 84 digital thermometer and *F*-value computer (Ellab A/S, Krondalvej 9, DK-2610 Rodovre, Denmark). Processing time and temperature were standardized based on target *F*-value of 6.0.

One factor that affects product quality and safety especially during storage is packaging. The primary function of packaging is to protect products from undesirable impacts on quality which includes microbiological and physicochemical alterations (Heinz and Hautzinger 2007). The original packaging material for Buffalo Meat Loaf was aluminum foil, but it was changed to cook-in casings (vector 6, 55 mm; MGM Commodity, Inc., Philippines) for a more stable product. Pork Veggie Dumplings were vacuum packed in a laminated nylon polyethylene (NYPE) bag (85 μ; MGM Commodity, Inc., Philippines) instead of just heat sealing them in polyethylene (PE) bags.

Sensory evaluation in laboratory scale by ten panelists was conducted using the 5-point intensity scale for the descriptive test and 9-point hedonic scale for the acceptability test every after production trials. Adjustments were then made based on the results of the sensory evaluation.

The most acceptable product formulation was subjected to shelf life study to determine the stability of the products while being exposed at a temperature in which they are to be stored. Microbiological analysis [total plate count using standard plate count (Difco, USA)] and sensory evaluation were used to measure the acceptability of the products until such time that they are deemed unfit for consumption. For Chevon Supreme, it was tested for commercial sterility to check on the adequacy of the thermal process it underwent.

7.3 Results and Discussion

7.3.1 Buffalo Meat Loaf

This is a ready-to-eat product composed of buffalo meat, boiled banana, and some vegetables (Table 7.1). The original recipe made use of coarsely ground buffalo meat, but the product was dry and tough. Both ascorbic acid and Vitamin C powder were also used in excessive amount. These ingredients are the same and function to speed up curing reaction (Heinz and Hautzinger 2007). Thus, in the standardized recipe, the meat was emulsified, and sodium erythorbate (the more stable salt and cheaper form of ascorbic acid) was used at 0.25 g/kg of raw material. Some of the ingredients were also replaced: skimmed milk in lieu of buffalo milk and modified tapioca starch instead of potato starch. Furthermore, *Ginisa* (sautéed) flavor mix, a commercially available seasoning in the Philippines, was omitted in the standardized recipe since the addition of monosodium glutamate would already enhance the flavor. The processing steps involved chopping the mixture in a bowl chopper and stuffing the emulsion in cook-in casings with each piece weighing about 250 g. Cooking was done by immersing the products in water (75 °C) until an internal temperature of 72 °C was reached.

The flavor, color, and general acceptability were liked moderately. Juiciness, texture, and sweetness were rated as slight. Based on the shelf life test, the standardized product (Fig. 7.1) kept in the chiller (0–4 °C) lasted for 3 months and can extend up to 6 months if stored in the freezer (−18 °C). The product costs PhP 35/piece or USD 0.80 (USD 1 = PhP 44).

Table 7.1 Original and standardized recipe of buffalo meat loaf

Original recipe of carabeef loaf (translated from Filipino)		Standardized recipe of buffalo meat loaf	
Meat materials	*Weight*	*Raw materials:*	*Quantity*
Buffalo meat, ground, lean	700.00 g	Buffalo meat	545.00 g
Pork back fat	300.00 g	Pork back fat	180.00 g
		Ice	90.00 g
Curing mix		*Extenders:*	
Refined salt	1 tbsp	Textured vegetable protein (TVP)	29.00 g
Curing salt	½ tbsp	Water for TVP hydration	29.00 g
Phosphate	1 tbsp	Isolated soy protein (ISP)	5.00 g
Water, chilled	¼ cup	Carrageenan	2.00 g
Ascorbic acid, ground	1 tablet	Skimmed milk	20.00 g
Vitamin C powder	¼ tbsp	Modified tapioca starch	20.00 g
Extenders		Banana, boiled, cube	80.00 g
Soak ½ cup TVP in 1¼ cup of buffalo's milk for 3 min. Add 1 tsp carrageenan and 1½ tbsp ISP		Additives:	
		Refined salt	12.00 g
		Curing salt (94% salt, 6% nitrite)	1.50 g
Seasonings		Phosphate	2.00 g
Refined sugar	4 tbsp	Sodium erythorbate	0.25 g
Pickle relish	¼ cup	*Seasonings:*	
Cheese, grated	½ cup	Refined sugar	28.00 g
Onions, chopped	¼ cup	Pickle relish	25.00 g
Raisins, chopped finely	½ cup	Cheese	35.00 g
Black pepper, ground	1 tbsp	Onions, fresh	28.00 g
Egg, fresh	2 pcs	Black pepper, ground	3.60 g
MSG	½ tbsp	Monosodium glutamate (MSG)	1.50 g
Garlic, chopped	1 tbsp	Garlic, fresh	1.50 g
Red bell pepper, chopped finely	2 tbsp	Red bell pepper	14.0 g
Banana, semi-ripe, boiled, chopped	2 pcs	Carrots	15.00 g
Carrot, grated	2 tbsp	Tomato	18.00 g
Tomato, chopped	2 tbsp	Raisins	25.00 g
Ginisa flavor mix	1 sachet	Egg, fresh	1 pc
Flour or potato starch	1 cup		
Procedure:		*Procedure:*	
1. Select good quality meat		Cut meat trimmings and fatty tissues in small pieces	
2. Chill meat before grinding		Grind meat trimmings and fats separately using 5 mm plate	

(continued)

Table 7.1 (continued)

Original recipe of carabeef loaf (translated from Filipino)	Standardized recipe of buffalo meat loaf
3. Measure the ingredients according to their quantity and segregate	Chop 75 % of ground meat, ice, and additives for 10–15 rounds; then add seasonings, fats, and remaining ice; and chop in fast gear until 12 °C
4. Mix phosphate, curing salt, salt, and vitamin C powder to the meat	Add tomato, red pepper, and raisins on the last few rounds of chopping
5. Add TVP, ISP, and carrageenan	Hand mix 25 % coarse meat with the emulsion
6. Add the rest of the ingredients, and mix well until blended	Stuff the mixture into vector 6 plastic casing (55 mm)
7. Cut aluminum foil, wrap carefully, and seal both ends	Cook at 75 °C until temperature reaches 72 °C
8. Prick the wrapped product with a needle and steam for 1 h	Cool by immersing in cold water until internal temperature reaches 15 °C
9. Remove from heat and cool down inside the refrigerator before packing it in a PE bag, and store in the freezer	Store in chiller (<4 °C) or in freezer (−18 °C)
10. To serve, unwrap the product, slice, and serve with catsup or fresh tomatoes and onions	
(*It can also be fried before slicing and serving*)	

Fig. 7.1 Buffalo meat loaf

7.3.2 Carablossom Burger

The name of the product is derived from the major ingredients, carabeef or buffalo meat and banana blossoms (Table 7.2). This is a nutritious product because banana blossoms are rich in dietary fibers, proteins, unsaturated fatty acids, vitamin E, and

Table 7.2 Original and standardized recipe of carablossom burger

Original recipe of carablossom burger		Standardized recipe of carablossom burger	
Meat materials:	*Quantity*	*Meat materials:*	*Quantity*
Ground carabeef (buffalo meat)	700.0 g	Carabeef (buffalo meat)	404.00 g
Ground pork (back fat)	300.0 g	Pork back fat	270.00 g
Curing mixture:		*Extenders and binders:*	
Iodize salt	1 tbsp	TVP (textured vegetable protein)	20.00 g
Phosphate	1 tsp	Water (for hydration)	60.00 g
Extenders and binders:		ISP (isolated soy protein)	3.00 g
Isolate	1 tbsp	Carrageenan	2.00 g
Carrageenan	½ tsp	Bread crumbs	22.00 g
TVP	¼ cup		
Water	½ cup	Cornstarch	17.00 g
Powdered milk	¼ cup	Skimmed milk	34.00 g
Fresh egg	1 pc	Banana blossom, boiled, chopped finely	168.00 g
Bread crumbs	½ cup	*Additives:*	
Cornstarch	¼ cup	Refined salt	12.00 g
Banana blossom (boiled, finely chopped)	1 cup	Phosphate	3.00 g
Seasonings:		Curing salt (94% salt, 6% nitrite)	2.00 g
Sugar	1 tbsp	Water	62.6 g
Vetsin (MSG)	½ tsp	*Seasonings:*	
Ground black pepper	½ tbsp	Refined sugar	10.00 g
Celery powder	½ tsp	Black pepper, ground	5.00 g
Garlic, finely chopped	1 tbsp	Celery powder	.80 g
Onions, finely chopped	½ cup	Garlic, fresh, chopped	12.00 g
Beef flavor	1 tsp	Onions, fresh, chopped	130.00 g
		Beef flavor, powder	2.00 g
		MSG	2.00 g
		Egg, fresh	2 pcs
Procedure:		*Procedure:*	
1. Select good quality of meat		Grind meat using 5 mm plate	
2. Measure all the ingredients		Hydrate TVP, ISP, and carrageenan	
3. Mix meat with the curing mixture thoroughly		Chop boiled banana blossom	
4. Add the extenders and binders ingredients, and mix until tacky		Mix meat with additives	
5. Then add the seasonings, and mix until well blended		Add extenders, binders, and seasonings	
6. To attain firm patties, chill mixture for 1–2 h		Form into patties (50 g per patty)	
7. Mold 50 g of mixture in a hamburger molder for a better patty result		Freeze formed patties	
8. Wrap patty individually on a glassine or paperlyn, and store it in a freezer		Pack in PE bag (10 pcs/pk)	
9. Fry patties in a little amount of oil		Serve by frying	

Fig. 7.2 Fried carablossom burger

flavonoids (Sheng et al. 2010). The proportion of the lean meat and fat and the amount of some ingredients of the original recipe were adjusted to improve the texture and flavor. This product was processed by simply mixing the ground meat with the rest of the ingredients. The meat mixture is formed into patties (about 50 g each), individually packed with a PE wrap and then stored in the freezer. The flavor and general acceptability of the fried product (Fig. 7.2) were rated as liked very much, while color was liked moderately. Juiciness, texture, and spiciness were described as slight and saltiness was moderate. Its shelf life in the freezer was 83 days (about 2 months and 3 weeks). Each patty costs PhP 4.10 (USD 0.09).

7.3.3 Chevon Supreme

This is a canned product with chevon (meat from goat) as the meat material. It is cooked in coconut milk seasoned with garlic, ginger, and chili. The fresh ingredients (coconut milk, ginger, and chili) were substituted with processed coconut milk, ginger powder, and chili powder for the flavor to be consistent and to lessen the labor needed in the preparation (Table 7.3). The cubed meat was cooked with the other ingredients before filling into tin cans (211 × 300; General Metal Container Corporation, Philippines). The curing process in the original procedure was omitted. Cooking was done at 110 °C and 15 psi until an *F*-value of 6 was attained. *F*-value was not measured in the original procedure which implies that there was no basis if the time and temperature combination was enough to render the product safe for consumption even after storage. The general acceptability, color of the sauce, and overall flavor of the finished product (Fig. 7.3) were assessed as liked moderately. The texture and saltiness were ranked as slight while spiciness was perceptible. As per analysis, the standardized canned product passed the test for commercial sterility defined as "the condition achieved by application of heat, sufficient, alone or in combination with other appropriate treatments, to render the food free from microorganisms capable of growing in the food at normal non-refrigerated conditions at which the food is likely to be held during distribution and storage" (CAC 2011). The cost of the product is PhP 96 (USD 2.19) per can of 240 g.

Table 7.3 Original and standardized recipe of chevon supreme

Original recipe of chevon supreme		Standardized recipe of chevon supreme	
Meat materials:	*Quantity*	*Meat materials:*	*Quantity*
Chevon	1.00 kg	Chevon	1,000.00 g
Ingredients:		*Additives:*	
a. Curing mix:		Refined salt	17.00 g
Phosphate	1 tsp	Curing salt (94% salt, 6% nitrite)	2.00 g
Curing salt	¼ tsp	Phosphate	2.50 g
Coarse salt	1 tbsp	Water	62.50 g
Ascorbic acid (500 mg)	1 tab	Sodium erythorbate	0.50 g
Water	¼ cup	*Seasonings:*	
b. Seasoning for sauce:		Achuete seeds	8.85 g
Achuete Oil	8 tbsp	Cooking oil	72.00 g
Garlic (chopped)	2 tbsp	Garlic, fresh, chopped	40.00 g
Ginger (chopped)	2 tbsp	Ginger powder	2.00 g
Coconut milk	2 cups	Coconut milk, canned	248.60 g
Sugar	2 tbsp	Refined sugar	40.00 g
Salt	3 tsp	Anisado wine	3.33 g
Sili labuyo	4 pcs	Brown sugar	1.33 g
Cloves	3 pcs	Chili powder	4.00 g
Anis muscovado	pinch	Cornstarch	30.00 g
		Cloves	3 pcs
Procedure:		*Procedure:*	
1. Select good quality of raw material. Wash thoroughly and chill for 1 h		Cut meat into cubes	
2. Cut meat into cubes (1 × 1 in)		Mix meat with additives	
3. Measure curing ingredients and mix with the meat and then cure overnight		Prepare achuete oil by mixing achuete seeds in hot cooking oil. Remove seeds	
4. Simmer meat with cloves and anis muscovado for 10 min and set aside		Saute garlic, meat, and seasonings	
5. Sauté garlic and ginger in achuete oil. Pour coconut milk and add sugar, salt, and sili labuyo		Add coconut milk	
6. Combine meat and cook for 10 min		Fill into cans (211 × 300)	
7. Pack in tin cans and half seal		Sterilize at 110 °C until required F-value	
8. Exhaust for 15 min and final sealing process for 20 min		Cool under cold shower or in cold running water, drain, and air dry	
9. Cool			
10. Wash			
11. Label			
12. Store			

Fig. 7.3 Chevon supreme

7.3.4 Jack Burger

The main ingredients for this burger patty are ground pork and boiled unripe jackfruit (Table 7.4). Because unripe jackfruit has distinctive meat-like texture similar to chicken, it is an excellent vegetarian substitute for meat. It also has cancer-fighting properties due to its isoflavones, antioxidants, and phytonutrients (Schmidt 2013). The process was the same with Carablossom Burger. The fried product garnered a rating of "like moderately" for its general acceptability, color, and flavor. It is slightly juicy, salty, and spicy. Its texture is perceptible. The shelf life test was concluded at 42 days (6 weeks) of storage in the freezer. Each patty costs PhP 4.62 (USD 0.11). Figure 7.4 shows the raw Jack Burger patties.

7.3.5 Pork Veggie Dumplings

This is a steamed product made of ground pork and bamboo shoots as the extender (Table 7.5). Aside from being rich in some nutrient components, mainly proteins, bamboo shoots could be called nutraceuticals or natural medicines because they contain phytosterols and a high amount of fiber that have cholesterol-lowering and anticarcinogenic activity acridity (Chongtham et al. 2011). The following modifications were done: the proportion of meat material was reduced, cornstarch was replaced with modified tapioca starch, shrimp powder was used instead of fresh shrimps, and bamboo shoots were reduced to 45 %. The bamboo shoots were first sliced and then boiled in water for half an hour to remove acridity (Chongtham et al. 2011). The ground pork was mixed with the ingredients, wrapped in wonton wrapper, and steamed. The finished product was vacuum packed in laminated NYPE bags. Its general acceptability, flavor, and color were ranked as liked moderately. Its juiciness, saltiness, and texture were assessed as slight. The standardized product (Fig. 7.5) can be kept for 50 days in the chiller while 70 days in the freezer. The cost per piece (12.5–15.0 g) is around PhP 2.19 (USD 0.05).

Table 7.4 Original and standardized recipe of Jack burger

Original recipe of Jack burger		Standardized recipe of Jack burger	
Meat materials:	*Quantity*	*Meat materials:*	*Quantity*
Pork, lean meat	1,400.0 g	Pork, picnic	677.00 g
Pork back fat	600.0 g	*Extenders and binders:*	
Curing mixture:		TVP (textured vegetable protein)	27.00 g
Refined salt	2 tbsp	Water	81.00 g
Phosphate	2 tsp	ISP (isolated soy protein)	5.00 g
Extenders and binders:		Carrageenan	3.00 g
TVP	½ cup	All-purpose flour	38.00 g
Isolate	2 tbsp	Jackfruit, unripe, boiled, chopped coarsely	169.00 g
Carrageenan	1 tsp	*Additives:*	
Bread crumbs	1 cup	Refined salt	12.00 g
Water	1 cup	Phosphate	3.00 g
Fresh egg	2 pcs	*Seasonings:*	
Unripe jackfruit (boiled, finely chopped)	500.0 g	Refined sugar	10.00 g
Seasonings:		Black pepper, ground	5.00 g
Refined sugar	2 tbsp	Celery powder	1.00 g
Black pepper	2 tbsp	Garlic, fresh, chopped	11.00 g
Celery powder	1 tsp	Onions, fresh, chopped	130.00 g
Garlic, finely chopped	2 tbsp	Skimmed milk	2.80 g
Onion, finely chopped	1 cup	MSG	1.50 g
Milk powder	4 tbsp	Egg	2 pcs
Burger seasoning	2 tsp		
MSG	1 tsp		
Procedure:		*Procedure:*	
1. Select good quality of raw materials, and grind lean meat and fat finely		Grind meat using 5 mm plate	
2. Select good quality of ingredients and measure properly		Hydrate TVP and ISP	
3. Add the curing mixture to the meat, and mix until tacky		Mix meat with salt and phosphate	
4. Add the extenders, and mix well until homogenous mixture is attained		Add extenders, binders, and seasonings	
5. Add the seasonings, and remix until well blended		Form into patties (50 g per patty)	
6. To attain firm patties, chill mixture for 1–2 h in the refrigerator		Freeze formed patties	
7. Mold 50 g of mixture in a hamburger molder		Pack in PE bag (10 pcs/pk)	
8. Line the patties individually with paperlyn, and freeze before packing		Cook by frying before serving	
9. Store the patties in the refrigerator			
10. Fry patties in a little amount of fat			

Fig. 7.4 Jack burger patties

Table 7.5 Original and standardized recipe of pork veggie dumplings

Original recipe of pork veggie dumplings		Standardized recipe of pork veggie dumplings	
Ingredients:	*Quantity*	*Meat materials:*	*Quantity*
Pork, ground	1.00 kg	Pork, shoulder	773.00 g
Shrimp, ground	250.00 g	*Extender/filler:*	
Carrots, chopped	250.00 g	Modified tapioca starch	89.00 g
Bamboo shoot, chopped	250.00 g	Bamboo shoots, boiled and chopped coarsely	138.00 g
Onion, chopped	120.00 g	*Additives:*	
Ginger, grated	20.00 g	Salt, refined	6.00 g
Cornstarch	60.00 g	Curing salt (94% salt, 6% nitrite)	2.00 g
Soy sauce	60.00 ml	Phosphate	2.50 g
Sesame oil	20.00 ml	Ice water	62.50 g
Egg, lightly beaten	2 pcs	*Seasonings/spices:*	
Salt	20.00 g	Shrimp powder	7.50 g
Black pepper	5.00 g	Sugar, refined	3.75 g
Prague powder	5.00 g	Black pepper, ground	2.00 g
Wonton wrapper	150 pcs	Carrots, chopped	125.00 g
		Onion, chopped	75.00 g
		Soy sauce	20.00 g
		Sesame oil	10.00 g
		Egg, fresh	2 pcs
Procedure:		*Procedure:*	
1. Mixing		Boil bamboo shoots in water in an uncovered pan for 30 min	
Combine 2 kg ground pork with 500 g chopped shrimp		Grind meat using 5 mm plate	
Add salt gradually while mixing. Set aside		Mix meat with additives until tacky	
Mix all powdered ingredients (cornstarch, black pepper, and mixture) and mix thoroughly		Add extender/filler and seasonings	

(continued)

Table 7.5 (continued)

Original recipe of pork veggie dumplings	Standardized recipe of pork veggie dumplings
Add the chopped vegetable (carrots, bamboo shoots, onion, and ginger), the lightly beaten eggs, and the sesame oil. Mix properly to ensure equal distribution of ingredients	Form into balls
2. Wrapping	Wrap in wonton wrapper
Place about 1 tbsp of the filling in the center of each wonton wrapper	Arrange the dumplings in a greased steamer
Brush the edges of the wrapper with water or egg whites	Steam for 25–30 min or
Gather the wrapper around the filling to form a pouch, slightly open at the top	Fry until golden brown
3. Cooking	Serve cooked pork veggie dumplings with a dipping sauce
Arrange the dumplings in the well-oiled steamer	
Brush top with sesame oil and steam for 25–30 min or deep fry for 3–4 min until golden brown	
4. Serving	
Serve steamed pork dumplings with dipping sauce made of soy sauce and kalamansi juice with a vegetable salad side dish	
Serve fried pork dumplings with ketchup or sweet chili sauce	

Fig. 7.5 Pork veggie dumplings

7.4 Conclusion

The processed meat products that were standardized used ingredients that are simple and readily available in the Philippines. Value-adding food processed meat products with Filipino indigenous ingredients can be economically advantageous especially for the people in the countryside where agricultural products abound. Most of all, these products are alternative ways of preparing safe and quality foods aside from the common menu that Filipino households are accustomed to.

Acknowledgments The authors wish to thank the following for their recipes: Ms. Marivic Andres (Buffalo Meat Loaf), Ms. Ma. Lani Gedaya (Carablossom Burger), Marilou Quaile (Chevon Supreme), Ms. Luren Grace Arguez (Jack Burger), and Ms. Allette Gayatin (Pork Veggie Dumplings). They are also grateful to the Bureau of Animal Industry for funding this research and their trip together with the Bureau of Agricultural Research.

References

Chongtham, N., Bisht, M. S., & Haorongbam, S. (2011). Nutritional properties of bamboo shoots: Potential and prospects for utilization as a health food. *Comprehensive Reviews in Food Science and Food Safety, 10*, 153–168.

Codex Alimentarius Commission. (2011). *Code of hygienic practice for low and acidified low acid canned foods* (CAC/RCP 23-1979). Available online at http://www*codexalimentarius.org/standards/list-of-standards/en/?provide=standards&orderField=fullReference&sort=asc&num1=CAC/RCP*. Accessed on 17 Sept 2013.

Heinz, G., & Hautzinger, P. (2007). *Meat processing technology: For small- to medium- scale producers*. Bangkok: FAO.

Schmidt, D. (2013). *Jackfruit*. Available online at http://thaifood.about.com/od/glossary/g/ *jackfruit.htm*. Accessed on 25 Sept 2013.

Sheng, Z., Ma, W., Jin, Z., Bi, Y., Sun, Z., Dou, H., Gao, J., Li, J., & Han, L. (2010). Investigation of dietary fiber, protein, vitamin E and other nutritional compounds of banana flower of two cultivars grown in China. *African Journal of Biotechnology, 9*, 3888–3895.

Chapter 8
The Future of Livestock: Feeding the World Sustainably and Humanely

Michael C. Appleby and Dinah Fuentesfina

Abstract Feeding the growing population in the Asia-Pacific Region and elsewhere is a vital aspect of sustainability. Livestock play a central role in global diets and require a considerable amount of resources. The World Society for the Protection of Animals co-funded a research to analyse this role. Livestock is important in food security, both directly and indirectly (through income, employment and manure for crop production). The effect of grain-based intensification is equivocal. It allows for increased production in smaller land areas and cheaper products that could benefit the urban poor. However, it may result in land use conflicts and exclude smallholders from markets. By using grain and land that could otherwise feed people directly, it reduces the resource base, as livestock in less intensive systems can convert inedible grass and crop residues into edible resources. It is also associated with instances of poor animal welfare. Analysis of scenarios for 2050 using the biomass balance model found that feeding more grains to livestock will strongly increase cropland demand, with a potential to trigger competition. The quantity and quality of the human diet are important, but the common assumption that this requires large amounts of animal protein is misplaced: diets with a lower share of animal products keep the option space open in terms of land use for other purposes such as biodiversity conservation. It is possible to feed the world balanced and equitable diets in 2050, while providing for animal welfare and addressing other aspects of sustainability.

Keywords Animal welfare • Environment • Food security • Livestock • Sustainability

M.C. Appleby (✉) • D. Fuentesfina
World Society for the Protection of Animals,
5th floor, 222 Gray's Inn Road, London WC1X 8HB, UK
e-mail: michaelappleby@wspa-international.org; dinahfuentesfina@wspa-asia.org

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_8

8.1 Introduction

Feeding the growing population in the Asia-Pacific Region and elsewhere and achieving environmental sustainability are two of the key challenges the world is facing. Already home to 56 % of the global population, Asia and the Pacific will account for one third of the projected 2.6 billion increase in global population between 2010 and 2050 (Asian Development Bank 2011). A growing proportion of that population is prosperous enough to diversify its diet away from staple cereals towards meat, dairy products, fruits and vegetables. So livestock play a central role in diets and require a considerable amount of resources. Projections suggest that most of the increase in worldwide animal protein demand by 2030 and beyond will come from developing Asia. For example, between 2000 and 2030, the annual consumption of beef is expected to increase by 25 million tonnes globally, of which almost half (12 million tonnes) will be in Asia. In the case of poultry, annual consumption in 2030 is expected to increase by 60 million tonnes relative to 2,000 levels, more than half of which (34 million tonnes) will come from Asia (FAO 2011).

Food security and environmental sustainability, subject to such pressures, are widely seen as conflicting with (and often more important than) protection of farm animal welfare.

However, achieving sustainability involves ecological, economic and ethical responsibility. Ethical considerations (of both people and animals) have sometimes received less attention than ecology and economics, but are an essential part of the acceptability and applicability of policies. And in relation to livestock production, all of the three Es lead us to consider animal management and the impact on animal welfare.

8.2 Animal Welfare and Sustainability

The World Organisation for Animal Health (OIE 2013) gives the following guiding principles for animal welfare:

- There is a critical relationship between animal health and animal welfare.
- Use of animals carries duty of care to ensure their welfare.
- Improvements in farm animal welfare often improve productivity and food safety and lead to economic benefits.

And we can add that:

- Improvements in farm animal welfare often lead to environmental benefits.
- Thus, animal management, with appropriate consideration of animal welfare, has impacts on many other issues such as hunger, poverty, disease control and environmental protection.

This was recognised by the 2012 UN Rio+20 Conference on Sustainable Development. The World Society for the Protection of Animals lobbied the delegates at preparatory meetings to consider livestock and was influential in achieving the following wording in the conference outcome document 'The Future We Want' (emphasis added):

111. We reaffirm the necessity to promote, enhance and support more sustainable agriculture, including crops, livestock, forestry, fisheries and aquaculture, that improves food security, eradicates hunger, and is economically viable, while conserving land, water, plant and animal genetic resources, biodiversity and ecosystems, and enhancing resilience to climate change and natural disasters. We also recognize the need to maintain natural ecological processes that support food production systems.
112. We stress the need to enhance sustainable livestock production systems, including through improving pasture land and irrigation schemes in line with national policies, legislation, rules and regulations, enhanced sustainable water management systems, and efforts to eradicate and prevent the spread of animal diseases, recognizing that the livelihoods of farmers including pastoralists and the health of livestock are intertwined.

8.3 Analysis of Future Scenarios

To explore what such policies will mean in practice, the World Society for the Protection of Animals, Compassion in World Farming and Tubney Charitable Trust funded research to analyse the role of livestock in food security, how intensification of livestock affects food security, and possible scenarios for production and consumption of livestock products in 2050 (Erb et al. 2012). We found that livestock plays a central role in food security, both directly and indirectly (providing income, employment and manure for crop production). The effect of grain-based intensification of livestock is equivocal. On the one hand, it allows for increased production in smaller land areas and for the provision of cheaper products that could benefit poor people in urban areas. On the other hand, it may result in land use conflicts and exclude smallholders from market access (see also Ahuja 2012). By using grain and land that could otherwise be used directly to feed people, it reduces the resource base of human societies, as a major function of livestock in less intensive systems is conversion of nonedible resources such as grass and crop residues into edible ones. It is also associated with instances of poor animal welfare. When analysing scenarios for 2050 using the biomass balance model, we found that a strategy towards feeding more grains to livestock will strongly increase cropland demand, with a potential to trigger competition.

Developing regions that already import food or feed (e.g. East Asia, Sub-Saharan Africa) are particularly vulnerable. For example, East Asia is only 82 % self-sufficient in cereals; 88 % in meat from ruminants; 96 % in pigs, poultry and eggs;

and 86 % in dairy products. Increased use of grains for livestock feed would therefore exacerbate shortages of cereals for direct use in human food in this region and/or require increased imports from other regions. Whether those other regions will be able to meet this need is doubtful, however, as they will be facing similar demands internally. A balance therefore needs to be found between production and consumption of livestock products, both within regions such as East Asia and worldwide.

8.4 Conclusion

The quantity and quality of the human diet are important, but the common assumption that this requires large amounts of animal protein is misplaced. Diets with a lower share of animal products keep the option space open in terms of land availability for other purposes such as biodiversity conservation. It will be possible to feed the world balanced, equitable and sustainable diets in 2050, while providing for animal welfare. Both these aims and other aspects of sustainability are complementary rather than in contradiction.

References

Ahuja, V. (Ed.). (2012). *Asian livestock: Challenges, opportunities and the response. Proceedings of an international policy forum held in Bangkok, Thailand, 16–17 August 2012*. Rome: FAO.

Asian Development Bank. (2011). *Climate change and food security in the pacific: Rethinking the options*. Mandaluyong City: Asian Development Bank.

Erb, K.-H., Mayer, A., Kastner, T., Sallet, K., & Haberl, H. (2012). *The impact of industrial grain fed livestock production on food security: An extended literature review*. London: World Society for the Protection of Animals.. Available at www.wspa-international.org/farming.

FAO. (2011). FAOSTAT. www.faostat.fao.org

OIE. (2013). *Introduction to the recommendations for animal welfare*. Available at www.oie.int/index.php?id=169&L=0&htmfile=chapitre_1.7.1.htm

UN Rio+20 Conference on sustainable development. (2012). *The future we want*. Available at www.un.org/en/sustainablefuture/

Chapter 9
Impact of Processing on Pesticide Residues in Vegetables

Shashi Vemuri and Ch.S. Rao

Abstract In the studies conducted on monitoring of pesticide residue levels of organochlorines (OC), synthetic pyrethroids (SP), organophosphates (OP) and carbamates, three vegetables, viz., brinjal, cauliflower and okra, were chosen to evaluate the effect of different household processes (washing and boiling/cooking) by unprocessed and processed means on reduction of residues. Samples were procured from local market at different intervals. Residues were estimated by using multiresidue method using gas liquid chromatograph (GC), with electron capture detector (ECD) and nitrogen-phosphorous detector (NPD) equipped with capillary columns. In all the three vegetables, washing reduced the residues by 25–77 % and boiling by 32–100 %. Maximum reduction of 77 % of insecticides was observed in brinjal, followed by 74 % in cauliflower and 50 % in okra by washing. The same trend was observed by a boiling process where a maximum of 100 % reduction of OP insecticides was observed in brinjal followed by 92 % in cauliflower and 75 % in okra. Boiling was found comparatively more effective than washing in removing the residues.

Keywords Vegetables • Pesticide • Processing • Residues • Washing • Boiling • Cooking

9.1 Introduction

Vegetables are the fresh and edible portion of some of the herbaceous plants. They are important foods and highly beneficial for health. They contain valuable food ingredients, utilised to build up and repair the body. In India, vegetables are major constituents of diet with a per capita consumption of 135 g per day as against the recommended 300 g per day. Their productivity is restricted, mainly due to insect pests and diseases. Among the vegetables, brinjal, cauliflower and okra are very

S. Vemuri (✉) • Ch.S. Rao
All India Net Work Project on Pesticide Residues, ANGRAU,
Eei Premises, Rajendranagar, Hyderabad 500 030, A.P, India
e-mail: sash_3156@yahoo.co.in

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_9

common giving better return over investment to the farmers. Brinjal (*Solanum melongena* L.) is an important vegetable crop grown extensively in India but suffers heavily at fruiting stage by the shoot and fruit borer causing 70 % damage to the crop making it totally unfit for human consumption (Duara et al. 2003). Cauliflower (*Brassica oleracea*), an important vegetable crop grown in India with an annual production of 3.39 million tonnes, is heavily attacked by various insects, resulting in severe loss of quality and production (Patel et al. 1999). Okra (*Abelmoschus esculentus* L.) is also an important vegetable crop grown extensively in India, and for the control of insect pests, a number of insecticides have been used (Sinha and Sharma 2007). For better yield and quality, insecticides are repeatedly applied during the entire crop growth including the fruiting stage, accounting for 13–14 % of total pesticides consumption, as against 2.6 % of cropped area (Sardana 2001). Indiscriminate use of pesticides particularly at fruiting stage and non-adoption of safe waiting period lead to accumulation of pesticide residues in consumable vegetables. Contamination of vegetables with pesticide residues has been reported by several researchers (Kumari et al. 2003). The present study was conducted to evaluate the pesticide residues of four different chemical groups, i.e. organochlorines (OC), synthetic pyrethroids (SP), organophosphorus (OP) and carbamates, in brinjal, cauliflower and okra and to assess the effect on residues of some household processes like washing and boiling/cooking.

9.2 Materials and Methods

The composite samples consisting of 1–2 kg of each vegetable, i.e. brinjal, cauliflower and okra, were collected from local market at weekly intervals. Each sample was divided in to three parts and were extracted and analysed within 2 days of collection. Only the edible part was processed and analysed for the analysis of organochlorine (OC), synthetic pyrethroid (SP), organophosphate (OP) and carbamate group of pesticides. In order to assess the effects of household processing like washing and boiling/cooking, one part of the sample of each vegetable was washed for 1 min under tap water and dried on filter paper. To the other part of each unwashed samples of three vegetables, 15 ml water was added and boiled till softness. Washed and boiled samples were processed in a similar manner as of unprocessed samples.

9.2.1 Extraction

All the samples were extracted fresh. Each vegetable was chopped into small pieces and after quartering, a representative sample (25 g) was macerated with 5–10 g anhydrous sodium sulphate in Waring blender to make a fine paste. The macerated sample was extracted with 100 ml acetone on mechanical shaker for 1 h by using the method of Kumari et al. (2001). Extract was filtered, concentrated up to 40 ml and

subjected to liquid-liquid partitioning with ethyl acetate (50, 30, 20 ml) after diluting four to five times with 10 % aqueous NaCl solution. Concentrated was the organic phase up to 10 ml on rotary evaporator and divided it into two equal parts. One part was kept for OC and SP and second for OP and carbamates.

9.2.2 Cleanup

For OC and SP insecticides, cleanup was carried out by using column chromatography. Column (60 cm × 22 mm) was packed with Florisil and activated charcoal (5:1 w/w) in between the two layers of anhydrous sodium sulphate. The extract was eluted with 125 ml mixture of ethyl acetate/hexane (3:7 v/v). The eluate was concentrated to 2 ml for residue analysis. Residues of OP and carbamates were also cleaned by adopting column chromatographic technique. The column was packed with silica gel and activated charcoal (5:1 w/w) in between the layers of anhydrous sodium sulphate. The extract was eluted with 125 ml mixture of acetone/hexane (3:7 v/v). After concentrating the eluate on rotary evaporator, the final volume was made to 2 ml for analysis by gas liquid chromatography (GC).

9.2.3 Estimation

The cleaned extracts were analysed on Shimadzu 2310 GC equipped with capillary columns using electron capture detector (ECD) and nitrogen-phosphorous detector (NPD). Operating conditions were as per details: for OC and SP insecticides, detector: ECD, column: SPB-5 of 5 % diphenyl/95 % dimethyl fused silica capillary column (30 m × 0.32 mm ID, 0.25 μm film thickness) with split system.

Temperatures (°C):150 (5 min) → 8 min^{-1}→ 190 (2 min) → 15 min^{-1} 280° (10 min); injector port: 280; detector: 300; and carrier gas: (N_2), flow rate 60 ml min^{-1}, 2 ml through column and split ratio 1:10. For OP and carbamates: detector: NPD, megabore column: HP-1 of methyl silicone (10 m × 0.53 mm ID, 2.65 μm film thickness). Temperatures (°C): Oven: 100 (1 min) → 10 min^{-1} → 200 (0 min) → 20 min^{-1} → 260 (3 min); injector port, 250, detector, 275, carrier gas N_2 18 ml min^{-1}, H_2, 1.5 ml min^{-1} and zero air 130 ml min^{-1}.

9.3 Results and Discussions

The average percent recoveries at the spiking levels of 0.5 $\mu g g^{-1}$ of each pesticide were in the range of 80–111, 73–95, 83–125 and 82–104 for OC, SP, OP and carbamate insecticides, respectively. The data collected during this study is presented in Tables 9.1 and 9.2. In the analysed samples, the detected pesticides comprised of

OC (HCH isomers [α, β, γ, δ-HCH], DDT analogues, [o,p-DDT, p, p′-DDT, p, p′-DDE and p, p′-DDD], α-endosulphan, β-endosulphan, endosulphan sulphate), SP (cypermethrin, permethrin, fenvalerate, λ-cyhalothrin and β-cyfluthrin), OP (monocrotophos, dimethoate, malathion, chlorpyriphos and quinalphos) and among carbamates (carbophuran) only. The study revealed contamination of all the three vegetables with HCH, DDT and endosulphan among the OC group. Σ-HCH was detected in the range of 0.010–0.044 $\mu g g^{-1}$ in brinjal, 0.034–0.52 $\mu g g^{-1}$ in cauliflower and 0.027–0.268 $\mu g g^{-1}$ in okra. The level of contamination was maximum in okra and minimum in brinjal, whereas Σ-DDT concentration was maximum (0.056–0.178 $\mu g g^{-1}$) in brinjal and minimum (0.018–0.025 $\mu g g^{-1}$) in cauliflower. Residues of endosulphan were detected in the range of 0.042–0.057 $\mu g g^{-1}$ in brinjal,

Table 9.1 Pesticide residues* ($\mu g g^{-1}$) in brinjal, cauliflower and okra

Insecticides detected	Brinjal			Cauliflower			Okra		
	1	2	3	1	2	3	1	2	3
α-HCH	0.007	0.003	0.009	0.002	0.005	0.007	0.003	0.025	0.005
β-HCH	0.003	0.001	0.003	ND	ND	ND	0.004	0.024	0.003
γ-HCH	0.010	0.005	0.025	0.008	0.006	0.031	0.018	0.213	0.024
δ-HCH	0.008	0.001	0.007	0.042	0.019	0.007	0.002	0.006	0.006
Σ-HCH	0.028	0.010	0.044	0.052	0.030	0.045	0.027	0.268	0.038
o,p′-DDT	0.012	ND	0.001	ND	ND	ND	ND	ND	ND
p,p′-DDT	0.029	0.160	0.038	0.018	0.019	0.025	ND	ND	ND
o,p′-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND
p,p′-DDE	0.008	0.018	0.012	ND	ND	ND	0.041	0.042	0.053
p,p′-DDD	0.009	ND	0.005	ND	ND	ND	0.018	ND	ND
Σ-DDT	0.058	0.178	0.056	0.018	0.019	0.025	0.059	0.042	0.053
α-Endosulphan	ND	ND	0.007	0.006	0.010	0.017	0.013	0.011	0.009
β-Endosulphan	0.017	0.048	0.027	0.001	0.005	0.008	0.084	0.077	0.078
Endosulphate	0.025	0.009	0.013	0.022	0.029	0.035	0.312	0.055	0.176
Σ-Endosulphan	0.042	0.057	0.047	0.029	0.044	0.060	0.409	0.143	0.263
Cypermethrin	0.012	0.003	0.008	ND	ND	ND	0.034	0.010	0.014
Permethrin	0.022	ND	0.024	0.673	0.725	0.633	ND	ND	ND
Fenvalerate	ND	ND	ND	0.007	0.011	0.017	ND	ND	ND
λ-Cyhalothrin	0.004	ND	0.002	ND	ND	ND	ND	ND	ND
β-Cyfluthrin	0.087	0.047	0.075	ND	ND	ND	ND	ND	ND
Monocrotophos	ND	ND	ND	ND	ND	ND	0.002	0.005	0.008
Dimethoate	0.001	ND	0.002	ND	ND	ND	0.002	0.002	0.006
Malathion	ND	0.008	0.004	ND	ND	ND	ND	ND	ND
Chlorpyriphos	0.022	0.021	0.018	0.024	0.027	0.031	ND	ND	ND
Quinalphos	0.007	0.002	0.009	ND	ND	ND	0.006	0.002	0.007
Carbophuran	0.020	0.009	ND	ND	ND	ND	ND	ND	ND

*The comparison between the treatments in terms of significance was not worked out as the impact of processing only was studied

MRL (mg kg^{-1}) from PFA: HCH (γ-HCH): 3.0, DDT: 3.5, endosulphan: 2.0, chlorpyriphos: 0.01, malathion: 0.5, fenvalerate: 2.0 and cypermethrin: 0.2 and 2.0 in cabbage MRL (mg kg^{-1}) from FAO/WHO: DDT: 1.0, endosulphan: 2.0, cypermethrin: 0.5, fenvalerate: 0.2, monocrotophos: 0.2 and carbophuran: 0.1

Table 9.2 Effect of processing on pesticide residues (μg g^{-1}) in brinjal, cauliflower and okra

Insecticides detected	Range of residues (mean) Brinjal [% reduction]			Range of residues (mean) Cauliflower [% reduction]			Range of residues (mean) Okra [% reduction]		
	UW	W	B	UW	W	B	UW	W	B
Σ-HCH	0.010–0.044	0.007–0.028	0.005–0.023	0.034–0.052	0.022–0.030	0.005–0.019	0.027–0. 268	0.023–0.158	0.021–0.131
	(0.027)*	(0.015)	(0.013)	(0.042)	(0.027)	(0.017)	(0.111)	(0.069)	(0.059)
		[44]	[52]		[36]	[59]		[38]	[47]
Σ-DDT	0.056–0.178	0.035–0.107	0.015–0.079	0.018–0.025	0.005–0.021	0.003–0.013	0.042–0.059	0.034–0.051	0.020–0.047
	(0.097)	(0.061)	(0.044)	(0.021)	(0.014)	(0.008)	(0.051)	(0.041)	(0.033)
		[37]	[55]		[34]	[61]		[20]	[35]
Σ-Endosulphan	0.042–0.057	0.029–0.042	0.022–0.034	0.029–0.060	0.017–0.042	0.012–0.029	0.143–0.409	0.139–0.263	0.123–0.224
	(0.048)	(0.035)	(0.029)	(0.044)	(0.029)	(0.019)	(0.280)	(0.178)	(0.172)
		[27]	[39]		[34]	[57]		[36]	[38]
SP	0.002–0.013	0.016–0.026	0.015–0.022	0.650–0.736	0.451–0.648	0.394–0.434	0.010–0.034	0.009–0.020	0.006–0.020
	(0.027)	(0.020)	(0.017)	(0.688)	(0.490)	(0.412)	(0.019)	(0.013)	(0.011)
		[26]	[37]		[29]	[40]		[31]	[42]
OP	0.008–0.010	0.001–0.004	0.005–0.012	0.024–0.031	0.005–0.008	0.002–0.003	0.003–0.007	0.001–0.003	0.001
	(0.009)	(0.002)	(0.009)	(0.027)	(0.007)	(0.002)	(0.004)	(0.002)	(0.001)
		[77]	[100]		[74]	[92]		[50]	[75]
Carbamates	0.009–0.020	0.004–0.018	0.001–0.014	–	–	–	–	–	
	(0.014)	(0.011)	(0.007)						
		[21]	[50]						

*The comparison between the treatments in terms of significance was not worked out as the impact of processing only was studied

0.017–0.042 μgg^{-1} in cauliflower and 0.143–0.409 μgg^{-1} in okra showing thereby maximum concentration in okra. Thus, in all the three vegetables, Σ-HCH was detected in the range of 0.010–0.268, Σ-DDT, 0.019–0.178 and Σ-endosulphan, 0.029–0.263 μgg^{-1}. Although all the samples were found contaminated with OC insecticides, none of the samples contained residues of any of these insecticides above maximum residue limits (MRL) fixed by the Prevention of Food Adulteration Act (PFA) 1954 and FAO/WHO (1996). Presence of endosulphan in the present study is due to use of endosulphan in almost every crop in AP India among the OC pesticides. Residues of cypermethrin (0.003–0.012 μgg^{-1}), permethrin (ND-0.024 μgg^{-1}), λ-cyhalothrin (ND-0.004 μgg^{-1}) and β-cyfluthrin (0.047–0.087 μgg^{-1}) in brinjal, permethrin (0.633–0.725 μgg^{-1}) and fenvalerate (0.007–0.017 μgg^{-1}) in cauliflower and only cypermethrin (0.010–0.034 μgg^{-1}) in okra were detected among the SP insecticides. Among OP, chlorpyriphos (0.018–0.031 μgg^{-1}) was detected in all the samples of brinjal and cauliflower. This major contaminant was detected in the range of 0.018–0.022 μgg^{-1} in brinjal and 0.024–0.031 μgg^{-1} in cauliflower, whereas no sample of okra showed presence of chlorpyriphos residues in detectable amounts. Some other insecticides like monocrotophos, dimethoate, quinalphos and malathion were also detected in detectable amounts in few samples. Only carbophuran, among carbamate insecticides, was detected in the range of 0.009–0.020 μgg^{-1} in brinjal. Residues of none of the pesticide exceeded the MRL value. The results obtained from the present study are consistent with an earlier study that show residues of these pesticides are present in different vegetables (Kumari et al. 2003; Deka et al. 2005).

9.3.1 Effects of Washing and Boiling

Among the household processes, washing process reduced the OC residues by 27–44 % in brinjal, 34–36 % in cauliflower and 20–38 % in okra, whereas the residues of SP insecticides in brinjal, cauliflower and okra were reduced to 26, 29 and 31 %, respectively. Maximum reduction of residues was observed in case of OP where the residues decreased to the extent of 77, 74 and 50 %, in brinjal, cauliflower and okra, respectively. Among the carbamate insecticides, carbophuran residues, which was detected in brinjal only, reduced by 21 % by washing. In the present study, washing was found effective in dislodging the residues as it depends on a number of factors like location of residues, age of residues, water solubility and temperature and type of washing. In earlier studies also, effects of these factors were observed in different vegetables by various researchers (Dikshit et al. 1986). Sarode and Lal (1982) reported 20–89 % reduction of DDT in potatoes and tomatoes, fenitrothion in okra, parathion in cauliflower and malathion in okra by washing. In present study, washing was found comparatively less effective in reducing the residues of SP insecticides than that of OC and OP insecticides. Current results are in consistent with some earlier reports where reduction (10–30 %) of alphamethrin residues in tomato and brinjal and cauliflower by Gill et al. (2001) and Malik et al. (1999)

was found. Reduction of fenvalerate residues on tomatoes to the level of 62 % was reported by Jain et al. (1979). Rinsing of various vegetables was found very effective (Krol et al. 2000). Boiling/cooking was observed to be more effective in reducing the residues. By this process, reduction of residues of OC insecticides was observed in the range of 39–55 % in brinjal, 57–61 % in cauliflower and 32–47 % in okra. Reduction to an extent of 37, 40 and 42 % of SP insecticides was observed in brinjal, cauliflower and okra, respectively. Among OP insecticides, reduction was 100 % in brinjal, 92 % in cauliflower and 75 % in okra. Carbophuran residues, detected in brinjal only, reduced to the level of 50 % by boiling. Thus, great variation in reduction of residues by boiling was observed which may be attributed to the rates of degradation and volatilization of residues as the concentration of residues increases by heat involved in boiling. Reduction of fenvalerate residues to an extent of 27–56 % in brinjal was reported by Sharma and Kumar (1993). Reduction of alphamethrin in the range of 25–32 % in brinjal and tomatoes and 12–17 % in cauliflower was reported by Gill et al. (2001) and Malik et al. (1999). Holland et al. (1994) reported appreciably reduction in pesticide residues in different commodities by using different processing methods. Hence, the present results are in consistent with the earlier results.

9.4 Conclusions

It can be concluded that the residues of none of the pesticides tested exceeded MRLs. Processing lowers the residues in vegetables. The pesticide residue reduction is important for evaluating the risk mitigation in vegetables. The overall results indicate boiling to be more effective in reducing the pesticide residues.

References

Deka, S. C., Barman, N., & Baruah, A. A. L. H. (2005). Pesticidal contamination status in farmgate vegetables in Assam, India. *Pesticide Research Journal, 17*(2), 90–93.

Dikshit, A. K., Handa, S. K., & Verma, S. (1986). Residues of methamidophos and effect of washing and cooking in cauliflower, cabbage and Indian Colza. *Indian Journal Agricultural Science, 56*, 661.

Duara, B., Baruah, A., Deka, S. C., & Burman, N. (2003). Residues of cypermethrin and fenalerate on brinjal. *Pesticide Research Journal, 15*(1), 43–46.

FAO/WHO. (1996). Joint food standards programme, Codex Alimentarius Commission, Codex Committee and Pesticide Residues (Vol. 213, 2nd ed.), Rome.

Gill, K., Kumari, B., & Kathpal, T. S. (2001). Dissipation of alphamethrin residues in/on brinjal and tomato during storage and processing conditions. *Journal of Food Science and Technology, 38*(1), 43–46.

Holland, P. T., Hamilton, D., Ohlin, B., & Skidmore, M. W. (1994). Effects of storage and processing on pesticide residues in plant products (technical report). *Pure and Applied Chemistry, 66*(2), 335–356.

Jain, H. K., Agnihotri, N. P., & Srivastava, K. P. (1979). Toxicity of fenvalerate and estimation of its residues on some vegetables. *Journal of the Entomological Research, 3*(2), 212–216.

Krol, W. J., Arsenault, T. L., Pylypiw, H. M., Jr., & Mattina, M. J. I. (2000). Reduction of pesticide residues on produce by rinsing. *Journal of Agricultural and Food Chemistry, 48*, 4666–4670.

Kumari, B., Kumar, R., & Kathpal, T. S. (2001). An improved multiresidue procedure for determination of 30 pesticides in vegetables. *Pesticide Research Journal, 13*(1), 32–35.

Kumari, B., Kumar, R., Madan, V. K., Singh, R., Singh, J., & Kathpal, T. S. (2003). Magnitude of pesticidal contamination in winter vegetables from Hisar, Haryana. *Environmental Monitoring and Assessment, 87*, 311–318.

Malik, K., Beena, K., & Kathpal, T. S. (1999). Persistence and decontamination of alphamethrin residues in/on cauliflower at two different temperatures. *Pesticide Research Journal, 10*(2), 246–250.

Patel, B. A., Shah, P. G., Raj, M. F., Patel, B. K., Patel, J. A., & Talati, J. G. (1999). Chlorpyriphos residues in/on cabbage and brinjal. *Pesticide Research Journal, 11*(2), 194–196.

Sardana, H. R. (2001, May 21–26). Integrated pest management in vegetables. In Training manual-2, Training on IPM for Zonal Agricultural Research Stations (pp. 105–118).

Sarode, S. V., & Lal, R. (1982). Persistence of residue of fenitrothion in or on Okra. *The Indian Journal of Agricultural Science, 56*, 135–138.

Sharma, P. L., & Kumar, N. R. (1993). Dissipation pattern of fenvalerate in/on brinjal fruits under midhill conditions. *Pestology, 17*(10), 20–21.

Sinha, S. R., & Sharma, R. K. (2007). Efficacy of neonicotinoids against okra insect pest. *Pesticide Research Journal, 19*(1), 42–44.

Chapter 10
Sodium Content of Snack Food and Ethical Considerations Pertaining to Its Distribution in Schools

Wachira Singkong and Boonyakrit Rattanapun

Abstract Childhood food consumption is a growing public health problem, worldwide. The increase in the prevalence of heart disease and high blood pressure in children is believed to be partly attributable to an increase in the consumption of snacks that are high in salt, and make up a daily sodium intake. The aim of this work was to evaluate the amount of sodium in main snack food categories. The result showed highest sodium content was Roast fish and squid crispy. The sodium content of observing for snack food groups and sodium dietary intake is critically discussed.

Keywords Snack • Sodium • Salts • Dietary • Junk food

10.1 Introduction

Sodium in food is mostly presented as sodium chloride or salt. In the human diet, salt may not have been added to foods until around 2000 B.C., when it was discovered to be useful for food preservation. Buying and selling of salt became a highly important and lucrative trading activity. Roman soldiers were paid in salt, and that was the origin of the word "salary."

Snack foods are one of the major sources of dietary salt intake (WHO 2012). The Thai agro-industry has involved in the reduction of salt in many kinds of these products. For food safety and security in the twenty-first century, the ethical considerations pertaining to sodium concentrations in snack foods is key to the target of replacing strategies and monitoring progress (Jensen and Sandoe 2002; Ravetz 2002). Snack foods are popular in school canteens; although the sodium intake from snack food is certainly not the only factor contributing to high blood pressure and heart disease in children, it appears a crucial impact for parents and dieticians to recognize the sodium content in children's diets and to urge reduction in sodium

W. Singkong (✉) • B. Rattanapun
Department of Food Science and Technology, Faculty of Science and Technology, Kamphaengphet Rajabhat University, Kamphaengphet 62000, Thailand
e-mail: champsing@hotmail.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_10

intake for those children who consume sodium at high levels. Thai FDA considered a safe and adequate sodium intake as 2,400 mg/day for children ages 6 and older.

There is a consensus that reducing salt intake will promote population health benefits such as decreasing high blood pressure and preventing heart disease (Kafatos and Vardavas 2007). However, the government must take measurements to prevent and control the production of snack foods, the use of salt in the quantity, quality, and impact on consumers. One of the purposes of this study was to report the amount of sodium in main snack food categories and items that will be possible to raise awareness to decrease salt content in snack foods in school. The second purpose of this study was to compare the amount of sodium of snack foods against the maximum targets (more than 120 mg/serving) set by the Thai FDA and to identify priority products for selection in snack foods for commercial and ethical reasons in the schools (Petchsombat 2005).

10.2 Materials and Methods

Snack selection began by studying the basics, exploring the products from markets, the sale of snack foods in school, and the snack consumption and behavior of students (Arvaniti and Kostas 2011). This information is used to summarize the reported variety of snacks and salt intake from snacks each day for children ages 6 and older. The snack foods were divided by the snack food online database. Accordingly, this database is segmented by type of material and snack major components into five groups (Wadhera and Capaldi 2012) Samples were purchased from five cafeterias. For each item, the sodium per 100 g, sodium per serving, and sodium per container, product name, size, and price were recorded as important data to compare with the examination in the laboratory. The sodium content inspection of each product was analyzed following standard methods (AOAC 2000) by atomic absorption spectroscopy (AAS).

10.3 Results and Discussion

Sodium reported in this research was from the samples of 124 products in five groups, the numbers of products chosen from four high school cafeterias and Kamphaengphet Rajabhat University cafeteria. Sodium has been reported from five snack food groups with diversity of high and low variability. This exception was roast fish and squid crispy (range, 21–24 mg/100 g) and one end of the highly salt (range, 1,591–1,870 mg/100 g). In other cases, that sodium content is very different in the measurements of other types of snack products. For the first four groups, the highest concentrations of sodium were more than half when compared to products with low sodium and sodium in some groups is very different. The sodium content in Roast fish and squid crispy (21–1,870 mg/100 g) was more than an 89-fold

difference, sodium content in Fry potato (53–844 mg/100 g) was more than a 16-fold difference, sodium content of Roast nut (381–405 mg/100 g) was not completely different, sodium content in Roast and fry corn (67–945 mg/100 g) was a 14-fold difference, and sodium content in Rice and flour products (22–1,171 mg/100 g) was a 53-fold difference.

The group of snacks with the highest sodium content were Roast fish and squid crispy (1,870 mg/100 g) from Table 10.2, Rice and flour (1,171 mg/100 g) from Table 10.1, Roast and fry corn (945 mg/100 g) from Table 10.4, Fry potato (844 mg/100 g) from Table 10.3, and Roast nut (405 mg/100 g) from Table 10.5, which had the lowest sodium content, respectively. Roast fish highly flavored was

Table 10.1 Sodium content of rice and flour snack group

Product name	Size (g) and price (baht)	Sodium (mg/container)	Sodium (mg/100 g)	Sodium (mg/serving)
Barbecue flavor corn flour crispy	55/5	251	456	136
Caramel butter coated yam crispy	50/10	173	345	103
Caramel coated yam crispy	45/10	347	771	231
Chicken flavor rice crispy	50/10	309	618	185
Cheese flavor rice crispy	50/10	263	526	157
Classic tube rice crispy	55/20	35	63	19
Corn flavor fry snack	12/5	6	53	15
Corn flavor crispy sample A	62/20	484	779	233
Corn flavor crispy sample B	55/10	248	451	135
Corn flavor crispy sample C	60/10	237	395	118
Corn flavor crispy sample D	25/5	30	118	35
Corn flavor crispy sample E	25/5	36	142	42
Corn flavor crispy sample F	18/5	35	193	58
Corn flavor crispy sample G	22/5	18	83	24
Corn flavor crispy sample H	18/5	39	218	65
Crab flavor crispy	100/25	672	707	212
Fish and rice crispy	100/25	843	843	253
Fish flavor rice crispy	65/20	15	22	6
Lobster flavor mixed flour snack	25/5	145	578	173
Milk flavor corn flour snack	55/10	23	41	12
Mixed cereal flour fry snack	184/30	866	470	141
Mixed flour fry snack sample A	70/20	105	149	44
Mixed flour fry snack sample B	70/20	394	562	168
Mixed flour fry snack sample C	40/10	16	39	11
Mixed flour fry snack sample D	40/10	467	1,168	350
Mixed flour fry snack sample E	90/20	226	251	75
Mixed flour fry snack sample F	90/20	318	352	105
Mixed flour fry snack sample G	90/20	785	872	261
Mixed flour fry snack sample H	25/5	99	394	118

(continued)

Table 10.1 (continued)

Product name	Size (g) and price (baht)	Sodium (mg/container)	Sodium (mg/100 g)	Sodium (mg/serving)
Mixed flour fry snack sample I	90/5	360	401	120
Mixed flour fry snack sample J	20/5	6	27	8
Mixed flour fry snack sample K	100/20	775	775	232
Mixed flour fry snack sample L	100/20	359	359	107
Paprika flavor rice crispy sample A	75/10	404	523	156
Paprika flavor rice crispy sample B	55/25	505	918	275
Pizza flavor corn flour snack	55/10	276	501	150
Pumpkin flavor rice crispy	45/10	71	157	47
Pumpkin mixed rice crispy	40/10	250	623	187
Shrimp rice crispy sample A	105/20	544	518	155
Shrimp rice crispy sample B	20/5	7	35	10
Shrimp rice crispy sample C	120/25	1,049	874	262
Shrimp rice crispy sample D	105/15	790	752	225
Shrimp rice crispy sample E	100/25	810	810	243
Shrimp rice crispy sample F	54/10	461	575	172
Shrimp rice crispy sample G	90/20	173	788	236
Shrimp rice crispy sample H	30/5	19	63	18
Shrimp rice crispy sample I	90/20	350	389	116
Spicy flavor crispy snack	60/10	189	315	94
Squid flavor corn flour snack	25/5	215	858	257
Squid flavor rice crispy sample A	60/10	703	1,171	351
Squid flavor rice crispy sample B	60/10	50	82	24
Squid flavor rice snack	70/10	554	791	237
Taro flavor rice crispy	45/10	157	349	104
Tomato flavor rice crispy sample A	55/25	33	59	17
Tomato flavor rice crispy sample B	75/10	200	800	240
Tomyam flavor shrimp rice crispy	105/20	889	846	254

Table 10.2 **S**odium content of roast fish and squid crispy snack group

Product name	Size (g) and price (baht)	Sodium (mg/container)	Sodium (mg/100 g)	Sodium (mg/serving)
Chili paste flavor roast fish snack	52/20	12	23	6
Cream flavor roast fish snack	52/20	871	1,674	502
Delight flavor roast fish snack	65/20	15	23	6
Onion flavor roast squid snack	30/10	477	1,591	477
Original flavor roast fish snack	52/20	973	1,870	561
Soy sauce flavor roast fish snack	30/10	481	1,605	481
Spicy flavor roast fish snack	65/20	16	24	7
Spicy flavor roast squid snack	30/10	7	24	7
Teriyaki flavor roast fish snack	52/20	12	23	6

Table 10.3 Sodium content of fried potato snack group

Product name	Size (g) and price (baht)	Sodium (mg/container)	Sodium (mg/100 g)	Sodium (mg/serving)
Algae flavor potato chips	110/20	342	311	93
Barbecue flavor French-fry	55/10	390	709	212
Barbecue flavor potato chips	45/20	375	832	249
Basil flavor potato chips	115/25	620	538	161
Butter coated potato chips	50/10	420	839	251
Chicken flavor potato chips	90/20	498	553	166
Cream flavor potato chips	90/20	288	319	95
Onion flavor potato chips	190/25	987	519	155
Pizza flavor potato chips	90/20	383	425	127
Potato chips sample A	28/5	236	844	253
Potato chips sample B	38/10	299	787	236
Potato chips sample C	38/10	295	776	233
Potato chips sample D	90/20	469	521	156
Potato chips sample E	90/20	442	491	147
Potato chips sample F	90/20	437	485	145
Potato chips sample G	105/25	457	435	130
Potato chips sample H	195/50	811	415	120
Potato chips sample I	95/20	383	403	120
Potato chips sample J	90/20	358	398	199
Potato chips sample K	105/25	351	334	100
Potato chips sample L	90/20	286	318	93
Potato chips sample M	90/20	279	310	93
Potato chips sample N	120/20	327	310	93
Potato chips sample O	85/20	222	261	78
Potato chips sample P	120/20	279	310	93
Potato chips sample Q	90/20	212	235	70
Potato chips sample R	110/20	245	223	66
Potato chips sample S	100/20	103	103	31
Potato chips sample T	120/20	106	87	26
Potato chips sample U	38/10	29	77	23
Potato chips sample V	90/20	49	53	16
Salad flavor potato chips	110/20	367	334	100
Texas barbecue flavor potato chips	115/25	281	243	78
Tomato flavor potato chips	31/10	157	505	151

the highest sodium in Roast fish and squid crispy group, with sodium content of 1,874 mg/100 g. Roast fish fire chili flavor (21 mg/100 g) had the lowest sodium in the protein snack food group. The mean sodium concentrations in the snack food groups were 762 mg/100 g (Roast fish and squid crispy), 465 mg/100 g (Rice and flour), 482 mg/100 g (Roast and fry corn), 419 mg/100 g (Fry potato), and 392 mg/100 g (Roast nut).

Table 10.4 Sodium content of roasted and fried corn snack group

Product name	Size (g) and price (baht)	Sodium (mg/container)	Sodium (mg/100 g)	Sodium (mg/serving)
Barbecue flavor roast corn	100/10	646	646	193
Berger cheese flavor fry corn	55/10	53	95	28
Caramel butter coated popcorn	100/15	945	945	283
Caramel flavor popcorn	90/15	697	774	232
Cheese flavor fry corn	55/10	305	554	166
Cheese flavor roast corn sample A	50/10	241	482	144
Cheese flavor roast corn sample B	100/10	316	316	94
Chicken flavor roast corn	100/10	546	546	163
Chocolate flavor popcorn sample A	100/15	529	529	158
Chocolate flavor popcorn sample B	95/10	445	468	140
Extreme sauce flavor fry corn	50/10	251	502	150
Hot grills flavor fry corn	90/20	81	90	27
Mexican cheese flavor fry corn	55/10	114	203	61
Milk flavor roast corn	100/10	67	67	20
Onion flavor fry corn	198/25	1,376	693	208
Pizza flavor roast corn	50/10	218	436	131
Roast corn sample A	50/10	242	584	175
Roast corn sample B	184/25	1,036	565	168
Roast corn sample C	18/5	14	77	23
Steak flavor fry corn	50/10	372	743	222
Sugar flavor popcorn	125/15	780	623	187
Super corn flavor fry corn	90/20	609	676	202

Table 10.5 Sodium content of roasted nut snack group

Product name	Size (g) and price (baht)	Sodium (mg/container)	Sodium (mg/100 g)	Sodium (mg/serving)
Coconut milk flavor roast peanut	200/20	810	405	121
Coffee flavor roast peanut	200/20	783	391	117
Roast green pea	98/20	374	381	114

In comparison to the sodium FDA maximum and minimum target (WHO 2012), there was half (67/124, 54 %) of the snacks in the group containing high levels of sodium (more than 120 mg/serving), and less than one fifth (28/124, 23 %) of the snacks were in the group with low sodium content (less than 60 mg/serving), for five snack food groups (124 products), which is directly comparable with that against Thai FDA targets. For 54 % (67/124), the excess sodium was above the Thai FDA maximum targets (more than 120 mg/serving). Snack food products above target were squid rice chips, potato chips, roast peanut, and corn coated caramel (Kafatos and Vardavas 2007). Snack foods below Thai FDA targets were rice and fish crispy, roast fish crispy, flat potato chips, and roast corn crispy.

The research of sodium in snack foods was studied only in snack foods that are contained in commercial packages and traded continuously. The local and community snack foods, as well as folk wisdom snack foods produced seasonally, were not included in the research according to the unspecific packaging and unidentified intake unit. Therefore, that could be a study of sodium in snacks and meals in the future. In the study of consumer preferences in the five snacks groups, consumers buy popular snacks in descending order as follows: Roast fish and squid crispy, Rice and flour, Roast and fry corn, Fry potato, and Roast nut. The factors that make consumers buy a popular snack (Nicklaus 2013) are lower prices and large quantity, less oil, good flavor, and beautiful packaging, which is convenient for consumption. This information is consistent with the history of snacks purchased as food sold in school cafeterias. The kinds of Fry snack and Roast nut were reduced for sale in the school because it is sold in small amounts.

10.4 Conclusion

The data from this research can be an assessment of the mean of sodium content in snack foods that students consume if they are healthy and safe or not. In the cafeteria, more than half of the snack foods have high sodium. The sellers, teachers, and school administrators must have the ethical alertness to choose and ban the products that will affect health factors such as high blood pressure and heart disease. These data will inform the development of policy in the cafeteria against the sale of snack foods that have a high salt content, and the impact that can be used to develop the school. School administrators should use their leadership and participation in the cafeteria, a transparent and true attempt to determine the types and quantities of snack foods with high sodium content.

Acknowledgments This study was supported in part by funds from the Food Safety and Inspection Service Center of Kamphaengphet Rajabhat University. The authors express their appreciation to the students and technician for participation in the study.

References

AOAC. (2000). *Official methods of analysis* (17th ed.). Washington, DC: Association of Official Analytical Chemists.

Arvaniti, F., & Kostas, N. (2011). Salty-snack eating, television or video-game viewing, and asthma symptoms among 10-to 12-year-old children: The Panacea study. *Journal of the American Dietetic Association, 111*, 251–257.

Jensen, K. K., & Sandoe, P. (2002). Food safety and ethics: The interplay between science and values. *Journal of Agricultural and Environmental Ethics, 15*, 245–253.

Kafatos, A., & Vardavas, C. I. (2007). Fatty acid and salt contents of snacks in the Cretan and Cypriot market: A child and adolescent dietary hazard. *Food Chemistry, 101*, 924–931.

Nicklaus, S. (2013). Salt content impacts food preferences and intake among children. *PLoS One, 8*, 1–8.

Petchsombat, T. (2005). Resurrecting a dying tradition: The strategic management of traditional Thai desserts and snacks at Laan Fueng Nakorn, the old Siam Plaza. *Manusya: Journal of Humanities, 8*, 87–97.

Ravetz, R. J. (2002). Food safety, quality, and ethics: A post-normal perspective. *Journal of Agricultural and Environmental Ethics, 15*, 255–265.

Wadhera, D., & Capaldi, D. E. (2012). Categorization of foods as "snack" and "meal" by college students. *Appetite, 58*, 882–888.

WHO. (2012). *Guideline: Sodium intake for adults and children*. Geneva: World Health Organization.

Chapter 11
The Effect of Organic and Inorganic Fertilizer on Production, Sesame Seed Oil Content, and Feasibility in Sandy Coastal Land

Nurhayati Dewi Ratna, Aris Eddy Sarwono, and Budi Hariyono

Abstract This study aimed to investigate the effect of organic and inorganic fertilizer (NPK) on the production and seed oil content of sesame and the feasibility of cultivation in the sandy coastal land. This study was conducted in Purworejo, Central Java, from June to December 2011. The experiment was arranged in factorial randomized block design with two factors, repeated three times. The first factor is fertilization: control (without fertilization), cow manure 10 tonnes/ha, NPK 100:100:50, cow manure 7.5 tonnes/ha + 25 % NPK, cow manure 5 tonnes/ha + 50 % NPK, and cow manure 2.5 tonnes/ha + 75 % NPK. The second factor is the variety: Sumberrejo-1, Sumberrejo-2, and local black sesame. Variables observed were plant height, days to flowering, day of harvest, seed weight per plant, weight of 1,000 seeds, and seed oil content, as well as economic indicators [benefit and cost ratio, the ratio of income and expenses (B/C ratio), internal rate of return (rate of return on investment, IRR), and payback period]. The data were analyzed by analysis of variance (ANOVA, 5 %), with further testing with Duncan at 5 %. The results showed no interaction effect of fertilization and variety. The fastest flowering (45 days) was on the control treatment. The age of harvest is almost the same, 105 days. The highest total seed oil content, 51.73 %, was obtained in the treatment with organic fertilizer at 10 tonnes/ha. Sumberrejo-1 and Sumberrejo-2 varieties were well adapted to sandy coastal land, providing production and seed oil content higher than the local variety. Sesame cultivation in sandy coastal land provide prospective economic viability and efficiency, especially by applying organic fertilizer on Sumberrejo-2, with achievements of B/C ratio 1.91, IRR 48 %, and payback period 0.5.

N.D. Ratna (✉)
Department of Agrotechnology, University of Slamet Riyadi Surakarta, Surakarta, Indonesia
e-mail: dewiratna2001@yahoo.com

A.E. Sarwono
Faculty of Economics, University of Slamet Riyadi Surakarta, Surakarta, Indonesia

B. Hariyono
Balittas, Malang, Indonesia

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_11

Keywords Sandy coastal land • Organic fertilizer • Inorganic fertilizer • Economic feasibility • Sesame (*Sesamum indicum* L.)

11.1 Introduction

Sandy beach land in Indonesia with an area of ±1.06 million ha (Kertonegoro 2009) is one of the significant potentials for agricultural development, and is expected to be used as a substitute for shrinkage resulting from land conversion to nonagricultural uses. The land is marginal land with low productivity, characterized by the dominant soil constituent material of sand, so that the water-holding capacity is very low. Land use of beach sand for productive cultivation is still wide open (Kastono 2007). Sesame cultivation will potentially improve the productivity of this land if selected varieties are suitable to the environmental conditions (Budi 2007). A wide range of varieties used needs to be adjusted with the aim of planting, climatic conditions (water availability), and soil.

Some of the excess land for agriculture is sand beaches, namely, broad, flat, rarely flooded, with abundant sunshine, and shallow groundwater depth (Yuwono 2009). However, low organic matter content of the soil aggregates that affect soil structure are seen. Provision of organic matter (manure) is one way for improving the quality of the land (Sanchez 1992). Organic matter can improve soil fertility: physical, chemical, and biological. Organic matter is a source of energy for soil microorganisms thus increasing the population of microorganisms, which in turn can improve the availability of nutrients (Buckman and Brady 1982; Widiana 1994). Provision of organic material such as manure improves soil structure, soil aggregate stability, water-holding capacity, permeability, award, aeration, and root development (Rajiman 2010).

Cow manure is a source of organic material containing nitrogen (N) 1.05 %, phosphorus (P) 0.5 %, potassium (K) 0.73 %, with 0.13 % Mg, 0.11 % Ca, and Fe 7,569 ppm, at pH 6.5 (Musofie 2008). In the reshuffle of organic material, mineral plant nutrients N, P, K, Ca, Mg, and S, as well as micronutrients, will be removed in a relatively small amount (Roesmarkam and Yuwono 2002).

The addition of organic matter can reduce the dependence on inorganic fertilizers and support efforts to achieve environmentally friendly agriculture. Research in India in 2002–2004 on sesame plants showed that the use of organic materials derived from 75 kg/ha wood ash + 3.75 t/ha manure + 900 kg/ha neem compost + 75 kg/ha + 20 kg fish bones/ha + sulfur + phosphorus bacteria enriched with 5 kg/ha (*Azotobacter* and *Trichoderma viride*, 0.4 %) in seed treatment, provided tangible results for the number of pods, seed production, and the benefit to cost (B/C) ratio (Duhoon et al. 2007).

The results of the study of El-Habbasha et al. (2007) stated that the use of organic materials in cultivating sesame is natural environmental protection from pollution. Cattle manure application can increase the number of pods at 17.5 %. The presence of macro and micro elements contained in the organic fertilizer can increase plant height and number of books (nodes), thus increasing the number of pods grown.

Fertilization in the form of 10 tons/ha of manure and 100 % NPK enriched with biofertilizer (*Azospirillium* and *Phosfobakteria*) at 2 kg/ha provides tangible results relative to the number of pods and seed yield, and gives the highest yield of 1.11 tonnes/ha or 32 % higher than in the NPK recommendation only, so it is an efficient supply of nutrients to improve the yield of sesame well as improving soil fertility/soil health (Palaniappan et al. 2003).

Several varieties of Indonesian sesame are well suited to be developed in paddy fields after rice and dry land, namely, Sumberrejo-1 and Sumberrejo-4; Sumberrejo-2 and Sumberrejo-3 are suitable for development in dry land (Mardjono et al. 2006). Thus, varieties Sumberrejo-1 and Sumberrejo-3 are expected to be tolerant to cultivation on sandy land.

One indicator is the level of production of sesame sesame oil. Sesame oil is low in saturated fatty acids and unsaturated fatty acids are 84 %, so it is not harmful to good health (Suddhiyam and Maneekhao 1997), so that the development of sandy land into a production center for sesame required land quality improvement efforts through beach sand organic fertilizer. This study aims to determine the effect of organic and inorganic fertilizers, and a wide variety of seeds, on the productivity of sesame and an economic analysis/feasibility analysis of sesame cultivation on sand beach land.

11.2 Materials and Methods

Research was carried out in the beach sand land of Purworedjo, Central Java, in June to December 2011. This land has an organic matter content of 0.25 % (low), pH 6.15 (sour), total N 0.17 % (very low), available P 254 mg/100 g, available K 0.05 cmol (+)/kg, 99 % sand fraction (very porous), and KPK 0.90 cmol (+)/kg (Parwata 2010). The wind speed is relatively high (salt can reach 40 km/h). Daily soil surface temperature can reach the range of 26.9–31.5 °C (Sarjiyah 1997).

The materials used are sesame seeds, cow manure, and inorganic fertilizer (N, P, K). The research design used was a factorial randomized block design with two factors and three replications. The first factor, fertilization, consists of six types: control (without fertilization), farmyard manure 10 tonnes/ha of NPK recommendation (100:100:50), manure 7.5 t/ha + 5 % NPK dose recommendation manure 5 tons/ha + 50 % NPK dose recommendation, and manure 2.5 t/ha + 75 % NPK dose recommendation. The second factor is the wide variety, consisting of three kinds: Sumberrejo-1, Sumberrejo-2, and local black. Experimental plots measured 2 m × 3 m, with a spacing of 25 cm × 60 cm.

Variables observed were plant height, age of first flowering, seed weight per plant, number of pods per plant, harvest age, weight of 1,000 seeds, and oil content (Soxhlet method). Data were analyzed by analysis of variance (ANOVA) and Duncan's test with the test further 5 %. Parameters include the feasibility of the internal rate of return (IRR, rate of return on investment), and benefit/cost ratio (B/C ratio, ratio of income and expenses), and payback period (PP, the period of return of investment).

11.3 Results

Table 11.1 shows the effects of organic and inorganic fertilizers as well as varieties of sesame plant height in sandy land in Purworejo, Table 11.2 shows effects of fertilizer treatment and a wide variety of the flowering, harvesting, seed weight/plant, weight of 1,000 seeds, and sesame oil content in beach sand land in Purworejo, and Table 11.3 the results of the analysis of benefit to cost (B/C) ratio, internal rate of return (IRR), and payback period influenced by fertilization and sesame yield in a wide variety of land such as Purworejo beach sand.

11.4 Discussion

11.4.1 Height of Plants

Growth is a process in plant life that results in changes in the larger sizes that determine crop yield and is the result of the interaction between the various internal factors (genetic) and elements of climate, soil, and environmental biology of plants (Rukmana 1998). Effects of organic and inorganic fertilizer application showed no interaction with treatment sesame varieties (Table 11.1). Plant heights at the fourth and eighth weeks have increased from fertilizer treatment. At 12 weeks the control plants reached 82.83 cm, taller than plants grown with organic fertilizer only, inorganic alone, or a combination thereof.

Table 11.1 Effect of organic and inorganic fertilizers as well as varieties of sesame plant height in sandy land in Purworejo

	Height of plants (cm)		
Treatment	4th week	8th week	12th week
Fertilization			
Controls	11.17a*	43.22 a	82.83 c
Cow manure 10 tonnes/ha	26.00 c	56.22 ab	59.64 a
NPK 100:100:50	17.00 b	62.00 b	63.78 ab
Cow manure 7,5 tonnes/ha + 25 % NPK	17.00 b	78.11 c	76.11 bc
Cow manure 5 tonnes/ha + 50 % NPK	30.44 d	67.56 bc	69.89 abc
Cow manure 2,5 tonnes/ha + 75 % NPK	27.00 c	65.33 bc	69.89 abc
Varieties			
Sumberrejo-1	22.72 b	62.19 tn	65.22 tn
Sumberrejo-2	23.72 c	65.43	71.72
Black local	17.86 a	58.60	74.12
CV (%)	5.29	15.21	15.79

*Figures accompanied by the same letter within a column are not significantly different at 5 % Duncan test

NPK nitrogen:phosphorus:potassium ratio, *tn* not significantly different

Table 11.2 Effect of fertilizer treatment and a wide variety of the flowering, harvesting, seed weight/plant, weight of 1,000 seeds and sesame oil content in beach sand land in Purworejo

Treatment	Age flowering (day)	Harvesting (day)	Weight of seeds/ plant (g)	Weight of 1,000 seeds (g)	Oil content (%)
Fertilization					
Controls	45.00 a*	97.00 a	4.37 b	1.30 a	30.36 a
Cow manure 10 tonnes/ha	46.78 bc	105.00 b	5.42 d	2.19 e	51.73 e
NPK 100:100:50	46.11 b	105.33 c	4.90 bc	1.99 d	49.17 bc
Cow manure 7,5 tonnes/ha + 25 % NPK	46.55 bc	107.00 bcd	4.94 bc	1.80 bc	49.60 c
Cow manure 5 tonnes/ha + 50 % NPK	46.56 bc	105.00 b	4.83 bc	1.83 bc	46.49 b
Cow manure 2,5 tonnes/ha + 75 % NPK	47.22 d	105.00 b	4.05 a	1.35 a	50.46 d
Varieties					
Sumberrejo-1	46.33 tn	104.17 tn	4.81 b	1.77 b	48.57 c
Sumberrejo-2	46.55	104.00	4.85 b	1.97 c	45.40 b
Black local	46.22	104.06	4.60 a	1.51 a	44.92 a
CV (%)	3.49	4.21	3.87	4.07	0.98

*Figures accompanied by the same letter within a column are not significantly different at 5 % Duncan test
tn not significantly different

Table 11.3 Results of the analysis of B/C ratio, IRR, and payback period influenced by fertilization and sesame in a wide variety of land in Purworejo beach sand

Fertilization treatments and varieties	Economic indicators		
	B/C R	IRR (%)	PP
Controls, Sumberrejo-1	1.12	11	6.2
Controls, Sumberrejo-2	1.31	24	2.4
Controls, black local	0.79	0	0
Cow manure 10 tonnes/ha, Sumberrejo-1	1.75	43	0.6
Cow manure 10 tonnes/ha, Sumberrejo-2	1.91	48	0.5
Cow manure 10 tonnes/ha, black local	1.14	12	3.5
NPK 100:100:50, Sumberrejo-1	1.59	37	0.8
NPK 100:100:50, Sumberrejo-2	1.75	43	0.6
NPK 100:100:50, black local	1.01	1	6.6
Cow manure 7,5 tonnes/ha + 25 % NPK, Sumberrejo-1	1.63	39	0.7
Cow manure 7,5 tonnes/ha + 25 % NPK, Sumberrejo-2	1.75	43	0,6
Cow manure 7,5 tonnes/ha + 25 % NPK, black local	1.08	7	6.0
Cow manure 5 tonnes/ha + 50 % NPK, Sumberrejo-1	1.22	18	2.1
Cow manure 5 tonnes/ha + 50 % NPK, Sumberrejo-2	1.30	23	1.5
Cow manure 5 tonnes/ha + 50 % NPK, black local	0.90	0	0
Cow manure 2,5 tonnes/ha + 75 % NPK, Sumberrejo-1	1.36	27	1.4
Cow manure 2,5 tonnes/ha + 75 % NPK, Sumberrejo-2	1.65	40	0.8
Cow manure 2,5 tonnes/ha + 75 % NPK, black local	1.05	4	11.1

B/C benefit and cost ratio (the ratio of income and expenses), *IRR* internal rate of return (rate of return on investment), *PP* payback period (the period of return of investment)

By the fourth week, three varieties showed differences in growth, although the eighth and twelfth weeks showed no difference, showing the three varieties had the same growth response in the sand beach land. Research results reported by Okpara (2007) on sesame indicated that the addition of N and P gives real results in an increase in plant height, number of branches/plant, leaf area index, dry weight, and seed yield.

Rifin (1990) states that when the plant is short of water in the vegetative phase this does not have a direct influence on the results, but the growth of the plant, such as the stems, will be hampered. When compared with the sesame plant that grows in areas normally such as paddy fields, plant height from these observations is still relatively low. The low height of sesame in the beach sand results from the extreme microclimate and the limited availability of water and nutrients. A plant habitus that is too tall is not good for high-windspeed areas because it can cause the plants to easily collapse or broken stems.

11.4.2 Age of Flowering

There is no interaction effect between treatment and fertilization in flowering of sesame varieties (Table 11.2). The age flowering phase is the phase transition from vegetative to the generative phase. If the vegetative phase comes too fast there will usually be a problem in the generative phase. The age of flowering of a plant is closely related to the age of the harvest. Basically, the faster a plant flowers, the longer is the grain-filling phase and the sooner the plant can be harvested. The results showed that the fastest flowering date was 45 days in the control treatment, and the longest was in the treatment of cow manure 2.5 t/ha + 75 % NPK, which is 47.2 days. The addition of organic fertilizer caused 1–2 days delay in flowering. All three varieties tested showed the same flowering date.

The environment of sesame plants grown on sand beach land with all the good cekamannya related to temperature and nutrient limitations can affect the crop cycle, which is associated with floral age. High temperatures above the optimum can affect the metabolism of flowering plants much faster. In treatment with organic fertilizer, soil conditions can be improved so that the soil temperature is maintained and flowering is not too fast. This observation agrees with Nath et al. (2003) that high temperatures accelerate the emergence of the first flower on the sesame plant.

11.4.3 Harvesting

Harvest age is the age of the plant to complete the entire life cycle, which is closely related to flowering. The faster a plant enters the flowering phase, the sooner it will enter the phase of crop harvest.

Based on the analysis, results for harvesting averaged between treatments were almost the same, that is, 105 days (Table 11.2). Compared with controls, the addition of fertilizer delayed harvesting by 8–10 days. The higher dose of organic fertilizer will increase the life of the harvest. The addition of organic fertilizers causes better water availability. The three varieties tested showed no difference in harvest age. Sesame is a short-day plant, about 7 h per day. The longer the day, the faster will be the harvest (Soenardi and Romli 1994). It can be used in planting strategies related to rainfall areas. In the land of sand beaches, intensity of solar radiation is quite high with long exposure, higher than in mountain areas in general, where it is often hindered by cloud (Nath et al. 2003). Associated with the harvest, the indeterminate nature of when the fruit is ready makes the sesame harvest uneven, giving rise to a longer harvest time and, if not handled properly, will cause considerable yield loss because the pods are ripe and do not rupture for pod harvest.

11.4.4 Weight of Seeds Per Plant

Weight of seeds per plant is presented in Table 11.2; seed is the main result desired in sesame cultivation. This variable is strongly influenced by the growth variable. Growth inhibition may reduce or negate the results (Wijaya 2009). The addition of nutrients S, N, P, and K from organic and inorganic fertilizers can serve as a factor generating function in addition to improving grain yield (Devakumar and Giri 1998). Treatment with manure at 10 tonnes/ha achieves the best results for seed weight per plant, that is, 5.42 g (equivalent to 361 kg/ha), an increase of 24 % compared to controls. N fertilization at doses of 100–200 kg/ha affects the amount of interest generated and the number of seeds and oil content in sesame cultivated in the sandy land (El-Nakhlawy and Shaheen 2009). Varieties Sumberrejo-1 and-2 Sumberrejo achieve grain yield 5 % better than local varieties, which reach only 4.60 g (equivalent to 307 kg/ha). It seems that the dose of manure of 10 t/ha in this study is still inadequate. In some kinds of land, Gratitude (2005) found that administration of cow manure 20 tonnes/ha is able to improve the quality of the soil as it increases the water-binding capability and availability of ammonium and nitrate, thus increasing the growth and yield in caisim.

11.4.5 Weight of 1,000 Seeds

The weight of 1,000 seeds is closely related to yield components with large seeds and the weight of each seed. This parameter is also a component that directly affects the resulting size of the sesame crop, the productivity. However, for the varieties of sesame Sumberrejo-1 and Sumberrejo-2 as well as local varieties of black sesame planted on sand beach land, the potential results are still classified in accordance with the normal description of the potential yield of sesame (Mardjono et al. 2006). The addition of nutrients derived from the treatment with cow manure at 10 tonnes/ha

was able to increase the weight of 1,000 seeds by 68 %, from 1.30 to 2.19 g. Haruna and Abimiku (2012) reported that the dose of organic fertilizer at 2.5 ton/ha gives good results in the increase of the parameters of number of pods, weight of pods/plant, number of seeds/plant, and weight of 1,000 seeds.

11.4.6 Total Oil Content

Hwang (2005) reported that the proximate composition of sesame seeds varies in terms of varieties, seed color, and seed coat surface properties. Oil content is influenced by plant growth conditions, average daily temperature, and temperature during the reproductive stage (Kuzayli et al. 1966). Addition of organic fertilizer treatment either alone or in combination with NPK significantly increased sesame seed oil content compared to controls, from 53 to 70 %. However, the highest content of sesame oil (51.73 %) was obtained with the application of cattle manure at 10 tons/ha. Sharar et al. (2000) said that the oil content in sesame is influenced by the rates of nutrient/fertilizer, such as N and P, as well as being influenced by differences in soil and climatic conditions. Oil content increased up to 75 kg N fertilizer and 50 kg P.

Hasan et al. (1999) suggested, as a test result, when sesame of different local kinds in Turkey were planted at various locations to determine the quality of sesame oil, the obtained results of total oil and fatty acid content varied, so the planting location determines the quality of oil production. Egbekun and Ehieze, in Nzikou (2009), said that the production of oil products is influenced by crop varieties, seed maturation phase, the system of cultivation, and the extraction methods that were applied. The existence of essential nutrients contained in manure will increase water retention, and nutrients that act as a source of nutrients in the soil will affect root development. Similarly, with the addition of NPK fertilizer from an organic source the nutrients will increase, contributing to the growth of the plant organs, and will eventually lead to an increase in photosynthesis, which in turn affects the results of dry matter (Harma 2011).

Economic feasibility parameters (B/C ratio, IRR, and payback period) analysis of feasibility or a feasibility study can also assess the extent of the benefits that can be obtained in carrying out a business activity. The results of this analysis are used as a material consideration in making a decision whether to accept or reject the idea of a business. Understanding feasibility in this case is the possibility of a business idea that will be implemented to provide benefits in terms of financial and social benefits (Novania 2001). With the feasibility analysis, the expected risk of failure in marketing the product can be avoided. By knowing the value of the B/C ratio, IRR, and payback period, the rate of profit on investment alternatives can be seen, and can determine investment priorities, so that the investment can be avoided if it only wastes resources.

From the analysis it can be stated that the cultivation of sesame in beach sand land by applying organic fertilizer varieties and Sumberrejo-1 and Sumberrejo-2 provide prospective feasibility, particularly evident in the treatment of organic

manure at 10 tonnes/ha with the variety Sumberrejo-2. It is seen from the aspect of assessment for B/C ratio, which indicates a value more than 1, which means that in this business an overview of the income is higher than the cost of operations, namely, 1.91. The IRR, also providing value that exceeds the rate of return advantage, shows perfectly reasonable interest/higher return than if the capital is stored in the form of deposits, which amounted to 48 %. Furthermore, from the aspect of payback period the rate of return of capital occurs very quickly, only with the harvest; once the capital has been able to return, the value is 0.5. For comparison, the feasibility of the research farm onion with ameliorant technology in sand beach lands is also able to improve soil fertility and increase yields from a sand beach, with a B/C ratio of 2.4 and P/C ratio of 3.4 (Setyono and Suradal 2005).

11.5 Conclusions

From the results of research carried out in the sandy beach land, it can be concluded that organic fertilizer at 10 tons/ha has significant effect in increasing the production and content of sesame oil. The yield of sesame varieties Sumberrejo-1 and Sumberrejo-2 is more productive than that of the local varieties. Sesame cultivation on sandy land by applying organic fertilizer at 10 tons/ha with the variety Sumberrejo-2 provides prospective economic feasibility and efficiency, with the achievement of a B/C ratio of 1.91, 48 % IRR, and PP 0.5.

Acknowledgments Thanks are conveyed to the promoter and team (Prof. Prapto Yudono, Dr. Taryono, MS., and Dr. Eko Hanudin MS.) for their attention and guidance of the dissertation research stage of this author.

References

Buckman, H. O., & Brady D. (1982). Ilmu tanah. Penerjemah: Soegiman. Bharata Karya Aksara. Jakarta. hal. 131–191.

Budi, L. S. (2007). Pengaruh cara tanam dan penggunaan varietas terhadap produktivitas wijen. *Buletin Agronomi, 35*(2), 135–141.

Devakumar, & Giri, G. (1998). Influence of weed control and doses and time gypsum application on yield attributes, pd, and oil yield of groundnut. *Indian Journal Agronomy, 43*, 453–458.

Duhoon, A. Yotishi, J., Deshmukh, M. R., & Singh, N. B. (2007). *Optimization of sesame* (*Sesamum indicum* L.) *production through bio/natural inputs*. All India Coordinated Research Project on Sesame and Niger (ICAR) J.N. Agriculture University, Jabalpur (M.P.) India-48200.

El-Habbasha, S. F., Abd El Salam, M. S., & Kabesh, M. O. (2007). Response of two sesame varieties (*Sesamum indicum* L.) to partial replacement of chemical fertilizers by bio-organic fertilizers. *Research Journal of Agriculture and Biological Sciences, 3*(6), 563–571.

El-Nakhlawy, & Shaheen, M. A. (2009). Response of seed yield, yield components and oil content to the sesame cultivar and nitrogen fertilizer rate diversity. *JKAU (Meteorology, Environment and Arid Land Agriculture Science), 20*(2), 21–31. (2009 A.D./1430 A.H.) Department of Arid Land Agriculture, Faculty of Meteorology, Environment and Arid Land Agriculture King Abdulaziz University, Jeddah, Saudi Arabia.

Harma, A. A. A. (2011). Growth and yield of sesame (*Sesamum indicum* L.) as affected by poultry manure, nitrogen and phosphorus at Samaru, Nigeria. *The Journal of Animal and Plant Sciences, 21*(4), 653–659.

Haruna, & Abimiku. (2012). Yield of sesame (*Sesamum indicum*, L.) as influenced by organic fertilizer in the Southern Guinea Savana of Nigeria. *Sustainable Agriculture Research, 1*(1), 66–69.

Hasan, B., Turgut, I., & Turgut, K. (1999). Variation of certain characters and line selection for yield, oil, oleic and linoleic acids in the Turkish sesame populations. *Journal of Agriculture and Forestry, 23*, 431–441.

Hwang, L. S. (2005). *Sesame oil. Baileys industrial oil and fat product*. Taipei: National Taiwan University.

Kastono, D. (2007). Aplikasi model rekayasa lahan terpadu guna meningkatkan peningkatan produksi hortikultura secara berkelanjutan di lahan pasir pantai. *Jurnal Ilmu Pertanian, 3*, 112–116.

Kertonegoro, B. D. (2009). *Peluang pengembangan agribisnis sayuran di lahan pasir pantai Kabupaten Kulonprogo Yogyakarta* (Kasus Desa Bugel Kecamatan Panjatan).

Kuzayli, M. V., Cowan, J. W., & Sabry, Z. I. (1966). Nutritive value of Middle Eastern foodstuffs. II. Composition of pulses, seeds, nuts and cereal products of Lebanon. *Journal of the Science of Food and Agriculture, 17*, 82–84.

Mardjono, R., Supriyono, & Sudarmo, H. (2006). *Galur-galur baru untuk pengembangan wijen di Indonesia*. Makalah disampaikan pada sidang Komisi Pelepasan Varietas di Direktorat Jenderal Perkebunan Jakarta.

Musofie, A. (2008). *Upaya pengembangan usaha tani di lahan pasir pantai melalui pemanfaatan limbah usaha peternakan*. Makalah Seminar Nasional FTP- UGM.

Nath, R., Chakraborty, P., Bandopadhyay, P., Kundu, C., & Chakraborty, A. (2003). Analysis of relationship between crop growth parameters, yield and physical environment within the crop canopy of sesame (*Sesamum indicum*) at different sowing dates. *Archives of Agronomy and Soil Science, 49*, 677–682.

Novania. (2001). *Ekonomi teknik*. Pusat Pengembangan Bahan Ajar UMB. hal 2–11.

Nzikou. (2009). Chemical composition on the seed and oil of sesame (*Sesamum indicum* L.) grown in Congo: Brazzaville. *Advance Journal of Food Science and Technology, 1*(1), 6–11.

Okpara. (2007). Effects of N, P fertilizer rate on the growth and yield of sesame in the South astern Rain Forest Belt in Nigeria. *Nigeria Agricultural Journal, 38*, 1–11.

Palaniappan, S. P., Jeyabal, A., & Chelliah, S. (2003). *Evaluation of integrated nutrient management in summer sesame* (*Sesamum indicum* L.). Nagarjuna Agricultural Research and Development Institute C 15, Vikrampuri, Secunderabad – 500 009, India.

Parwata, Arya, IGM. (2010). *Kajian fisiologis ketahanan kekeringan tanaman jarak pagar* (*Jatropha curcas* L.) *di lahan pasir pantai*. Disertasi. Sekolah Pascasarjana. Universitas Gajah Mada.Yogyakarta.

Rajiman. (2010). *Pemanfaatan bahan pembenah tanah lokal dalam upaya peningkatan produksi benih bawang merah di lahan pasir pantai Kulon Progo*. Disertasi FP-UGM Yogyakarta.

Rifin, A. (1990). Pertumbuhan, hasil dan serapan hara N, P dan K tanaman jagung pada berbagai fase cekaman air. *Penelitian Pertanian, 10*(1), 19–21.

Roesmarkam, A., & Yuwono, N. W. (2002). *Ilmu kesuburan tanah*. Yogyakarta: Kanisius.

Rukmana. (1998). *Budidaya Wijen*. Yogyakarta: Kanisius.

Sanchez, P. A. (1992). *Sifat dan pengelolaan tanah tropika*. Alih bahasa: Amir Hamzah. Institut Teknologi Bandung. Bandung. 397 hal.

Sarjiyah. (1997). Budidaya tiga varietas kacang tanah di lahan pasir pantai, Dusun Gisik, Bugel, Kulon Progo, Yogyakarta. *Agriculture UMY, 6*(2), 1–6.

Setyono, B., & Suradal. (2005). *Kelayakan usaha tani bawang merah di lahan pasir pantai dengan teknologi ameliorasi di Kab*. Yogyakarta: Bantul Prov. DIY. Balai Pengkajian Teknologi Pertanian.

Sharar, M. S., Ayub, M., Choudhry, M. A., & Asif, M. (2000). Growth and yield of sesame genotypes as influenced by NP application. *International Journal of Agriculture and Biology, 1*(2), 86–88.

Soenardi, & Romli, M. (1994). *Pengaruh waktu tanam terhadap pertumbuhan dan produksi pada empat galur wijen*. Prosiding Seminar Sehari Pengembangan Pertanian Berwawasan Lingkungan Dalam Era Globalisasi. Fakultas Pertanian, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya. 10 September 1994.

Suddiyam, P., & Maneekhao, S. (1997). Sesame (*Sesamum indicum* L.). A guide book for field crops production in Thailand. Field Crops Research Institute (166 pp.). Department Agriculture.

Widiana, G. N. (1994). Peranan EM-4 dalam meningkatkan kesuburan dan produktivitas tanah. *Bulletin Kyusei Nature Farming, 5*, 28–43.

Wijaya. (2009). Keragaman sifat wijen (*Sesamum indicum* L.) generasi M3 hasil irradiasi sinar gama ^{60}Co di lahan pasir pantai.

Yuwono, N. W. (2009). Membangun kesuburan tanah di lahan marginal. *Jurnal Ilmu Tanah dan Lingkungan, 9*(2), 137–141.

Chapter 12
Water Balance Analysis for the Determination of Available Growing Season at Sub-Watershed, Loa Janan, East Kalimantan

Akas Pinaringan Sujalu and Ismail

Abstract This geographic sub-watershed is in Loa Janan, position 116°49′ EL–117°08′ EL and 0°34′ SL–0°45′ SL, with an extent of 644.2 km^2 that includes eight villages. Characteristics of rain in this area are included in the area class III (1,500–2,000 mm/year), with a bimodal or double wave rainfall model with C pattern. The highest rainfall period is in December and April, and the lowest rainfall in September and November. The sub-watershed has level Q (±9.8 %), or rainfall type A (very wet area with tropical wet vegetation), and an E1 agroclimate zone.

Monthly water balance indicated that this area has a potential growing season available all year round (12 months), a water surplus for 8 months (478.8 mm/year), and a water deficit for about 3 months (44.5 mm/year).

Keywords Water balance • Growing season

12.1 Introduction

Water is a natural resource that is renewable and can be found everywhere, although still limited in quantity and quality and availability, both geographically and according to the season. Therefore, increased use will result in human intervention against the greater water resources; this will cause change in order and the hydrological cycle as more and more territory is used, and an uneven distribution of water, both spatially and temporally, as well as decreasing water quality. At the same time, the utilization efficiency and lower water use often ignore areas from which the water flow is derived.

Along with the development of the city, most of the upstream regions of sub-watersheds have experienced pressure that caused degradation of the River Loa Janan, mainly because of logging, housing needs, and changes in regional function.

A.P. Sujalu (✉) • Ismail
Faculty of Agriculture, The 17th of August 1945 University, Samarinda,
Jl. Ir. H. Juanda 80, Samarinda 75124, Indonesia
e-mail: pinaringan_b@yahoo.co.id; ismail.6913@yahoo.co.id

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_12

Conditions are very obvious on a swamp area that stretches along the banks of the Mahakam River downstream and especially the watershed in Loa Janan of other rivers, of which a large part has been transformed into economic zones and settlements.

Management of a sub-watershed with good manners and rights is an attempt at controlling the reciprocal relationship between natural resources such as vegetation, soil, and water by humans and all their activities so that the watershed management objectives to ensure sustainability and harmony of the ecosystem and increase the benefits of natural resources contained therein for human life can be achieved. It is intended as an effort to maintain the Mahakam River water discharge in the dry season, which can prevent the intrusion of seawater. It also avoids increasing the flow rate of surface water in the rainy season, which can lead to high frequency of flooding in the cities of Samarinda and Tenggarong (Trisusanto 2002).

The direct impact that is felt as the change in the water balance of watershed Loa Janan is tangible, with the occurrence of droughts and floods that are more widespread and more frequent disturbances in various aspects of life.

12.2 Research Methods

12.2.1 Time and Place of Research

The study was conducted for approximately 6 months (July–December 2011) in watershed Loa Janan, covering an area of approximately 644.2 km^2.

12.2.2 Data Collection

Data were collected from both primary and secondary sources related to the research:

(a) Climate, particularly rainfall and evaporation
(b) Physiographic characteristics, particularly land slope
(c) Soil conditions, especially those related to water status in soil

12.2.3 Water Balance Analysis

Analysis of the water balance of land is expressed in the form of integral equations by simplifying some similarities, so that the water balance of a land area can be expressed in the form of the equation:

$$\mathrm{CH} = \mathrm{ETA} \pm \Delta\mathrm{WCS} \pm \mathrm{Li}$$

where:

CH = rainfall (mm months^{-1})
ETA = actual evapotranspiration (≤ETP)
Δ WCS = soil water content changes (mm months^{-1})
Li = runoff (surplus or deficit depending on its value) (mm months^{-1})

12.2.3.1 Analysis of Potential Evapotranspiration (ETP)

Calculation of potential evapotranspiration (ETP) using equations from Buckman and Braddy, quoted by Sujalu (1997) and Ismail (2009), is as follows:

$$\mathrm{EPTi} = 616 \times \left(10 \times \frac{\mathrm{Ti}}{\mathrm{I}}\right)^{a1}$$

$$\mathrm{I.} = \sum_{jan}^{des} \left(\frac{Ti}{5}\right)^{1.514}$$

$$\mathrm{a} = 6.75 \times 10^{-7}\mathrm{I}^3 - 7.71 \times 10^{-5}1^2 + 1.792 \times 10^{-2}1 + 0.492$$

where;

ETP = evapotranspiration
Ti = temperature of the month to the first month
I = index monthly heat
a = constant

12.2.3.2 Analysis of Soil Water Content (WCS)

Changes in water content of soil (WCS) is the difference in soil moisture content in a period relative to earlier periods between sequences. Each change in soil water content can be calculated with the formula R − ETP. If that is a negative value, there will be a deficit (lack of) water (ETP = Eta). Conversely, if (R − ETP) is positive, then there will be a surplus/excess of water (R − ETP − ΔWCS), so that soil water availability decreases exponentially and is expressed by the equation:

$$\mathrm{ASW} = \mathrm{WHC} \times \mathrm{k}^{\mathrm{a}},$$
$$\mathrm{WHC} = \mathrm{FC} - \mathrm{PWP},$$
$$\mathrm{WCS} = \mathrm{PWP} + \mathrm{ASW}$$

where

WCS = actual soil water content (mm)
ASW = availability of soil water actual (mm)
WHC = water-holding capacity or availability of maximum soil water (mm)
FC = field capacity (mm)
PWP = permanent wilt point (mm)
k = constant [obtained k = ((Po + P_1)/WHC)]

with

Po = 1.000412351 and P_1 = −1.073807306
a = accumulation of potentially lost water (accumulated potential water loss, APWL), which represents the accumulated value (R − ETP) when the value of R < ETP

12.3 Results and Discussion

12.3.1 Preview Area Sub-Watersheds Loa Janan

Sub-watershed Loa Janan is part of the Mahakam River watershed, located at coordinates between 116°49–117°08′ EL and 0°34′–0°45′ SL, with a total area of 644.2 km^2, divided into five districts, namely, sub-districts of Bakungan, Batuah, Loa Duri Ilir, Loa Duri Ulu, Loa Janan Ulu, Purwajaya, Tani Bhakti, and Tani Harapan. The sub-watershed area in Loa Janan has varied topography, with elevation ranging from 10–120 m above sea level with a diverse variety of heights (Table 12.1).

12.3.2 Condition Elements of the Climate in the Sub-Watershed Loa Janan

Rainfall data (2001–2010) from three climate observation stations in the sub-watershed area Loa Janan for the year showed that monthly average rainfall ranged from 104 to 214 mm month^{-1} or an average of 168 mm month^{-1}, whereas the average rainfall ranged from 1,500 to 2,850 mm/year or an average of 2,018 mm/year. Rainfall occurred on rainy days (rd) with monthly rates ranging from 9 to 14 rd with on average rainfall occurring 11 rd month^{-1}.

Analysis of rainfall characterization includes four main components, namely:

1. Annual rainfall spread of this area falls within class region III (rainfall between 1,500 and 2,000 mm/year).
2. Spread type rainfall in Loa Janan sub-watershed area has no period of dry months (months with rainfall <100 mm month^{-1}). Thus, the obtained value of Q = ±9.8 %,

Table 12.1 The area land use type at sub-watershed area Loa Janan (116°49′–117°08′ EL dan 0°34′–0°45′ SL)

No.	Area land use type	Area (ha)	(%)
01.	Farm (dry land farming)	403.13	0.65
02.	Forest	292.15	0.46
03.	Shrub	13,996.25	22.23
04.	Mixed garden	8,473.44	14.21
05.	Bush	29,501.36	46.07
06.	Wetland	1,248.99	2.06
07.	Garden	2,106.64	3.52
08.	Settlements	4,267.78	7.21
09.	Settlement expansion (Pp)	415.61	0.69
10.	Slough/swamp area	1,815.63	2.91
Amount		64,420.98	100

Source: Anonymous (2001)

or rain type A (which may imply that the watershed area Loa Janan is very wet areas with dense vegetation of tropical rainforest).

3. Rainfall patterns are bimodal or dual (double wave) with the notation pattern C; periods of high rainfall occurred in December and April and periods of low rainfall occurred in September and November.
4. For agro-climate zones, the watershed has no dry months, 8 humid months (HM), and 3 wet months (WM), including agro-climate zones E1 (Table 12.2).

12.3.3 Calculation of Potential Evapotranspiration (ETP)

Calculation of potential evapotranspiration (ETP) conducted monthly by using equations from Buckman and Braddy, quoted by Sujalu (1997) and Ismail (2009) in the watershed area Loa Janan ranged from 137.2 to 140.2 mm or an average of 138.8 mm month^{-1}; the highest point in April was 140.2 mm and the lowest point in July was 137.2 mm.

12.3.4 Water Balance

The calculation results in soil water status as obtained from analysis of soil physical properties in the laboratory soil of AATA (Agency of Agriculture Technology Assessment) of Province of East Kalimantan from Heriansyah (2004) showed that soil available water content (WCS) was in the range between 244 and 299 mm or an of average 268 mm.

Table 12.2 Climate data average monthly Loa Janan sub-watershed area 116°49′ EL–117°08′ EL dan 0°34′ SL–0°45′ SL

	Month											
Climate elements	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm month^{-1})	194	123	233	333	183	113	178	121	104	134	198	214
Rainy days (days)	12	11	12	14	12	11	9	10	9	11	11	12
Temperature (°C)	26.8	26.7	27.0	27.2	27.0	26.6	26.2	26.5	26.6	26.9	26.9	26.9
Humidity (%)	87.2	86.3	89.2	90.2	88.6	86.5	85.6	86.2	83.4	85.9	87.1	86.3
Sun radiation (Kkal cm^{-2})	0.55	0.48	0.51	0.53	0.53	0.51	0.51	0.49	0.41	0.44	0.44	0.52

Water balance implies the details of the input and output of water in one area at a certain time period, compiled in the form of quantitative equations, which provide information in the form of quantitative values of each component of input and output water, as can be seen in Appendix Table 12.4.

Monthly water balance analysis of the results mentioned here shows that these areas have a surplus during the 8 months from January to May and in November–December. The monthly water surplus in overall water surplus reached 478.8 mm/year. In addition to having monthly water surpluses, the region normally has a monthly cumulative water deficit in the period from July to October of as much as 44.5 mm/year as a whole.

As has been previously communicated, in its position the Loa Janan River divides the city of Tenggarong, and considering the amount of potential runoff that occurred in the region and also by considering the conditions of Loa Janan area topography, the watershed area in Loa Janan is very possibly suitable to build dams or reservoirs, which have various functions. Although the main function is to accommodate the construction of the dam, monthly surplus water runoff results in a potential that is large enough in this area, as well as water reserves in the period of the months of water deficit that can be utilized by a variety of purposes including drinking water.

12.3.5 Analysis of Cropping Periods (Growing Season)

Determining the length of the cropping period (growing season) can be based on the ratio P/PE (ratio between precipitation and potential evapotranspiration), defined as the time interval in a year that has a ratio P/PE > 0.5 plus the time needed for evapotranspiration of 100 mm of groundwater considered available in the soil (FAO). Results of analysis of the ratio P/PE can be seen in Table 12.3.

Based on this analysis, the P/PE ratio of the foregoing shows that the P/PE in rainfall average monthly cumulative throughout the year (12 months) is always >0.5. Therefore, according to the restrictions provided by FAO, the sub-watershed Loa Janan has a planting period (length of growing season) of 12 months or all year round.

12.4 Conclusion

Based on the description as a whole, it can be concluded that sub-WBA Loa Janan area has a all-year-round (12-month) potential planting period (growing season), which is supported by the surplus water during 8 months or cumulatively amounting to 478.8 mm/year and a deficit of water for 3 months or cumulative of 44.5 mm/year.

Table 12.3 Ratio rainfall (R) and potential evapotranspiration (EP) monthly

	Months											
Climate elements	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm/month)	194	123	233	333	183	113	178	121	104	134	198	214
Evapotranspiration. Pot./ ETP (mm)	139.0	138.7	139.6	140.2	139.6	138.4	137.2	138.1	138.4	139.3	139.3	138.7
Ratio P/PE	1.4	0.9	1.7	2.4	1.3	0.8	1.3	0.9	0.8	0.9	1.4	1.5

Appendix

Table 12.4 Monthly water balance in the Loa Janan sub-watershed area

Parameter	Bulan											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Rainfall (mm)	194.0	143.0	233.0	333.0	183.0	113.0	178.0	121.0	104.0	134.0	198.0	214.0
Potential Evapotr/ETP (mm)	139.0	138.7	139.6	140.2	139.6	138.4	137.2	138.1	138.4	139.3	139.3	138.7
R – ETP (mm)	55.0	4.3	94.4	192.8	42.4	−25.4	40.8	−17.1	−34.4	−5.3	58.7	75.3
APWL (mm)	0	0	0	0	0	0	0	−17.1	−51.5	−61.8	0	0
Water content of soil / WCS (mm)[1]	268	268	268	268	268	242.6	268	250.9	198.5	136.7	185.4	260.7
Δ WCS	0	0	0	0	0	−25.8	0	−17.1	−58.0	−62.0	−3.3	0
Actual evapotran/ETA (mm)[2]	139.0	138.7	139.6	140.2	139.6	138.4	136.9	142.0	152.0	196.0	139.3	138.7
Deficit (mm)	0	0	0	0	0	0	0.3	3.9	13.6	26.7	0	0
Surplus (mm)	55.0	4.3	94.4	192.8	42.4	0	0	0	0	0	58.7	75.3

116°49′ EL–117°08′ EL dan 0°34′ SL–0°45′ SL

1. Water content of soil (WCS) at field capacity (FC)

2. Actual evapotranspiration (ETA) in the period of time deficit (R<ETP) was obtained from R (mm) + Δ WCS.

At the time of surplus (R>ETP) the amount was equal to ETP

References

Anonymous. (2001). *Inventory and identification of areas prone environment in sub-watershed Loa Janan Samarinda* (Mapping erosion hazard level). BAPEDALDA. East Kalimanatan.

Asdak, C. (1995). *Hydrology and watershed management*. Yogyakarta: Gadjah Mada University Press.

Ismail. (2009). Water balance analysis at Karangmumus River Watershed Area (RBA) Samarinda City. *Journal MAKARA-SAINS, 13*(2), 151–156. Universitas Indonesia.

Seyhan, E. (1990). *Hydrology basics*. Yogyakarta: Gadjah Mada University Press.

Sosrodarsono, S., & Takeda. (1983). *Hydrology for water resources*. Jakarta: PT Pradnya Paramitha.

Sujalu, A. P. (1997). *Climate resources utilization for agriculture and water management planning*. Seminar Papers. LPTP-East Kalimantan.

Trisusanto, A. (2002). *Protected area management plan for the upper rock watershed mumus samarinda through local community approach*. Thesis. Graduate Program. Faculty of Civil Engineering. Surabaya Institute of Technology (Unpublished)

Chapter 13
The Right to Organic/Ecological Agriculture and Small-Holder Family Farming for Food Security as an Ethical Concern

Wayne Nelles

Abstract This paper examines the right to ecological and organic agriculture-based food security through rural small-holder family farming or associated livestock production, fishing, pastoralism and gathering, as an important ethical concern. It discusses how rural small-holder rights to adequate, healthy, safe, nutritious food (as well as land, seeds, waters, and traditional or local knowledge needed for producing an ecologically sustaining food sources) remain poorly understood or ignored, inadequately supported or advocated and not legally defended well by governments. It further suggests that those rights, and small farmers' ability to earn a decent, socially responsible and ecologically sustainable livelihood, may be undermined by governments and large, multinational private sector companies, through unjust (de facto unethical) policies or laws, and even corporate criminal behaviour. The paper reviews such as issues in the context of agrarian reform and justice demands, global policy debates, guiding ethical norms and legal frameworks, recommendations from international agency reports, identified human rights obligations of transnational corporations and arguments from the United Nations Special Rapporteur on the Right to Food. In sum, it argues that governments have a moral (and in some respects legal) obligation to better uphold the rights of small-holder family farmers to practice ecological or organic agriculture, allowing them to produce appropriate and adequate food. It suggests that national planning, policy reforms and development cooperation might better acknowledge and support this obligation while beginning new initiatives during the United Nations *International Year of Family Farming*, *2014*.

Keywords Agro-ecology • Family farming, food rights • Justice, organic

---

Presented to The First International Conference of the Asia-Pacific Society for Food and Agricultural Ethics (APSAFE 2013) "*Food Safety and Security for the 21st Century*", November 28–30, 2013, Chulalongkorn University

W. Nelles, Ph.D. (✉)
Chulalongkorn University School of Agricultural Resources, Bangkok, Thailand

Vancouver, Island University (VIU) – Collaborating Partner/Home Institution, Powell River Campus, Powell River, Canada
e-mail: Wayne.Nelles@viu.ca

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_13

13.1 Introduction

The 1948 *Universal Declaration on Human Rights* is one of the most well-known ethical norms of the twentieth century, which endures today. Whether its intentions have been adequately respected or realized remains a broader concern. Nonetheless, that declaration pledged that "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food…" (Article 25). Subsequently, many other international agreements, legal frameworks, aid or development cooperation programmes and national initiatives targeted global hunger and food security challenges. But this somewhat vague and generic rights commitment has allowed disputed interpretations about ethical implications or legal obligations. A key concern now, however, from the perspective of the principal UN agency responsible for monitoring and studying human rights, is that:

> the right to food is not a right to be fed, but primarily the right to feed oneself in dignity… (and that)… To produce his or her own food, a person needs land, seeds, water and other resources, and to buy it, one needs money and access to the market. The right to food requires States to provide an enabling environment… (Office of the United Nations High Commissioner for Human Rights 2010, p. 3)

This ultimately means, for those who wish to exercise it, the right to *produce* adequate, safe, healthy, nutritious and appropriate food as well as access to the various technical tools, knowledge, skills and practices or other means and resources for doing so. This paper discusses this challenge as an important ethical concern and suggests that support for ecological or organic agriculture is a vital means to better realize the right to achieve food security by and for rural small-holder family farmers.[1]

So far ecological or organic agriculture rights for small farmers have not been well defined in law. There also does not yet appear to be a clear ethical imperative and strong "enabling environment", as the UN High Commissioner for Human Rights called for, to facilitate food rights implementation more generally. Nonetheless, the issue has emerged as an important theme in some international debates and agencies.

[1] The concept of small-hold farmers can include family or local/peasant or indigenous community farmers involved in many types of primarily local food growing or associated livestock production, fishing, pastoralism and gathering, for their own food security, and to support adequate income generation, "fair trade" and rural livelihoods principally benefiting families, small groups or local communities. Small-hold farms could include personal or family businesses on small plots of land, or those managed by small cooperative groups, or even local small business enterprises. The concept of a "small" geographical area, scale of operations or farm size (hectares, employees, income, sales, etc.) is relative. But it usually refers to the vast majority (at least 90 %) of up to 1.5 billion farmers worldwide, mostly in developing countries of the Global South, managing or working on some 404 million farms of less than 2 ha producing around 70 % of the world's food (IFOAM 2011; World Rural Forum 2011). Small does not include large domestic or international food or farming corporations which own or run industrial-scale agribusiness operations on hundreds, thousands or even millions of hectares.

13.2 Ethics of Food Insecurity, Small Farm/Ecological Loss, TNCs and Injustice

Recent UN reports documenting the state of global poverty, hunger, nutrition and food security suggest that today from 868 million to over 1 billion people globally still face undernutrition, malnutrition, chronic hunger and food insecurity, with not enough to eat to meet basic daily needs. Moreover, with some tragic irony, 70–80 % of the hungriest, least food secure, poorest and most vulnerable are small farmers, rural or indigenous people and agriculture labourers or contractors (FAO et al. 2012, p. 4; IFAD 2010, p. 16; Ziegler 2011, p. 3). Meanwhile, over the past few decades, hundreds of thousands of small family farms and livelihoods worldwide have been lost and are increasingly under threat, along with the ecosystems and rural communities which are once both supported and benefited from them (Buckland 2004; GRAIN 2012; Holt-Gimenez et al. 2009; Patel 2007).

Reasons for this troubling state of affairs are varied and complex. Each case requires specific attention reflecting unique circumstances and challenges. But part of the broader explanation, shared by various analysts and small farmers most affected, is that many governments have increasingly supported macroeconomic approaches and large transnational corporations (TNCs) as tools for national development and (ostensibly) food security. They have sometimes done this with advice from international agencies and experts, even TNCs themselves. But they have not given adequate care or concern about impacts on small farms or had much direct consultation with rural farm communities and indigenous groups or made an honest assessment of ethical implications. Governments have also not well addressed the multiple or primary causes of hunger and malnutrition, which could include TNCs often playing a negative role. They have not reduced or eliminated barriers against small farmers and citizens to grow, harvest or market adequate nutritious food to meet their personal needs and sustain local economies, communities or healthy ecosystems. Instead, they have favoured and enabled TNCs through a plethora of international agreements, national policies, unfair subsidies and harmful laws which have increased multinational corporate control over an industrial, commodity-focused, monocrop and export-oriented, agriculture, food and seed system.

Over the past two decades, this global system has significantly undermined small farmer, indigenous and peasant rights to food and allowed many more violations. This system has destroyed many lives (literally, through farmer suicides among other tragedies), livelihoods, local economies, communities, ecosystems, biodiversity, local food security, traditional resources, seeds and lands. The system has condoned or facilitated the overwhelming economic and political influence of hundreds or thousands of particular corporations through a multitude of specific national or local laws; various types of corruption, human rights or labour abuses; and manipulation of consumer choice through deception and false or misleading advertising. Beyond raising obvious ethical concerns, some TNC activity has also been clearly illegal. Some TNCs survive, continue to offend and prosper even when fined for transgressions (which they view as just the cost of doing business) or convicted of

criminal behaviour in environment and food sectors. An entirely new field of academic study and legal practice – "green criminology" or "environmental justice" – has grown to document and analyze such unethical and criminal behaviour. Law suits have named civil society groups or farmers against corporations on one the hand or on the other, corporations suing or intimidating small farmers through patent laws or successfully lobbying government officials (through bribes or other means) to change laws in their favour (e.g. Brisman 2008; GRAIN 2012; Walters 2007). Many governments, some themselves corrupt, directly or tacitly support this unjust system and TNCs are dominating it.

This huge and complex global challenge has not gone unnoticed for some people and organizations in the international community and even some progressive governments which have sought to address some serious or glaring concerns. At the beginning of the twenty-first century, for example, in the face of expanding influence of TNCs among other factors affecting smallholders' plight, the Food and Agriculture Organization (FAO) designated ethics a new priority. It established a new Committee on Ethics and an independent Panel of Eminent Experts to review critical issues and inform decision-making. Its initial report argued that:

> …hunger results from neglect of the universal right to food. Both formal ethical systems and ethical practices in every society presume the necessity of providing those who are able bodied with the means to obtain food and enabling those who are unable to feed themselves to receive food directly. Failure to do so is deemed an injustice, an unethical act…(FAO 2011, p. 3)

Right to food discourse has also now included some reference to agro-ecological/organic food and agriculture principles in obligations conceptualized and promoted by various international agencies, regional organizations and governments in voluntary guidelines (FAO 2005). However, due largely to still strong corporate interests and influence with deregulatory neoliberal economic values in an entrenched global trading system and investment regimes, these are still *voluntary* guidelines (i.e. suggestions), not legally enshrined or enforceable rights. The result is that corporations (through supportive or neglectful governments, sometimes corrupt politics, dubious legislation and unfair/unethical taxpayer-funded subsidies) do simply what fits their economic or political interests. Those corporations and governments do not fundamentally or adequately respect ecosystem values or small farmer concerns.

Nonetheless, TNCs arguably have ethical, if not legal, responsibilities to contribute to the realization of the "right to adequate food" (Commission on Human Rights 2003). Yet the UN Special Rapporteur on the Right to Food quoting a 1996 UN Secretary-General report on TNCs stated their global reach "is not matched by a coherent global system of accountability" and that "despite wielding greater power than ever before" TNCs "are trying to avoid being held accountable…" He further noted that although states were ultimately accountable for compliance, all members of society including "the private business sector – have responsibilities… and avoid complicity in violations of the right to food carried out by others, including host Governments" (Ziegler 2006, pp. 16–18). This would be a profound indictment if taken seriously by governments and external monitoring or enforcement bodies, especially as TNC power and influence have grown dramatically since 1996.

Meanwhile, broader ethical and legal implications for food and agriculture have not been well discussed in the public arena or in academia, while international agencies and governments are still not adequately addressing the issue. For example, among FAO staff and experts, genetically modified organism (GMO) issues in particular have been ranked as one of the most important ethical concerns yet to be adequately addressed (Bhardwaj et. al. 2003, pp. 569–70). Yet TNCs, and their use or abuse of GMOs, continue to grow, spread and permeate the global food and seed system. A vast civil society movement, representing millions of consumers, small farmers and peasant communities, worldwide do not support GMO seeds and crops, or intellectual patenting of life forms, as acceptable under any circumstances. The global organic agriculture movement, represented by the International Federation of Organic Agriculture Movements (IFOAM) including farmers, small business owners, scientists and educators, prohibits GMOs in organic agriculture as inappropriate technologies, contaminants and health hazards threatening local economies, food safety and small farm incomes. Instead, IFOAM advocates more attention to small farmer rights and agro-ecological methods (IFOAM 2011; IFOAM World Board 2002).

13.3 A New Ethical Imperative? Small Farmer and Organic/Agro-ecological Food Rights

Some small-holder farmers and civil society or scholar activists have organized not just to protest maltreatment or unsustainable practices and GMOs. They are part of a countermovement encouraging stronger local food systems and fair trade alternatives to exploitive TNC-controlled agribusiness, and there are many successful examples (Lamb 2008; Norberg-Hodge et al. 2002). Civil society groups fighting harmful impacts of the global agribusiness trend over two decades and view their battle partly as a moral struggle to protect indigenous and family farm rights, communities as well as the integrity of the ecosystems upon which they depend. GRAIN, winner of the 2011 "Right Livelihood Award", (considered the "alternative Nobel Prize") reflects this view, shared by the broad *Via Campesina* movement (GRAIN 2012). Their goals go beyond food security alone, but most call organic/agro-ecological methods as key to delink them from TNC dominance, reduce TNC power over others and call for "food sovereignty" to protect themselves and insure independent local community control over decisions about agriculture practices, land management, water, natural resources and food supplies.

For those proposing viable alternatives, the mandate usually goes beyond simplistic food security definitions of governments or corporations. Rather, food sovereignty implies a radical transformation of the entire global food and economic system. This means the removal of agriculture from World Trade Organization (WTO) rules and many other regional or bilateral trade agreements, due to their devastating effects on local communities, economies, health, nutrition and food

security (GRAIN 2012; Rosset 2006). It means a stop to inappropriate, unwanted biotechnology resulting in unethical private patenting and manipulation of GMO seeds or other life forms (Brac et al. 2000; IFOAM World Board 2002).

Over the past decade, global environmental problems (many associated with agriculture and food systems) have also grown alongside the power and global reach of TNCs, as well as the countermovement for food sovereignty. Environmental problems which have intensified and become more difficult to curtail or mitigate have included land degradation, deforestation, desertification, pollution, aquifer depletions, greenhouse gas emissions and climate change, habitat and biodiversity loss, GMO contamination/pollution and more. Amid such troubling developments, other international agency studies have also acknowledged the need to better link food rights, land reform and environmental sustainability analyses with ethical reflections. A recent review of major ethical issues by FAO appointed experts suggested that:

> …The ethical concerns related to food and agriculture are…essentially twofold. One is to promote conditions in which sufficient food is produced and distributed in ways that ensure that everyone has access to adequate food; the other is to promote policies and measures ensuring ecological sustainability of food production, including in fisheries, and similar sustainability in the practice of forestry. (FAO 2011, p. 10)

The "sustainability" concept in food or agriculture sectors is still contentious and is viewed or operationalized differently among diverse stakeholders. Nonetheless, among important issues and recommendations, some FAO experts made was to give more support to small-scale food production to better benefit the food-insecure in local markets. They called on the FAO to encourage states to prioritize agro-ecological models to overcome hunger and provide employment, as well as promote small farmer agriculture, indigenous peoples' livelihoods and security of land tenure (FAO 2011, p. 13, 25).

Complementary studies by the Special Rapporteur on The Right to Food and Human Rights Council Advisory Committee offered similar analyses and recommendations. They argued for a range of interrelated perspectives and approaches which included organic agriculture and agro-ecological methods to better protect the rights and health of peasants, indigenous peoples, small-holder farmers and agriculture labourers; facilitate more effective agrarian reforms and rural development; deter "biopiracy"; and insure protection and viability of traditional seeds, genetic material and biodiversity. This would also mean stronger support for the UN Human Rights Council's *Declaration on the rights of peasants and other people working in rural areas* (Schutter 2010; Ziegler 2011, passim).

The Special Rapporteur's work ultimately supports many moral (and sometimes legal) claims that civil society critics of environmentally and socially destructive agribusiness and organic advocates have long made. He noted that some governments have resisted "right to food" language, preferring instead to focus on the (less political or legal obligation producing) concept of "food security". The Special Rapporteur also criticized the emphasis on biotechnology and free trade which he noted were "bitterly criticized" by NGOs and social movements, would not neces-

sarily solve world hunger, and could actually be obstacles to insuring right to food. He noted their proposals for more viable policy alternatives which included small-scale farming, agro-ecology and (reflecting the concerns of the worldwide peasant movement) the concept of food sovereignty (Ziegler 2002, pp. 5, 7).

From a broader perspective the 1966 United Nations *International Covenant on Economic Social and Cultural Rights* in reference to food rights highlighted the need to reform agrarian systems. It gave more specific legal and political force towards food rights and obligations among States Parties (i.e. signatory governments). It even highlighted the need "to improve methods of production, conservation and distribution of food…" Yet these issues have been marginalized over several decades as global agribusiness expansion and large-scale industrial development dominated much international agency policies, agricultural research and programming as well as in many national policies or economic strategies. And although new global attention to the idea of corporate social responsibility (CSR) and sustainable development in agribusiness could be a welcome development, it still may not guarantee food rights, mitigate the plight of small farmers or even support agro-ecology and organic agriculture. Realization of the right to food with agrarian reform would (if ethical, legally just and effective) better deter abuses while more positively supporting land access rights and security of tenure for peasants for growing food and sustaining communities (Ziegler 2009, p. 22). This remains unfinished business.

From the perspective of how land can be most effectively (ecologically, economically, socially) used by peasants or other vulnerable groups including small-scale farmers, the Special Rapporteur on the Right to Food later, in a report on agro-ecology, argued that "States can and must achieve a reorientation of their agricultural systems towards modes of production that are highly productive, highly sustainable and that contribute to the progressive realization of the human right to adequate food". They can also improve nutrition while combatting climate change. Agro-ecology, he said, is a key tool for facilitating all this by enhancing on-farm fertility, improved production, reducing farmers' reliance on external inputs and state subsidies and making them less dependent on local retailers and moneylenders. Supporting small farmers' right to food and development through agro-ecology can strongly contribute to broader economic development as well. But, he said, government policies must better support agro-ecology and scaling up of practices (Schutter 2010, pp. 1, 9–10, 13, 15–16).

13.4 Conclusion: An Opportunity for Ethical Dialogue, Reform and New Research, IYFF, 2014

Deadly, often preventable, hunger and food insecurity especially among small farmers is clearly a major ethical issue, whether caused by benign neglect, harshly competitive neoliberal economic policies, deliberate political intention,

TNC business strategy or other reasons. At the same time, practical, ethically justifiable, alternatives have grown. Various social movements support agro-ecology and organic agriculture practices shared by millions of small farmers worldwide. The World Rural Forum (WRF) in particular is a coalition of some 365 agricultural and development organizations in over 60 countries. It identified many environmental and socioeconomic problems faced by small farmers due to a (TNC influenced) "global food system" which had "become such a dominant force shaping the surface of this planet and its ecosystems" and "that we can no longer achieve sustainability without revamping the food system". The WRF further suggested that "sustainable food systems provide great hope…, a future in which all can lead satisfying lives within the means of the biosphere". Small family farmers, the WRF argued, can show viable alternatives (WRF 2010, pp. 1–2).

The WRF led a successful campaign over several years to have the United Nations General Assembly (UNGA) declare 2014 *International Year of Family Farming* (*IYFF*, *2014*) which the UNGA affirmed (UNGA 2012). The WRF advocated the IYFF suggesting specific objectives for small-holder farmers and agro-ecology in particular. It asked for stronger promotion and defence of family farming requesting governments to do the following:

> Pursue agrarian reforms … (and) *Promote sustainable*, *agro-ecological approaches by and with family farmers*. Invest with family farmers in sustainable, agro-ecological, environment-friendly agriculture models, systems, technologies and practices that ensure proper management of natural resources (land, soil, forests, waters), sustainability of the environment and biodiversity, climate resilience, wide use of local resources and local wisdom, and control over their own seeds…(World Rural Forum 2011, pp. 3–4)

Not all governments may support the IYFF 2014 for similar reasons or share all WRF objectives and such a broad or radical agro-ecological, social or agrarian reform vision. But the UNGA representing most UN member governments have supported in principle small family farmer rights and their food security through agro-ecological methods. Similarly, the UN Special Rapporteur on the Right to Food provided a strong argument for related new initiatives and reform (de Schutter 2010). How those rights are now understood, realized and protected may still depend partly on differing or shared ethical perspectives and personal or corporate values which then inform actual laws, government policies, reform strategies, practices and programmes.

In sum, human survival depends on food production, harvesting, provision and processing from domesticated or wild sources. Yet food sustainability requires adequate land, water and other environmental inputs to thrive. Without care or knowledge of natural resources, agriculture can also harm ecosystems and people. Organic agriculture and agro-ecological methods can provide ethically justifiable alternatives to the current TNC-dominated industrial system which continues to ignore such concerns while undermining small farmer rights.

This paper calls for new collaborative policy dialogue and interdisciplinary research partnerships among academics, farmers, civil society groups, international agencies and governments to strengthen and uphold rural small-holder rights to ecological and organic agriculture-based food security. New work should better

demonstrate governments' (as well as TNCs') moral and legal responsibilities for supporting small farmers' rights. More public awareness initiatives and policy dialogue about organic agriculture values and agro-ecological methods should be undertaken. New research should help guide national planning priorities. New priorities and approaches in development cooperation should better support these obligations. All such work, together, can contribute to improved understanding of the issues while helping to inform innovative policies and programmes to support agrarian reforms and better realize small farmers' rights. The *IYFF*, *2014*, could be an opportunity for beginning a new public conversation about related ethical and legal concerns.

References

Bhardwaj, M., Maekawa, F., Niimura, Y., & Macer, D. R. J. (2003). Ethics in food and agriculture: Views from FAO. *International Journal of Food Science and Technology, 38*, 565–577.

Brac de la Perriere, Ali, R., & Seuret, F. (2000). *Brave new seeds: The threat of GM crops to farmers*. London: Zed Books.

Brisman, A. (2008). Crime-environment relationships and environmental justice. *Seattle Journal for Social Justice, 6*(2), 727–817.

Buckland, J. (2004). *Ploughing up the farm: Neoliberalism, modern technology and the state of the world's farmers*. Black Point: Fernwood Publishing.

Commission on Human Rights. (2003, August 26). *Norms on the responsibilities of transnational corporations and other business enterprises with regard to human rights*. Sub-commission on the promotion and protection of human rights. United Nations, E/CN.4/Sub.2/2003/12/Rev.2.

FAO, WFP and IFAD. (2012). *The state of food insecurity in the World 2012: Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition*. Rome: Food and Agriculture Organization of the United Nations (FAO).

Food and Agriculture Organization of the United Nations (FAO). (2005). *Voluntary guidelines to support the progressive realization of the right to adequate food in the context of national food security*. Rome: FAO. Adopted by 127th Session, FAO Council November 2004.

Food and Agriculture Organization of the United Nations (FAO). (2011). *Report of the panel of eminent experts on ethics in food and agriculture, fourth session 26–28 November 2007*. Rome: Publishing Policy and Support Branch, Office of Knowledge Exchange, Research and Extension, FAO.

GRAIN. (2012). *The great food robbery: How corporations control food, grab land and destroy the climate*. Barcelona: Pambazuka Press.

Holt-Gimenez, E., Patel, R., & Shattuck, A. (Eds.). (2009). *Food rebellions: Crisis and hunger for justice*. Oakland: Food First Books/Institute for Food and Development Policy.

IFOAM World Board. (2002, May). *Position on genetic engineering and genetically modified organisms*. International Federation of Organic Agriculture Movements (IFOAM).

International Federation of Organic Agriculture Movements (IFOAM). (2011). *The role of smallholders in organic agriculture: IFOAM position paper*. Bonn: IFOAM.

International Fund for Agricultural Development (IFAD). (2010). *Rural poverty report, 2011. New realities, new challenges: New opportunities for tomorrow's generation*. Rome: International Fund for Agricultural Development (IFAD).

Lamb, H. (2008). *Fighting the banana wars and other Fairtrade battles: How we took on the corporate giants to change the world*. London: Rider/Random House.

Norberg-Hodge, Merrifield, H. T., & Gorelick, S. (2002). *Bringing the food economy home: Local alternatives to global agribusiness*. Bloomfield: Kumarian Press/Zed Books/Fernwood Publishing.

Office of the United Nations High Commissioner for Human Rights. (2010). *The right to adequate food* (Fact Sheet, Vol. 34). Geneva: United Nations.

Patel, R. (2007). *Stuffed and starved: The hidden battle for the world's food system*. Toronto: Harper Collins/Perennial.

Rosset, P. M. (2006). *Food is different: Why we must get the WTO out of agriculture*. Black Point: Fernwood Publishing.

de Schutter, O. (2010, December 20). *Report submitted by the Special Rapporteur on the right to food* (*Agro-ecology*). Human Rights Council. A/HRC/16/49.

United Nations General Assembly (UNGA). (2012, March 28). *International year of family farming, 2014, resolution adopted by the general assembly on 22 December 2011*. A/RES/66/222.

Walters, R. (2007). Food crime, regulation and the biotech harvest. *European Journal of Criminology, 4*, 217–235.

World Rural Forum. (2011, November 2). *Proposals for the compilation document Rio + 20, presented by World Rural Forum*.

World Rural Forum. (2010, July). *Conceptual document of the campaign in favor of an International Year of Family Farming -IYFF*. www.familyfarmingcampaign.net

Ziegler, J. (2006, March 16). *Economic, social and cultural rights, the right to food. Report of the Special Rapporteur on the right to food, Jean Ziegler*. United Nations Economic and Social Council. E/CN.4/2006/44.

Ziegler, J. (2011, February 18). *Preliminary study of the Human Rights Council Advisory Committee on the advancement of the rights of peasants and other people working in rural areas*. United Nations General Assembly, A/HRC/16/63.

Ziegler, J. (2002, August 27). *United Nations General Assembly: Report of the Special Rapporteur of the Commission on Human Rights on the right to food*. A57/356.

Ziegler, J. (2009, August 4). *Peasant farmers and the right to food: A history of discrimination and exploitation*. United Nations Human Rights Council, A/HRC/AC/3/CRP.5.

Chapter 14
Pre-HACCP as a Management Development Tool Toward Achieving Food Safety Standard: Thailand's Experience

Sudsai Trevanich, Khemmapas Ontoum, Warapa Mahakarnchanakul, Warunee Varanyanond, Chidchom Hiraga, Patcharee Tungtrakul, and Preeya Vibulsresth

Abstract Thailand is a major food producer in the ASEAN region and the world. To remain competitive in global processed food exportation, Thai food factories must monitor every step of production to control and guarantee superior product quality in terms of both safety and nutrition. Recognizing that over 95 % of the country's food producers are small and medium enterprises (SMEs), Kasetsart University, which specializes in Agriculture and Food, jointly with the National Food Institute, has developed a comprehensive management development model to encourage Food SMEs to work toward achieving Hazard Analysis Critical Control Point (HACCP) certification. This is known as the **Pre-HACCP Model®**. This food safety management development model was designed and developed based on KU's food industry research, technical service and commercialized food product under the KU food® brand, as well as over 40 years of experience working with both informal and formal SMEs.

To consolidate the human resources of over 200 food-related experts, more than 55 laboratories and six pilot plant facilities at four campuses throughout the country, Kasetsart University established a management network and virtual organization called KU Food Innovation Research and Services in Thailand (KU-FIRST). Key activities of the Pre-HACCP Model® include (1) Creating a step-wise training program, comprising Good Manufacturing Practice (GMP), Sanitation Standard Operating Procedures (SSOP) and achieving Hazard Analysis Critical Control Point (HACCP), (2) Developing a country-wide network of food safety advisors, (3) Voluntary food SMEs subscription membership in the program, (4) Comprehensive training complete with food group-specific training manuals, (5) Adoption of food

S. Trevanich (✉) • W. Mahakarnchanakul • P. Vibulsresth
Department of Food Science and Technology, Faculty of Agro-Industry, Kasetsart University, 50 Ngamwongwan Road, Chatuchak, Bangkok 10900, Thailand
e-mail: fagisstn@ku.ac.th; kufsp@hotmail.com

K. Ontoum • W. Varanyanond • C. Hiraga • P. Tungtrakul
Institute of Food Research and Product Development, Kasetsart University, Room 322, 3rd floor, 50 Ngamwongwan Road, Chatuchak, Bangkok 10900, Thailand

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_14

safety standard practices by food SMEs through periodic consultations with advisors and (6) Evaluation of production and management practices for Pre-HACCP certification.

As Thailand prepares to become a member of the ASEAN Economic Community (AEC) in the year 2015, KU-FIRST is extending its Pre-HACCP Program by forming the Thailand University Network – UFIRSTNet – to reach out to food SMEs nationwide. Moreover, Kasetsart University's Food Quality Assurance (FQA) laboratory has been, and will continue to serve as, a reference laboratory for food quality evaluation.

Realizing that the future globalization of food trading will require innovation to deal with more complex constraints, including the sources and quality of raw materials, carbon footprints, etc., it is necessary to further strengthen the capacity of food SMEs. As a result, it is deemed appropriate to further develop the training program accordingly.

Among the several strategies to be further developed, Kasetsart University is creating a new training program to produce professional **Food Safety Counselors**® for the AEC, to be launched in 2014. In addition to the various up-to-date technical subjects to be covered including food mile, emphasis will be given to *ethics and codes of conduct*.

Keywords Pre-HACCP • Food safety • Management development

14.1 Introduction

Unsafe food not only affects the consumers' health, it can also have a great economic impact on a country. Thailand is widely recognized as one of the largest producers of foods and agricultural products with high value of about 1,000 billion baht per year. The world's food market and trade are changing at a fast pace nowadays because of rapid developments in global science and technology; consequently, food safety is becoming a top priority for consumers in many countries. The major causes of unsafe food include microbiological, chemical, and physical hazards. Such hazardous contaminants in foods are of great public concern as they increase the incidence of food-borne diseases. The Thai government pays great attention to food safety management throughout the food supply chain in order to increase awareness of this issue and to produce safe foods for all consumers at the domestic and international levels. The Thai government has established a food safety policy, declared in 2004, primarily to promote Thailand as the "kitchen of the world." As part of this, the Thai government has implemented a food safety policy to ensure strict food safety management systems for food production and processing throughout the food supply chain ("from farm to table, from farm to forks, or from farm to

gut"). This can strengthen the competitiveness of Thai food products in the global market. To achieve the goal of food safety, all stakeholders from both the governmental and private sectors must be responsible for monitoring and tracing unsafe foods, as well as establishing and implementing food safety control measures in order to maintain safety and quality standards that meet international levels. In addition, food safety ethics, knowledge, and education of the personnel involved in each step of the food supply chain are major keys to success.

Over 95 % of the country's food producers are small and medium enterprises (SMEs). As such, most have not been certified with food safety assurance systems, such as HACCP. The main problems include a lack of thorough understanding of food safety procedures, insufficient incentives to improve food safety in food processing plants, and a dearth of qualified employees. In addition, there are not enough experts educated in food safety. More experts could address the current lack of food safety knowledge found throughout all sectors in the food supply chain. In addition to large food manufacturing companies, small and medium enterprises as well as local entrepreneurs marketing local foods through the One Tambon One Product (OTOP) programs face similar problems, but at different levels. Strengthening food safety knowledge would certainly increase the quality and safety of Thai food products at all levels, especially food SME producers, who are integral parts of the food industry. Therefore, in order to achieve the goal of being recognized as "the kitchen of the world" and to develop the potential of food SME producers, the National Food Institute under the Ministry of Industry, Thailand, provides a support grant to Kasetsart University, which specializes in agriculture and food. The Institute of Food Research and Product Development and the Faculty of Agro-Industry under the Center for Innovation, Science, and Food, Kasetsart University (KU-FIRST), have been assigned to work jointly with the National Food Institute in order to develop a comprehensive management development model to encourage food SMEs to work toward achieving Hazard Analysis Critical Control Point (HACCP) certification (KU-FIRST 2008). This is known as the Pre-HACCP Model® or the enhancing of food safety management systems for the food SME industry in Thailand through "Pre-HACCP". This food safety management development model was designed and developed based on KU's food industry research, technical service, and commercialized food products under the KU food ® brand, as well as over 40 years of experience working with both informal and formal SMEs. The Pre-HACCP Model® covers mainly training workshops on safety and quality management systems, training the trainers, on-site consulting by food safety advisors, and evaluation of production and management practices for Pre-HACCP certification.

In the present paper, the comprehensive food safety management development model, namely, Pre-HACCP Model®, which was jointly set up under a collaboration between Kasetsart University and the National Food Institute (NFI) under the Ministry of Industry, is briefly discussed.

14.2 Setup, Implementation, and Outputs of the Pre-HACCP Model®

The Pre-HACCP Model® project was fully funded by the NFI under the Ministry of Industry. The project was conducted as a collaboration between Kasetsart University and other academic institutes throughout Thailand during the fiscal year 2007–2008. The Pre-HACCP Model® project was developed to prepare human resource capacity in the food supply chain, especially primary food producers, food processors, and food employees in small and medium enterprises (SMEs). The project also aimed to encourage food SME entrepreneurs to improve their future food safety assurance systems step by step, from the preparation of prerequisite programs (Good Manufacturing Practice (GMP) and Sanitation Standard Operating Procedure (SSOP)) to the implementation of Hazard Analysis and Critical Control Point (HACCP) and ultimately the achievement of HACCP certification. The program also conducted "training the trainers" for the academic sector and related sectors in order to train professional food safety advisors in food safety management systems for SMEs.

The project of Pre-HACCP Model® was conducted over 24 months. Specific activities included six key activities as follows: (1) creating a stepwise training workshop program, comprising practical GMP, SSOP, and HACCP; (2) developing a countrywide network of food safety advisors; (3) voluntary subscription membership of food SMEs in the program; (4) comprehensive training workshops completed with six food group-specific training manuals; (5) adoption of food safety standard practices by food SMEs through periodic consultations with advisors; and (6) evaluation of food safety production and management practices for Pre-HACCP certification. Each activity is described in detail as follows:

14.2.1 Creating a Stepwise Pre-HACCP Model® Training Workshop Program

The steering committee of the Pre-HACCP Model® project was assigned by the president of Kasetsart University. The committee members included a number of specialists from the Institute of Food Research and Product Development (IFRPD) and the Faculty of Agro-Industry, Kasetsart University. The role of the committee was to establish the design of the training program, the background materials of the Pre-HACCP Model® project, etc. The committee held many brainstorming meetings and provided input on the training programs and initiatives to be incorporated in the Pre-HACCP Model® materials as well as the form and content of the training workshops. The working team decided to deliver the Pre-HACCP Model® training program as face-to-face instruction with workshops over a short period of three or four consecutive days. This decision took into account a range of factors, including

the nature of the required skills and knowledge, the number of persons to be trained, the type of food SMEs involved, etc. Three major programs that needed to be implemented by commercial food processors to achieve food safety included GMP, SSOP, and HACCP. GMP and SSOP act as guidelines for food processors and should be viewed as essential prerequisite programs for the development and implementation of an HACCP system. The designated details of the Pre-HACCP Model® training courses were approved by representatives from the government and experts from private organizations, as well as the food industry, in public hearings. The approved core content of the Pre-HACCP Model® training program included the following: GMP and its implementation, SSOP, and HACCP. A training team was assembled and responsibility was assigned to each trainer of the project. The selection of criteria was also established in order to recruit food SME producers participating in the Pre-HACCP project. The Pre-HACCP Model® training program aimed to achieve a total of 600 participating food SMEs from six groups of food products. A total of 1,286 participants from 601 participating food SMEs were trained in 12 training workshops organized in different geographical locations of the country as shown in Table 14.1. Meanwhile, a total of 144 new potential food safety advisors were also produced. They worked closely with invited specialist mentors and experts during on-site observations of food safety practices and consultations. The first training workshop with a total of 56 participants was held on 18–21 December 2007, and the last training workshop was held on 30 September–3 October 2008 at the same venue of the Institute of Food Research and Product Development, Kasetsart University, Bangkok. There were altogether 1,430 trainees from 601 SMEs (1,286 persons) and concerned government agencies (144 persons) from 25 organizations. It was noted that SMEs from the central region were most enthusiastic about potential development (268 or 44 %), compared to the north (101 or 17 %), northeast (70 or 12 %), south (68 or 12 %), west (59 or 10 %), and east (21 or 4 %).

To certify Pre-HACCP for food SMEs, the working team of the Pre-HACCP project established the guidelines and checklist as well as certification criteria for baseline assessment and final evaluation of food SMEs. It is important to note that food SMEs and other trainees participating in the project of the Pre-HACCP Model® were not required to make any payment.

14.2.2 Developing a Countrywide Network of Food Safety Advisors

This project created a network of food safety advisors through institutions as well as governmental and independent organizations. A total of 175 food safety advisors from 20 different academies and other organizations were produced throughout the country (Table 14.2). Such food safety advisors will act as consultants to the SME food industry across the country.

Table 14.1 Number of training workshops, food SMEs, and food safety advisors involved in training workshops

Training no.	Date	Venue	No. of food SMEs	No. of participants	No of food safety advisors	Total number of participants
1	18–21 December 2007	Institute of Food Research and Product Development, Kasetsart University, Bangkok	22	43	13	56
2	22–25 January 2008	Institute of Food Research and Product Development, Kasetsart University, Bangkok	68	136	13	149
3	12–15 February 2008	Institute of Food Research and Product Development, Kasetsart University, Bangkok	71	143	23	166
4	20–22 March 2008	Lotus Hotel Pang Suan Kaew, Chiang Mai province	44	81	28	109
5	25–28 March 2008	Institute of Food Research and Product Development, Kasetsart University, Bangkok	68	143	7	150
6	20–23 May 2008	Institute of Food Research and Product Development, Kasetsart University, Bangkok	56	132	15	147
7	10–13 June 2008	Institute of Food Research and Product Development, Kasetsart University, Bangkok	59	134	8	142
8	26–28 June 2008	BP Grand Tower Hotel, Songkhla province	38	66	25	91
9	10–12 July 2008	Kwanmor Hotel, Khon Kaen province	26	56	8	64
10	29 July–1 August 2008	Institute of Food Research and Product Development, Kasetsart University, Bangkok	54	128	3	131
11	26–29 August 2008	Institute of Food Research and Product Development, Kasetsart University, Bangkok	52	128	1	129
12	30 September–3 October 2008	Institute of Food Research and Product Development, Kasetsart University, Bangkok	43	96	0	96
Total			**601**	**1,286**	**144**	**1,430**

Table 14.2 Food safety advisors from different academic institutions in Thailand

Regions of Thailand	University/institute	Unit networks	Numbers of food safety advisors
Northern	Chiang Mai University	Faculty of Agro-Industry	25
	Pibulsongkram Rajabhat University	Faculty of Food and Agricultural Technology	4
	Maejo University	Faculty of Engineering and Agro-Industry	2
	Naresuan University	Faculty of Agriculture	6
Northeastern	Kasetsart University	Faculty of Natural Resources and Agro-Industry	8
	Suranaree University of Technology	Institute of Agricultural Technology	4
	Ubon Ratchathani University	Faculty of Agriculture	4
	Khon Kaen University	Faculty of Agriculture	11
		Business and Industry Development Office: BIZ, Faculty of Engineering	4
		Department of Science and Technology, Nong Khai Campus	1
Eastern	Burapha University	Faculty of Science	6
Western	Silpakorn University	Faculty of Engineering and Industrial Technology	3
	Kasetsart University	Faculty of Engineering, Kamphaeng Saen Campus	5

(continued)

Table 14.2 (continued)

Regions of Thailand	University/institute	Unit networks	Numbers of food safety advisors
Center	Kasetsart University	Department of Biotechnology, Faculty of Agro-Industry	1
		Department of Food Science and Technology, Faculty of Agro-Industry	5
		Department of Microbiology, Faculty of Science	2
		Department of Fishery Products, Faculty of Fisheries	4
		Institute of Food Research and Product Development	20
	King Mongkut's Institute of Technology Ladkrabang	Faculty of Agro-Industry	7
	Dhurakij Pundit University	Faculty of Arts and Sciences	4
	University of the Thai Chamber of Commerce	Faculty of Science	6
	Rajamangala University of Technology Suvarnabhumi	Faculty of Science	5
	Food Science and Technology Association of Thailand (FoSTAT)	–	2
	Central Laboratory (Thailand) Co., Ltd.	–	2
Southern	Walailak University	School of Agricultural Technology	6
	Prince of Songkla University	Faculty of Agro-Industry	28
Total	**20**	**24**	**175**

14.2.3 Voluntary Subscription Membership of Food SMEs in the Program

Participating food SMEs can be classified into seven different groups based on the types of food products, namely, foods packaged in sealed containers, dried and intermediate moisture foods, chilled and frozen foods, spices and seasonings, beverages, fermented foods, and other (Table 14.3). A total of 601 food SMEs from 7 groups of food products participated actively in 12 of the project training programs. Food SMEs of the spice and seasoning industry contained the smallest number of participants (21 persons or 3.49 %), while dried and intermediate moisture foods have the largest group of participants (204 persons or 33.94 %). Surprisingly, the number of drinking water and ice manufacturers attending the training workshop was high at 98 persons (16.31 %) (Fig. 14.1).

14.2.4 Comprehensive Training Complete with Food Group-Specific Training Manual

In addition to training workshops, the training team of the Pre-HACCP project developed a Pre-HACCP book and six food group-specific training manuals in order to provide knowledge and practical examples relevant to HACCP implementation for food SMEs (Fig. 14.2). The Pre-HACCP book contains three parts, including two basic prerequisite programs and one fundamental HACCP principle; meanwhile, six food group-specific HACCP implementation manuals were produced to provide knowledge and practical examples relevant to HACCP

Table 14.3 Different groups of participating food SMEs

Types of products	Samples
1. Foods packaged in sealed containers	Canned tuna, canned aloe vera, canned rambutan in syrup, bucketed bamboo shoot
2. Dried and intermediate moisture foods	Dried noodles, rice, flour, herbal powder, chili paste products, ginger powder, curry paste, supplementary foods
3. Chilled and frozen foods	Fruits, vegetables, chilled meats/frozen meats, fresh noodles
4. Spices and seasonings	Spice powder, pepper, sauces, chili sauce, ketchup, fingerroot powder
5. Beverages	Fruit and vegetable juices, herbal juices, pasteurized milk, pasteurized coffee, fresh vermicelli noodles
6. Fermented foods	Soy sauce, fish sauce, fermented pork (Nham), fermented Chinese radish, salted radish pickles, fermented fish (Pla-ra), Thai fermented sausage, fermented fish sauce
7. Other	Drinking water and ice

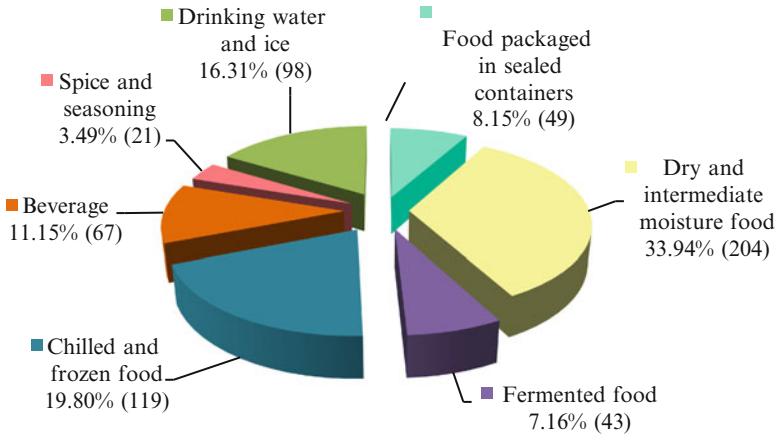

Fig. 14.1 Food SMEs participating in the Pre-HACCP project based on food product categories

implementation for each category of food SMEs. The specific contents of each part of the Pre-HACCP book are illustrated in Table 14.4. A book on food safety management systems, focusing on "Pre-HACCP" for SMEs, along with guidelines for six food group-specific SMEs, was later published and distributed in the amount of 8,000 and 24,000 copies, respectively.

14.2.5 Adoption of Food Safety Standard Practices by Food SMEs Through Periodic Consultations with Advisors

After 3–4 days of training workshops, a team of invited advisors and consultants provided guidance to the participating food SMEs on at least three occasions. This advice included (1) suggestions on the prerequisite programs of food SME plants, (2) guidance on planning HACCP, (3) advice on conducting an initial plant assessment (preaudit), and (4) assessment of other parties, such as the Food and Drug Administration under the Ministry of Public Health. In addition to the 60 invited advisors, about 115 additional technical specialists were granted opportunities to join the training, indicating a high degree of interest in the food safety campaign.

The Pre-HACCP standard is divided into three levels. Assessment of 562 trained food SMEs by experts and consultants in the training showed that 401 plants (71.35 %) passed the Pre-HACCP standard while 105 plants (18.68 %) failed. However, 56 food SMEs (9.96 %) that were trained were not ready to join the assessment. A total of 371 plants were found to have the potential to be developed into an HACCP system within the next 1–2 years (Table 14.5).

However, not all food SMEs participated. Of the total number of 506 food SMEs participating in the last activity of the program, 77.08 % (391 food SMEs) were

Fig. 14.2 Front covers of the Pre-HACCP book (*top*) and six food group-specific HACCP implementation manuals (*bottom*)

qualified and certified for Pre-HACCP. Of the 391 food SMEs, 122 (31.28 %) dried and intermediate moisture food SMEs were certified for Pre-HACCP, which was the largest group; meanwhile, 11 (2.82 %) spice and seasoning SMEs were certified for Pre-HACCP, constituting the smallest group.

Fig. 14.2 (continued)

14.2.6 Evaluation of Production and Management Practices for Pre-HACCP Certification

Food SMEs that completed the training workshops and successfully implemented Pre-HACCP in their food manufacturing received the Pre-HACCP mark with a plaque and a certificate showing that their products meet food safety standards (Fig. 14.3). This has the potential to develop into an HACCP system within 2 years,

Table 14.4 The specific topics of the Pre-HACCP book

Part 1: Basic knowledge for prerequisite program preparation	Part 2: SSOP	Part 3: HACCP
Introduction	Safety of water, ice, and steam	Introduction
Establishment and location	Conditions and cleanliness of food contact surfaces	Prerequisite programs
Equipment		
Raw materials and chemicals	Prevention of cross contamination	HACCP principles and preliminary steps
Water, ice, and steam	Maintenance of equipment and facilities for hand washing, sanitizing, and toilets	Principle 1: Hazard analysis
Cleaning and sanitizing	Prevention of adulteration	Principle 2: Critical control point
Pest control	Use, storage, and labeling of toxic chemicals	Principle 3: Critical limits
Personnel hygiene	Control of employee health conditions	Principle 4: Monitoring
Process control	Exclusion of pests	Principle 5: Corrective action
Storage and transportation		Principle 6: Verification
Product control		Principle 7: Documentation and record keeping
Training		
Documentation		
Resources and sources for citation		

Table 14.5 Assessment criteria of Pre-HACCP

Region of Thailand	Evaluation of Pre-HACCP						
	Satisfactory	Excellent	Good	Fair	Unsatisfactory	Uncertified	Total
		≥80 %	≥70 %	≥60 %	<60 %		
Central	175	124	37	14	41	27	243
Northern	78	54	20	4	16	7	101
Southern	51	40	7	4	14	3	68
Northeastern	44	30	9	5	20	3	67
Western	38	31	4	3	10	8	56
Eastern	15	12	3	0	4	8	27
Total	401	291	80	30	105	56	562

Fig. 14.3 Pre-HACCP mark

likely supported by loans from donors such as the SME Bank. This is expected to significantly improve the standards of quality and safety of food.

The working team of the Pre-HACCP project prepared verification activities with 90 random plants located across the country. Food safety experts from 17 qualified educational institutions and other organizations were involved. The evaluations were consistent with the stated goals. The highest degree of satisfaction from participating food SMEs was in regard to training and on-site consulting activities. However, the working team of the Pre-HACCP project found that the initial barrier to implementing food safety management was limited personnel in food SMEs. The second problem was plant location, building infrastructure, and equipment. Thus, financial support in the form of government funding for improvements will be required in order to ensure the success of the HACCP system.

14.3 Conclusions

Overall, the Pre-HACCP project achieved its main goals and targeted outcomes. The strengthening of human resources and the enhancement of knowledge are perhaps the most important elements in food safety development throughout the food supply chain. Knowledge and information are powerful tools for increasing awareness and promoting common sense in regard to food safety. The Pre-HACCP Model® training workshop program has proven to be an effective method of doing exactly that. As evidence, the project has received positive feedback from most of the participating food SMEs. However, continuous follow-up activities for Pre-HACCP-certified food SMEs are required in order to evaluate the success of the project. As Thailand prepares to become a member of the ASEAN Economic Community (AEC) in the year 2015, KU-FIRST is extending its Pre-HACCP Program by forming Thailand University Network – UFIRSTNet – in order to reach out to food SMEs nationwide. Moreover, Kasetsart University's Food Quality Assurance (FQA) laboratory has been, and will continue to serve as, a reference laboratory for food quality evaluation. Realizing that the future globalization of food trading will require innovation to deal with more complex constraints, including the sources and quality of raw materials, carbon footprints, etc., it is necessary to further strengthen the capacity of food SMEs. As a result, it is deemed appropriate to further develop the training program accordingly. Among the several strategies to be further developed, Kasetsart University is creating a new training program to produce professional **Food Safety Counselors®** for the AEC, to be launched in 2014. In addition to the various up-to-date technical subjects to be covered including food mile, emphasis will be given to *ethics and codes of conduct*.

Acknowledgments This paper is based on the final report of the Pre-HACCP project entitled with "The Enhancing of Food Safety Management System for SME Food Industry in Thailand Through Pre-HACCP." On behalf of KU-FIRST in collaboration with the Institute of Food Research and Product Development and the Faculty of Agro-Industry, Kasetsart University, the

authors would like to express our thanks to the National Food Institute under the Ministry of Industry of Thailand for granting support to the Pre-HACCP project. This material was compiled with financial support from KU-FIRST under Dr. Malee Suwana-adth's supervision. The authors would also like to acknowledge the contributions of the following persons: Warapa Mahakarnchanakul, Warunee Varanyanond, Chidchom Hiraga, Patcharee Tungtrakul, and Preeya Vibulsresth. Any opinions, details, conclusions, or errors contained in this material are those of the authors and do not necessarily reflect the views of the supporting organizations.

Reference

KU Food Innovation Research and Services in Thailand (KU-FIRST) in collaboration with the Institute of Food Research and Product Development and the Faculty of Agro-Industry, Kasetsart University. (2008). *The enhancing of food safety management system for SME food industry in Thailand through "Pre-HACCP"*. 180 p.

Chapter 15
Ethical Reflections on the Process of Food Production in China

Zhao Bing and Li Jianjun

Abstract The article firstly discusses the ubiquitous food safety issue, such as milk powder contamination, poisonous additive within ham and vegetables, and excessive pesticide residues. These examples are the start of our concern about the process of food production in China. There are four main reasons for our discussion, including the importance of agricultural civilization and China's international role, vicious food safety incidents frequently happened in China, small-scale and highly fragmented food producers, and the imperfect food supervision system in China. Furthermore, food ethics study will be included in the paper, mainly discussing the fundamental moral responsibility, utilitarianism or pragmatic ethics, duty-based ethics, etc., in the process of planting, growing, and processing the agricultural products and the animal by-products. At the same time, the regulation principle will be given for these issues to ensure pollution-free and safety food production and on this basis to provide the evidence for the regulation of the food practitioner.

Keywords Food production • Food safety • Food ethics • China

15.1 Introduction

Food is essential for people's self-existence, development, and welfare. Consequently, food safety and food quality problem directly affect people's health and the quality of life and even have an impact on the sustainable development of society. In spite of the importance of food safety, some food companies, often driven by the economic considerations, turned out to act carelessly and did not adhere to the national or international standard safety procedures. This resulted in cases in which dairy products were contaminated with melamine, hydrogen peroxide ended up in shark's fin, and dichlorvos has been found in Jinhua ham. These cases which have been well reported in the media are not only genuine threat to consumer rights,

Z. Bing • L. Jianjun (✉)
College of Humanities and Development Studies, China Agricultural University,
Room 121, Minzhu Building, No.17, Qinghu East Road, Haidian District, Beijing, China
e-mail: zhaobing08@163.com; army6481@vip.sina.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_15

but they also affect Chinese food production and export indirectly. The current situation is not so much the result of problems related to the production technology chain. It is rather the result of a few food producers or processors who deliberately do not comply with the safety regulations. Therefore, we propose that the fundamental solution to the food safety problems is to trace and investigate the basic problems of the food production process. This is an essential step toward the establishment of a food safety credit system that is linked with discipline for the food producers. Such a system may directly help to improve the current levels of food safety and thus ensure people's health and life security.

In order to get a better understanding of the current food safety situation and to make a preliminary step toward a food safety credit system, it is essential to analyze food production from the perspective of ethics. As a part of moral philosophy, ethics entails conceptual and normative tools to regulate the human nature and the interhuman relationship and the relation between individuals and society. Each of these three types of relationships is relevant in the context of the food safety debate, and an analysis from the perspective of ethics may therefore help to get improved conceptual clarity with regard to the food safety and better grip on the normative assumptions that underlie the debate on food safety.

15.2 Reasons for Concern About the Process of Food Production in China

Food safety is on the public agenda in China. We argue that there are four main reasons why this attention is legitimate and even needs further reflection. The first reason refers to the importance of the China's agricultural civilization and its international role in agriculture and food production. China is a great country with a long history of agricultural civilization. In China, 630 million people live in the rural area, which is about 46 % of the overall national population in 2013 (National Bureau of Statistics of the People's Republic of China 2014). The agricultural production scales are large, and a wide variety of agricultural products are produced. For China, this is of the utmost importance given its population of about 1.3 billion people. Consequently, next to food security, food safety has always been a fundamental concern of the Chinese government. As an old Chinese proverb goes, "Food is of primary importance for everyone (民以食为天)" which clearly reflects the significance of food production in traditional Chinese culture.

The discussion also touches upon the role China plays in the international context. Especially since China has become a member of the World Trade Organization (WTO), the discussion on health and food safety has a clear international dimension that is directly linked to questions of trade. As a WTO member and a market player that wishes to improve its access to foreign markets, China has to comply to the WTO Agreement on Sanitary and Phytosanitary Measures that sets out a "best practices" regulatory model with which national food safety regulation must comply. Other WTO members however questioned whether the food policy of China abides

by the rules of the WTO on food safety (Prévost 2012). These accusations turned out to be a significant impetus for far-reaching reforms and resulted in the need to establish policy and regulation that improve the food chain supervision as soon as possible. This development would not only benefit the food export but also is very important to the Chinese people.

The second reason for our concern is the frequent and malicious food safety incidents. With the fast and ongoing process of industrialization and urbanization in China, vicious food safety incidents frequently happened in China. One of the most striking examples has been the melamine scandal in September 2008. It turned out that milk and infant formula had been adulterated with melamine, an ingredient that leads to kidney stones and other renal failure, especially among young children. This "poisonous milk powder incident" or "melamine contamination event" had a huge impact. On the one hand, the scandal got a lot of attention because of its tragic results. According to the Chinese Health Ministry, 296,000 children were affected by milk powder. From these children, 52,898 babies had been treated in hospital for kidney problems that were caused by melamine. On top of this, the death of six infants was directly linked to the tainted milk (Ministry of Health 2009). Furthermore, the impact of this scandal was huge, because it appeared to be not an isolated misstep of an individual company. It turned out that several companies were implicated in this scandal. Hao Xin and Richard Stone (2008) showed the results of a thorough investigation into the tainted milk scandal. It left the scientists astonished because of the technical sophistication of those who used melamine to adulterate food products.

As a response to this scandal, China took a range of measures to deal with the tainted milk powder incident. The Ministry of Health, mass media, and all sectors of society took action in the face of this "poisonous milk powder incident." Nonetheless, a case of melamine-tainted milk powder was reported in 2010 (People's Daily Online 2010). Milk powder produced by a dairy factory in China's Qinghai Province has been found to contain the industrial chemical melamine over 500 times higher than the amount allowed. As a consequence, parents in China fear to buy milk powders from China dairy companies.

If we look at the broader picture of food safety incidents, we see a remarkable development that is presented in Table 15.1. This table shows the number of cases of food poisoning in China in the period 1991–2011. These figures are based on different sources. They partly come from the China Health Statistical Yearbook and the General Office of the Ministry of Health (Wu et al. 2012). The figures for 2006–2011 are shown separately, because of the changed responsibilities of the Department of Health. The figures show that from 1991 to 2002, the number of incidents with food poisoning declines gradually (from 1,861 to 464 cases). The turning point appears in 2003. In the next years, the number of food poisoning incidents increases obviously. From 2004 to 2005, the number of food poisoning rose from 2,305 to 2,453. Only after 2006, the number of incidents starts to drop from 596 to 189 in 2011. Perhaps this change owes to strong supervision of food administration and high concern of consumers. However, the decrease of food safety incidents has not increased the confidence of citizens for food safe production and supervision.

Table 15.1 The report about the number of food poisoning in China (1991–2011)

The year	The number of poisoning cases
1991	1,861
1992	1,405
1993	1,226
1994	1,174
1995	947
1996	878
1997	522
1998	592
1999	591
2000	696
2001	624
2002	464
2003	1,481
2004	2,305
2005	2,453
2006	596
2007	506
2008	431
2009	271
2010	220
2011	189

Source: "China Health Statistical Yearbook 1992–2006," " the General Office of the Ministry of Health in China about the bulletin of 2006–2011 national food poisoning reports"

In spite of the fact that the number of reported incidents seems to decrease, food safety is still and prominently on the public agenda. It resulted not only in attention from government or industry but also in actions by concerned individual. For instance, Wu Heng, a Fudan University graduate student, built a website dedicated to problems of food safety and tainted food products, entitled "Throw it out the window!" This website provides a clear map that pictures food safety problems by location over time. Based on this way of representing the situation, it certainly appears that things have got worse over the past few years. However, we have to be hesitant to draw definitive conclusions, as it is also possible that the increased attention is also the result of the fact that the media has reported on these stories more frequently. Similarly, the fact that China's east coast has more media outlets may be part of the reason why its western regions appear to be much safer in terms of food quality.

The third reason for our concern about food safety in China is related to the role of food producers in China. Food production is characterized by a large number of

relatively small-scale producers (farmers and food companies) that operate in a highly dispersed market. According to the data from food and drug safety responsibility international BBS (Yi 2013), there are an estimated 130,000 food production enterprises in China, more than 3,000 food additive production companies, and about 700 kinds of food sale corporations. Most of these farms and companies are small scale. This combination of a huge market with small-scale producers seriously complicates the government's possibilities to enforce the food and drug safety regulation. The possibilities to guarantee food safety are even further complicated by the fact that the modern food industry system is not transparent. There is an increasing gap between producers and consumers, and a long food production chain including planting or breeding, processing, and packing is shaped (Lang 1999). Thus, drafting legislation and policy by the government is not enough to ensure food safety. As some experts stated, safe food is primarily a task of producers. This implies that moral awareness of producers is essential. Therefore, ethical discussion is needed for food safety governance.

Before we analyze the ethical dimensions, we first want to focus once again on the current situation of food scandals and the food supervision system in China. The current situation is characterized by a vulnerable combination of excessive competition in the food sector, low technique in the process of production, fierce competition pressure in labor market, and a decentralized management. This leads to a situation in which food safety issues easily occur. This becomes even more a problem because the food supervision system is not perfect. Especially on a regional level, local governments tend to protect their own food industry. As a consequence, the regulatory enforcement is not strong enough. Furthermore, the authority to enforce food safety regulations is divided among many departments, such as Food and Drug Administration, Ministry of Agriculture, Ministry of Health, Ministry of Industry and Commerce, etc. This often leads to unclear responsibilities, power vacuums, and lack of management. Moreover, there are not enough laws and regulations governing food producers. Thus, food producers have opportunities not to comply with the rules or even to produce illegally. In order to ensure food safety, the Ministry of Commerce in China selected 50 cities around the country as pioneer cities for producing meat that is linked to a food traceability system in 2010. To carry out the "farmland to table" chain traceability, consumers in the market who buy a piece of green, a head of garlic, can clearly check the planting, wholesale, and sales of each link. In spite of many efforts from departments of the government, people are still hesitant about whether this system can really solve the problems of food safety in China. They doubt the quality of the traceability system and therefore are not convince that this will improve the future of the food safety.

Some foreign scholars seem to agree with this view. They analyze that the status of food safety of China is not optimistic (Bae and Kim 2009). Abuse or illegal usage of highly concentrated agricultural chemicals and contamination on the production environment of agricultural products are serious, and the management and supervision are not working well in small-scale food enterprises. For China, the management of food safety is a huge challenge.

15.3 Ethical Reflections on the Process of Food Production

Food ethics is still a relatively new field of applied ethics. If we take one of the first definitions of the task of food ethics, we can follow Mepham, who claimed that consideration of food ethics "might (…) promote more appropriate ways of thinking about human well-being and autonomy, and facilitate the practical and political changes which need to be introduced if we are not only to achieve a more just global society, but indeed if we are to hand onto our successors a world which is worth inheriting" (1996, xi–xii). In the same line, Marion Nestle (2010) pointed out that food ethics includes moral tools in order to improve health and happiness. As a consequence, food safety is one of the central themes in food ethics (FAO 2003; Jensen and Sandøe 2002; Thompson 2001), and ethical reflection is essential to deal with food safety problems.

To trace what ethics can contribute to the food safety debate, we may start with the 2008 speech by the former premier Wen Jiabao. In his comment on the melamine scandal, he mentioned that many factories and milk retailers are lacking the most fundamental business morals and social responsibility. They are just cold blooded (xinhuanet.com 2010). This raises the question on what these fundamental business moral responsibilities entail. As a general start, the principles proposed by Beauchamp and Childress (2001) in their book *Principles of Biomedical Ethics* may give a first indication. They distinguish the principles of respect for autonomy, the principle of beneficence, the principle of non-maleficence, and the principle of justice. In our opinion, each of these principles also could and should be applied as a fundamental ethical baseline of food industry and food production. In practice, this implies that food producers have the moral responsibility to avoid foodborne diseases, to cut down illegal adding or overuse of chemicals and food deceit as soon as possible, and also to take active measures in order to guarantee the health and safety of consumers and to work on consumer trust.

Even if we take this as a starting point, it still is important to have a clear view on the implicit normative positions that underlie the actions of food producers. This especially centers on the question whether the moral attitude of the food producers is relevant in the food safety discussion. According to utilitarianism ethics or pragmatic ethics, the moral worth of an action is determined only by its outcomes. Actions of illegal adding or overuse of chemicals and food fraud are morally wrong because it harms individual consumers and the society at large and even has affected producers themselves. As Wu Heng, the abovementioned founder of the website "Throw it out the window!" stressed, if every producer takes poisonous food to others by illegal adding or overuse of chemicals, every Chinese will be a victim of unsafe food. In spite of these far-reaching consequences, the fact that the producers "lack the most fundamental business morals and social responsibility" as such is not considered to be a direct moral problem from the perspective of consequentialism.

From a duty-based ethics, the attitude and intention that underlie an act are morally relevant for the ethical evaluation of that act. Illegal adding or overuse of chemicals and fraudulent actions are morally unacceptable regardless of its social

consequences. The act to cheat with consumers or to deliberately impose a risk on people for reasons of profit is unacceptable as such.

Finally, Confucian philosophy can clearly contribute to the ethical reflection process on food safety. Confucian philosophy entails the mainstream traditional Chinese values that can easily be recognized throughout history. Its morals and political ideals played a dominant role in most of the ancient Chinese dynasties. Its relevance is, however, not restricted to history; the Confucian values are still very influential in shaping the ethics and moral outlooks of Chinese people. In order to trace the relevance of Confucianism, we can look at the famous quote from the *Analects*:

> *Zi Gong* [*a disciple*] *asked*: "*Is there any one word that could guide a person throughout life*?" *(子贡问曰: "有一言而可以终身行之者乎?")*
>
> *The Master replied*: "*How about* '*reciprocity*'! *Never impose on others what you would not choose for yourself*." *(子曰: "其恕乎!己所不欲,勿施于人。")* (*Analects XV.24*)

This basic ethical principle of fairness formulated as "What you do not wish for yourself, do not do to others (己所不欲, 勿施于人)" should be the fundamental principle of food production. In practice, this may imply that in the current food safety situation, one person may say that "I don't eat chicken wings, because I know that chicken wings which I produce do not accord with the standard of food production, but I could drink milk." And the other person said that "I don't drink milk, because I know that the milk which I sell has pollution, but I could eat chicken wings." This shows that the current situation is morally untenable and morally undesirable: If every toxic food maker chooses this way of thinking, the food producers feel safe by not eating what they produce. In this game, there is no winner, because everybody might be junk food eater. Thus, if food producers do not want to eat unsafe food, then they should not produce these foods. With problems of food safety, no man is an island, no one can escape.

The Confucian principles are pragmatic and clear and also stress the importance of the intentions and attitude of the food producers and processors. Therefore, corporate social responsibility (CSR) should become an essential element in food production. On the one hand, it implies self-discipline in order to ensure food safety even when the economic situation is less than ideal. Food enterprises need to strictly abide by the moral and legal rules of food production. On the other hand, CSR implies that science should play a central role in the food industry. Claims with respect to health and well-being need a scientific basis. However, also scientists can never forget the ethical implications of their role in the process of research and development. When scientists apply science and technology to food production, they should fully consider the impact of their findings, but also be aware of the clear interaction between science and moral values. Finally, the responsibility is not limited to the food sector or the scientists. Of course, consumers also have the duty to shoulder the responsibility, rather than hope for excessive and unrealistic cheap food.

If the Confucian principle is taken seriously and there will be an improved attention for the various responsibilities for food producers, scientists, and society, it is

possible to achieve – what the Chinese famous economist Li Yining thought to be the most important social responsibility of the food sector – high-quality products, excellent service, and sufficient competence and experience with regard to food safety.

15.4 Conclusion

In this paper, we presented the food safety concerns of China and framed them in related problems of demographic changes, population growth, and production capacities. In spite of the fact that an analysis of these developments helps to understand the current food safety problems, we claim that the main reason of many of the serious food safety scandals has been that food producers lack morality and do not take their responsibility. Their commercial interests too often prevail over their social responsibility, which result in illegal or excessive use of additives. Even though economic interests are legitimate in a market context, they never can justify any risk with regard to food safety.

Furthermore, we conclude that food safety should stay on the public agenda, because in the modern food chain, including production, transportation, processing, wholesaling, and retailing, there are many possibilities that food can be exposed to chemicals or microbial pathogens, either by accident or deliberately. To stress the moral responsibility of the actors in the production chain is essential, if it is only for the fact that a complete supervision of all producers is both extremely difficult and costly. This latter conclusion, however, does not diminish the role and importance of food safety legislation. The governance of food safety should be considered as a concerted action that needs cooperation between the government, enterprises, consumers, and civil societies. Consumers, like the government and industry, need to participate in the food safety governance too.

This joint approach and the central role of consumers are essential to address problems of consumer trust. A lack of trust or even distrust often is the result of information asymmetry combined with untrustworthiness (cf. Meijboom 2008). It is necessary to establish trust mechanism between food producers and consumers and explore new patterns of agricultural product production and sales, such as community support agriculture. Dreyer and Renn (2009) stress the importance of large-scale interdisciplinary research on the current food safety governance with the aim which encourages public participation. We think such a participatory approach may be a relevant way to address the discussed Chinese food safety problems. This, however, should go along with ethics education as a basic part of food safety governance and decision making. The media can play a role in explicating the reflection on the moral values and principles that underlie food production and food safety.

Last but not the least, we conclude that at least for China, the ethical principle of Confucianism “What you do not wish for yourself, do not do to others.” should be the fundamental and leading principle of the food production sector. If this will

become the normative basis of all food safety activities in China, problems of food safety will diminish or at least the problems will become more transparent and easier to deal with. This may not be an easy task, but it will be feasible if all partners take their responsibility.

Acknowledgments I wish to acknowledge Prof. Franck L.B. Meijboom for his valuable comments on an earlier draft of this paper. I also like to thank Prof. Soraj Hongladarom very much for his generous invitation to us for the first international conference of the Asia-Pacific Society for Agricultural and Food Ethics (APSAFE).

References

Bae, S. E., & Kim, C. H. (2009). A study on the situation and problem of the food safety in China. *The Journal of the Korean Society of International Agriculture, 21*(1), 13–18.

Beauchamp, T. L., & Childress, J. F. (2001). *Principles of biomedical ethics*. New York: Oxford University Press.

Confucius, B. tr. & Hinton, D. The analects. XV.24. http://en.wikipedia.org/wiki/Confucius

Dreyer, M., & Renn, O. (2009). *Food safety governance* (pp. 111–120). Berlin: Springer.

FAO. (2003). *Expert consultation on food safety: Science and ethics*. Rome: FAO. Rome, 3–5 Sept 2002, http://www.fao.org/docrep/006/j0776e/j0776e00.htm.

Jensen, K. K., & Sandøe, P. (2002). Food safety and ethics: The interplay between science and values. *Journal of Agricultural and Environmental Ethics, 15*(3), 245–253.

Lang, T. (1999). Diet, health and globalization: Five key questions. *Proceedings of the Nutrition Society, 58*(02), 335–343.

Meijboom, F. L. B. (2008). Problems of trust: A question of trustworthiness. In *An ethical inquiry of trust and trustworthiness in the context of the agricultural and food sector*. Utrecht: Labor.

Mepham, B. (Ed.). (1996). *Food ethics*. New York: Routledge.

Ministry of Health of China. (2009). *Annual report*. Beijing: Ministry of Health of China.

National Bureau of Statistics of the People's Republic of China. (2014). *The People's Republic of China national economic and social development statistical bulletin in 2013*. Beijing: National Bureau of Statistics of the People's Republic of China.

Nestle, M. (2010). *Safe food: The politics of food safety*. Berkeley: University of California Press.

People's daily online. (2010). Melamine-tainted milk powder re-appears. *Peopledaily.com.cn.* http://english.peopledaily.com.cn/90001/90778/90862/7059132.html. 9 July 2010.

Prévost, D. (2012). Food safety in China: Implications of accession to the WTO. *China Perspectives, 2012*(1), 39–48.

Thompson, P. B. (2001). Risk, consent and public debate: Some preliminary considerations for the ethics of food safety. *International Journal of Food Science & Technology, 36*(8), 833–843.

Wu, L., Qian, H., et al. (2012). *Introduction to 2012 China development report on food safety* (pp. 195–196). Beijing: Peking University Press.

Xin, H., & Stone, R. (2008). Chinese probe unmasks high-tech adulteration with melamine. *The Journal of Science, 322*(5906), 1310–1311.

Xinhuanet.com. (2010). China's clampdown melamine powdered milk reappearance, highlight regulatory determination. *xinhuanet.com*. http://news.xinhuanet.com/politics/2010-02/10/content_12963734_1.htm. 10 Feb 2010.

Yi, Y. (2013). Food and drug safety responsibility international BBS. *Biotech.org.cn.* http://www.biotech.org.cn/information/113892. 7 Nov 2013.

Part III
Distribution and the Environment

Chapter 16
Sucked into the Global Vegetable Oil Complex: Structural Changes in Vegetable Oil Supply Chains in China and India, Compared with the Precedents in Japan

Midori Hiraga

Abstract China and India rapidly increased imports of palm oil, and of soybean in the case of China, since the mid-1990s, and they transformed from mostly self-sufficient countries of vegetable oil into the global leading importers. It is commonly suggested that this rapid increase and the concurrent change in diet are caused by increased income, population growth and urbanisation. This research, however, suggests that there have been important policy influences at play in this nutrition transition. The research employs the food regime frameworks (Friedmann and McMichael 1989) to study the historical development of global vegetable oils, especially soybean oil and palm oil, and argues that dissemination of modern vegetable oils began as nonfood use to support industrial development of colonial countries in the first food regime and then their production and consumption were expanded with the active support of nation states in the second food regime. Next, the research studies the policy changes of trade liberalisation in recent China and India in the corporate food regime (McMichael 2005), aiming to depict their roles in the (re)structuring of the supply chains of vegetable oils with examples of instant noodle industry in China and *vanaspati* industry in India. The conclusion suggests that these countries have not simply increased oil imports but have been consolidated into the globalised vegetable oil complex by replacing domestically produced oilseeds and traditional methods of oil processing. Meanwhile, they have been jeopardising the domestic producers and the public health by increasing the availability of fat in the nation's diet as a forerunner of nutrition transition.

Keywords Vegetable oil • Soybean • Palm oil • Food regime • Nutrition transition

M. Hiraga (✉)
Graduate School of Economics, Kyoto University, Kyoto, Japan

Centre for Food Policy, City University London, London, UK
e-mail: midorihiraga@gmail.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_16

16.1 Introduction

China and India have rapidly increased imports of palm oil, and of soybean in the case of China, since the mid-1990s, and they transformed from mostly self-sufficient countries of vegetable oil into the global vegetable oil and oil crop importers. Over the same period, they have become the world's leading producers of poultry, eggs, pork and dairy products as well. It is commonly suggested that this rapid increase and the concurrent change in diet are caused by increased income, population growth and urbanisation in these countries. This research, however, looks into the structural factors in vegetable oil supply chains that encouraged demands for imported soybeans and palm oils and suggests that there have been important policy influences at play in this nutrition transition, the shift towards diets high in energy-dense processed foods, meat, fats and sugars (Popkin 2002).

Based on a political economy approach, starting with the food regime perspective (Friedmann and McMichael 1989), this research first studies the historical development of the modern vegetable oils in order to understand the global contexts in which China and India made these transformations. Then, the research studies the policy changes of trade liberalisation in recent China and India, aiming to depict their roles in the (re)structuring of the supply chains of vegetable oils with examples of instant noodle industry in China and *vanaspati* industry in India. This presentation aims to depict a macro-level view of policy changes in global vegetable oils, which is suspected to have increased the availability of oils and fats.

16.2 The Development of Modern Vegetable Oils in the First Food Regime

16.2.1 The Invention of Modern Vegetable Oils

The global availability of vegetable oils has been increasing, with soybean and palm oils accounting more than 60 % today (Fig. 16.1). The production of soybean, sunflower, rapeseed and palm oil increased steadily in the 1980s, partly as a result of state support. This increase accelerated in the early 1990s when key states promoted international trade of soybeans and palm oil (Hawkes et al. 2012). Their abundance has made cheap oils and fats more available globally, so that even poor nations have access to a relatively high-fat diet, and oils and fats are suggested to be a forerunner of nutrition transition before animal products (Drewnowski and Popkin 1997).

This prevalence of vegetable oil is a relatively recent phenomenon, however. Until the middle of the nineteenth century, vegetable oil played a very small role in the human diet (Grigg 1999). Historically, animal and marine fats were far more important than vegetable oil (O'Keefe 2000). Although various kinds of oil crops had been cultivated for thousands of years, early uses of such oils, with the exception of olive oil, appear to have been nonfood purposes such as for illumination,

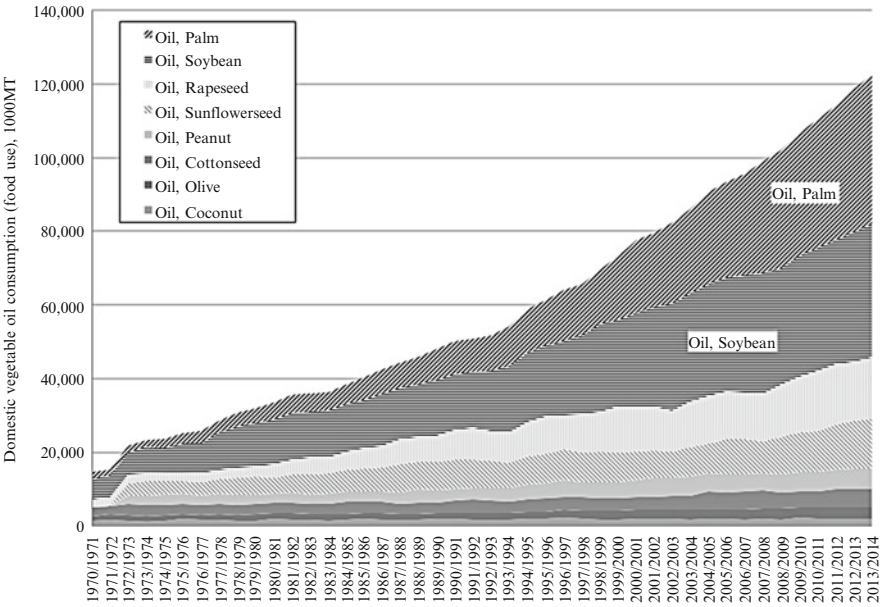

Fig. 16.1 Global availability for consumption of vegetable oils, 1970–2013 (Source: USDA FAS Production, Supply and Demand database, available at: http://www.fas.usda.gov/psdonline/. Accessed September 25, 2013)

lubrication and medicine (O'Keefe 2000, summarised in Cordain et al. 2005). It was the beginning of the twentieth century that mechanically driven steel expellers and hexane extraction processes allowed worldwide vegetable oil production, and new purification procedures permitted the exploitation of non-traditionally consumed oils (O'Keefe 2000, summarised in Cordain et al. (2005: p. 344). With this technological development, cottonseed, for example, transformed "what was garbage in 1860 was fertilizer in 1870, cattle feed in 1880, and table food and many things else in 1890" (*Popular Science*, cited in Ramsey and Graham 2012). In this way, the large-scale production of refined vegetable oils was added to the world's food supply which significantly altered both the quantitative and qualitative composition of fat intake of the population (Cordain et al. 2005).

16.2.2 The Development of Palm Plantation in Colonies in the First Food Regime

Although palm oil was eaten in traditional West African diets, it was the Industrial Revolution that created strong demand for palm oil, for soap and candle making. When William Lever (the founder of today's Unilever) sought large-scale land concessions in the British West African colonies in 1907, it was to produce palm oil for

his Lancashire soap mills (Berger and Martin 2000). After 1900, European-run plantations were established in Central Africa and in colonised Sumatra and Malaya (today's Indonesia and Malaysia) in the 1910s. Then, sophisticated factories were developed "to produce oil of the high and standardized quality that would appeal to Western food processors" (Berger and Martin 2000; Grigg 1999). Technologies were developed to produce highly refined, bleached and deodorised palm oil (Tan and Sharma 1989).

16.2.3 The Beginning of Soybean Crushing in Colonised Manchuria

In a similar way, soybean was commodified under the colonial food regime, though in Asian context. Although soybean has long been a part of the traditional Asian diet, mainly in fermented forms, it was only about 100 years ago when soybean was commodified for new usage – crushed into soy meal and soybean oil. A Japanese trading company, Mitsui Bussan, promoted soybean production in occupied Manchuria, the northeast part of today's China. The main purpose at the time was said to provide soy meal as fertiliser to support modern agricultural development in Japan. They began exporting soybeans to Europe in 1908 as well as to the USA (Usui 2010; Soyinfo Center n.d.). The first crushing facility in the USA began operating in 1911 with soybeans from Manchuria (American Soybean Association (ASA) n.d.). By the early 1930s, 95 % of soybean oil in the USA was used for industrial purposes, and crushing grew at a rapid rate from 1934, especially after the discovery of a new use for soy meal as animal feed (Berlan et al. 1977).

16.3 Active Roles of Nation States in the Dissemination of Vegetable Oils in the Second Food Regime

16.3.1 Nation States Supporting Production of Vegetable Oils

The first food regime saw palm oil and soybean became world commodities under colonial power to support their industrial development. Then, under the second food regime, their domestic production was promoted by nation states such as the USA, Brazil and Argentina, in the case of soybeans, and Malaysia and Indonesia, in the case of palm oil.

Many previous studies discuss the development of oil crop production. Briefly speaking, the US government actively promoted domestic soybean production when the war broke out against Japan in World War II. It set protective duties to block the import of soybean and soybean oil from Manchuria and tropical oil from Southeast Asia (also occupied by Japan) (Berlan et al. 1977). After World War II, soybean production in the USA continued to increase with the strong support of the government and industry associations like ASA.

Then soybean production was expanded into Latin America from the 1960s to 1980s, with active support of nation states of Brazil and Argentina. Japanese government also supported the expansion of Brazil's soybean production after the global grain price crash in 1973, aiming to diversify its soybean source. With technological and financial support from Japan, the state-supported agricultural research overcame the obstacle of low latitudes and the savanna conditions of Cerrado region and allowed a massive expansion of soybean production in the centre-west of Brazil (Wei 2008).

In the case of palm oil, the nation states of Malaysia and Indonesia actively promoted palm oil production and the palm oil refinery industry (Gustafsson 2007, among many others).

16.3.2 Nation States Supporting Consumption of Vegetable Oils: Japan's Example

Following World War II, the USA expanded its soybean market to the rest of the world under the US hegemony of the second food regime. As Friedmann and McMichael argued (1989), the American style of intensive meat production based on soy meal and maize was introduced to Europe through the Marshall Plan and to Japan and other countries through the Agricultural Trade Development and Assistance Act (the so-called PL-480). Soybean oil was promoted and substituted other oils by the same route. Cooking oil, mainly soybean oil, was the second most shipped product under PL-480 after wheat (Friedmann and McMichael 1989).

The "Westernisation" of Japanese diet post-World War II is considered to be a successful example of increasing the nation's vegetable oil consumption. In order to develop a new market for US wheat and soybean, the governments of the USA and Japan actively disseminated bread-and-milk-based diet through school lunch schemes and promoted the use of vegetable oils through nutritional advice and the "kitchen cars" and "frying pan movement", in which demonstration vehicles toured Japan introducing oil-rich menus (Suzuki 2003). The consumption of vegetable oils and animal products increased rapidly after World War II in Japan, and soon Japan became the largest importer of maize in the world and one of the largest importers of soybean.

16.4 The (Re)structuring of the Supply Chains of Vegetable Oils in China and India

16.4.1 The Shift to the "Corporate Food Regime"

It can be argued that today's China and India are experiencing a similar "Westernisation" of diet as Japan did several decades ago. The global context for these countries, however, has shifted to become what McMichael (2005) discussed as "corporate food regime", in which the WTO's Agreement on Agriculture plays

the key institution, and nation states have less right to food self-sufficiency as their national strategy. More decisions on food and agriculture are made in a "transnational policy space" (Coleman et al. 2004).

16.4.2 Strategy Shifts of Neighbouring Asian Countries and Global TNCs

When China began opening its southern reaches to foreign investment in the early 1980s, companies from Japan, South Korea, Hong Kong and Taiwan were looking for low-cost manufacturing locations beyond their own borders. This timing, together with its geographical proximity to Asia's richer neighbours, is suggested as a reason why China received approximately US$730 billion more in foreign direct investment (FDI) than India between 1995 and 2009 (Prime et al. 2012). Japan in particular was seeking new production bases after the G5 agreement of Plaza Accord in 1985, which intervened the currency exchange market to appreciate Japanese yen against US dollar, as well as against Chinese Renminbi. In 1986, a policy report from the Committee on Economic Structural Adjustment for International Cooperation in Japan (Maekawa report) recommended the government to promote outbound FDI and increase imports of agricultural products (including processed food) when that product can be imported cheaper than produced domestically (with the exception of staple agricultural products). In the following years, from 1985 to 1987, overall food imports to Japan increased by 34.4 %, the highest growth being in processed foods at 86.4 %, followed by 73.6 % for meat, 71.8 % for seafood, 55 % for fruit and vegetables and 14.6 % for oils, fats and oilseeds (Katsumi 1988, cited in McMichael 2000b).

Global strategy of major grain transnational corporations (TNCs) has shifted as well. The regional distribution of soybean crushing facilities has changed dramatically: from 1991/1992 to 2003/2004, the share of world soybean crushing in the USA and EU declined (from 37.26 % to 25.26 % and 14.35 % to 9.91 %, respectively), and its share in Brazil and Argentina has increased (16.31–17.37 % and 8.41–14.51 %, respectively). In China, it surged from 3.7 % to 15.48 % due to TNCs' heavy investment (Goldsmith et al. 2004).

China and India opened their vegetable oil market in the middle of such corporate food regime, where strong influences exist from WTO, neighbouring countries and TNCs.

16.4.3 China

16.4.3.1 China's Food Policy and Its Alteration by Trade Liberalisation

China applied to join the General Agreement on Tariffs and Trade (GATT) in 1986 and was admitted to the WTO in 2001. During the prolonged negotiation period, China implemented various trade liberalisation policies (Fan et al. 2007). Soybean was previously listed as a "strategic commodity", but the Chinese government

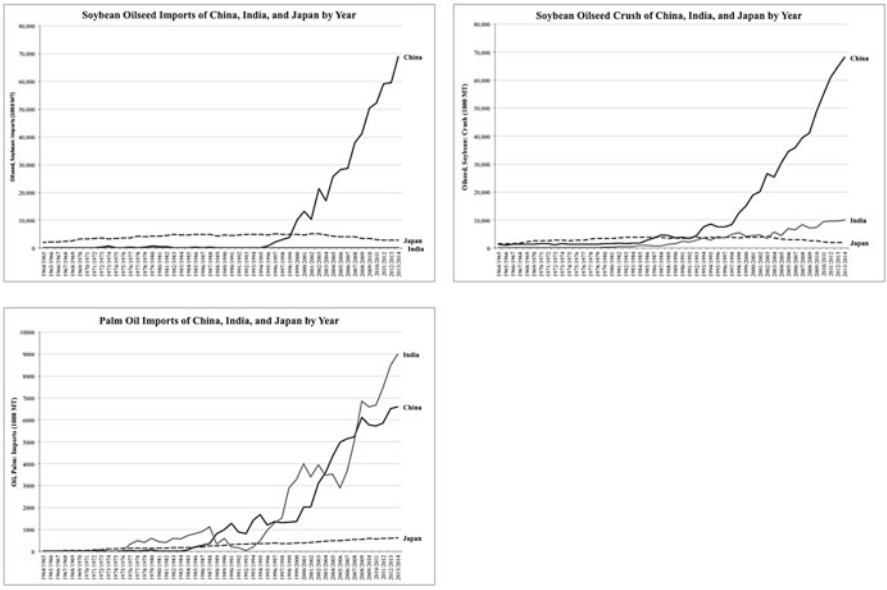

Fig. 16.2 Soybean oilseed imports, crush and palm oil imports of China, India and Japan, 1964–2013 (Source: USDA FAS Production, Supply and Demand database, available at: http://www.fas.usda.gov/psdonline/. Accessed September 26, 2013)

liberalised its trade to promote import, namely, reducing the import tariffs from 40 % to 3 % in 1996. China became a net importer of soybeans in 1996 and soon became the largest soybean importer of the world by the middle of 2000s (IATP 2011; Fig. 16.2). The Chinese government also encouraged FDI, by reducing corporation tax for foreign companies to 15 % in 1991 when the corporation tax for domestic companies was 33 %. In 2002, it went further and exempted the payment of corporation tax for foreign food companies for 3 years (Usui 2010). These policies facilitated global TNCs to build large-scale oilseed crushing facilities in China. Archer Daniels Midlands (ADM) was the first TNC to invest in China's oilseed crushing business and has become the largest processor of oilseeds there with its partners like the Chinese state-owned China National Cereals, Oils and Foodstuffs Corporation (COFCO) and Singapore's Wilmar (Goldsmith et al. 2004). Cargill has invested in China since 2006 and Bunge began its activities in China in 2004 (Ozawa 2011). Their large, modern crushing facilities were built mostly in the southern coast of China – a convenient location for imported soybean, though domestic crushing plants had been located in the northeast of China – a location close to domestic soybean production area.

16.4.3.2 An Example of (Re)structuring the Meat and Animal Feed Supply Chain in China

Until the mid-1980s, the majority of pork was produced by small-scale producers with fewer than five pigs (IATP 2011), backyard poultry was dominant (FAO 2009) and industrial feed production was negligible (Ke 2007) in China. In contrast, China

today is one of the world's largest producers of these commodities (FAO 2009; IATP 2011; WATT 2012) with the structural change of large-scale operations replacing backyard production (IATP 2011; FAO 2009). Intensive, large-scale livestock operations rely on feed input, mainly soy meal and maize, instead of utilising food waste in the area. China's industrial feed production developed from an almost negligible level before the 1980s into over 50 mt in 1995 to 78 mt in 2002 (Ke 2007) and to 148 mt in 2009 (Sun 2011:p. 13). In 2011, four out of the top ten global feed manufacturers were Chinese corporations, while Thailand's Charoen Pokphand (CP) Group, a dominant actor in China, remains at the top (Best and Jennison 2012).

16.4.3.3 An Example of (Re)structuring the Vegetable Oil Supply Chain in China: Instant Noodle Industry

China became a global importer of not only soybeans but also of palm oil, and it is suggested that the major user of imported palm oil is China's instant noodle industry (WWF 2011; Hsu 2001). China produced the largest amount (8.28 mt) of instant noodles in the world in 2011 (China.org.cn 2012). Yet this industry was negligible in China until Taiwanese and Japanese instant noodle companies began their production in China in the early 1990s (Nikkei 2009; Tsuruoka 2006). Nissin Foods, the inventor of instant noodle, began its production in China in 1993 (Tsuruoka 2006). Taiwanese Tingyi Holding Corp. began producing instant noodles there in 1992, later receiving investment and technical alliance from Japan's Sanyo Foods Co. (Nikkei 2009). Investments of Taiwanese and Japanese companies were made possible by the deregulation of FDI in China and welcomed by Japanese companies venturing overseas due to the policy changes in Japan discussed previously. Likewise, the expansion of Taiwanese companies into China was made possible by a policy change in diplomatic relations between China and Taiwan, from the armed forces confrontation to peaceful unification through the development of an economic relationship (Ito 2011). Although no exact data was found on how much palm oil is used by the instant noodle industry, its rapid development can be assumed to be a contributing factor in China's increased demand for palm oil.

16.4.4 India

16.4.4.1 India's Food Policy and Its Alteration by Trade Liberalisation

The government of India had heavily regulated food and agricultural sectors with the emphasis on self-sufficiency since its independence in 1947. The period between 1980 and 1992 was called "the best phase of Indian agriculture", achieving both growth and the equitable distribution of benefits (Hoda and Sekhar 2007: p. 301). Agriculture is estimated to provide income for 58 % of the population, and its food industry consists of a multitude of small-scale, nonintegrated processing and

marketing firms, with the small-scale industry (SSI) reservations restricted investment since shortly after its independence (Landes 2008).

In 1991, however, India began conducting major macroeconomic and structural reforms in industry, exchange rate and foreign trade and investments, under the pressure from the International Monetary Fund (IMF) and the World Bank (Fan et al. 2007). Then, in 1994, India's food and agricultural industries were directly impacted following the signing of the Uruguay Round Agreement on Agriculture (URAA) and the subsequent establishment of the WTO in 1995 (Fan et al. 2007).

16.4.4.2 An Example of (Re)structuring Vegetable Oil Supply Chain in India: *Vanaspati* Industry

Although India's vegetable oil sector had near self-sufficiency, India opened the market in 1994 and then quickly became the world's leading vegetable oil importer – ahead of both the EU and China (Fig. 16.2). In 2002–2003, India imported over 15 % of the total global vegetable oil imports, mainly palm oil (62 % of total import) and soybean oil (35 %) (Ghosh 2009). India's import dependency in edible oils increased steadily, and it exceeded 50 % in 1999 and 2000 (Hoda and Sekhar 2007).

Traditionally in India, oilseeds like sesame and rape-/mustard seeds were crushed locally using *ghani*, mortar and pestle powered by animals (Achaya 1994). Even by the late 1990s, 58 % of domestic edible oil output was still processed by manual extraction in approximately 130,000 units of ghanis and about 15,000 units of small-scale expellers. Policies like SSI reservation made it impractical for most small crushers to make the capital investment in processes like solvent extraction or high level of refining (Dohlman et al. 2003).

Significant change can be found in *vanaspati* (vegetable ghee) industry after trade liberalisation. Vanaspati is hydrogenated vegetable oil which substitutes animal-sourced ghee (clarified butter). India's vanaspati industry was the largest organised buyer of edible oils, and it was the second largest food processing industry in India. Historically, Indian government had heavily regulated vanaspati production and distribution through the Vegetable Oil Product Control Order of 1947 (Chhatrapati 1985). The oil source for vanaspati has been shifted since its birth in the 1930s, reflecting the government's policy on edible oils. Vanaspati was originally made of 100 % groundnut oil produced in India. Then in 1947, the government regulated to use 5 % refined sesame oil to prevent adulteration. In 1957 it encouraged to use cottonseed oil to promote cottonseed crushing in India, and in the 1960s the government allowed the import of soybean oil under PL-480 for vanaspati production. It restricted the use of groundnut oil in vanaspati production to 25 % in 1975 and totally banned it in 1977 (Chhatrapati 1985). Vanaspati has typically been made from the lowest cost combination of oils that meet product specifications (Dohlman et al. 2003). When the import of palm oil was liberated after 1994, the Indian government encouraged imported palm oil to be used in the vanaspati industry by setting lower tariffs on palm oil import specified to vanaspati production (Sonnad and Raveendaran 2010). Various studies suggest that vanaspati today is

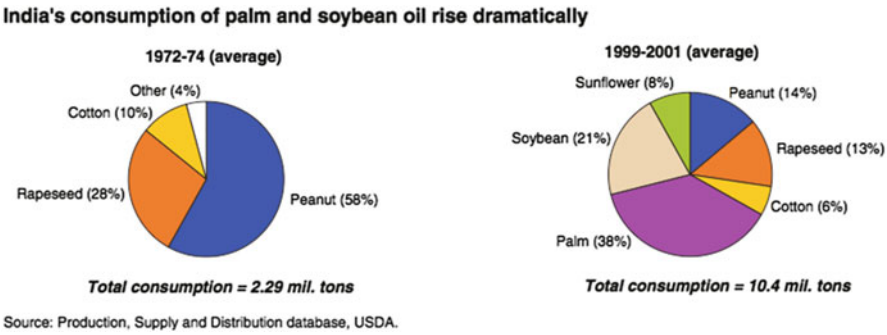

Fig. 16.3 Change in kinds of vegetable oils consumed in India (Dohlman et al. 2003, p. 4)

composed primarily of palm oil; Dohlman et al. (2003), for example, found that more than three-quarters of vanaspati is made from palm oil, with the remainder made from soybean oil.

The composition of vegetable oils consumed in India shifted significantly after trade liberalisation. In the early 1970s, palm, soybean and sunflower oil together accounted for less than 4 % of the total consumption of vegetable oil in India. Instead, almost all vegetable oil consumed was domestically produced groundnut oil (53 %), rapeseed oil (25 %) and cottonseed oil (9 %) (Dohlman et al. 2003). After trade liberalisation, palm and soybean oils have become the leading oils consumed in India, accounting for 38 % and 21 % of total consumption, respectively, between 1999/2000 and 2001/2002 (Dohlman et al. 2003; Fig. 16.3).

16.5 Replacing Domestic Production, Processing and Consumption with Globalised Vegetable Oils

As soybean and palm oil import rapidly increased in China, its domestic production of oilseeds stagnated (Fig. 16.4). In India, too, domestic production of edible oil started to fall in post-WTO era due to a steep decline in real prices, hurting domestic producers (Chand et al. 2004). Most of the oilseed farmers either shifted to other crops or kept their lands fallow if unsuitable for alternative uses (Reddy 2009).

Domestic oilseed crushers also suffered in both countries. Before trade liberalisation, both China and India promoted the development of their local oil processing industries to crush domestically produced oilseeds like groundnut, rapeseeds and soybeans (IATP 2011). In India, the SSI policy restricted the large-scale investment in modern solvent extraction and refinery facilities and thus preserved the manual extraction of local oilseeds by local crushers until the late 1990s. After trade liberalisation, however, these domestic oil crushers suffered, by the competition with TNCs' large-scale oil crushing facilities as well as price volatility amplified by trade liberalisation because the domestic price of oilseed and edible oils became to be

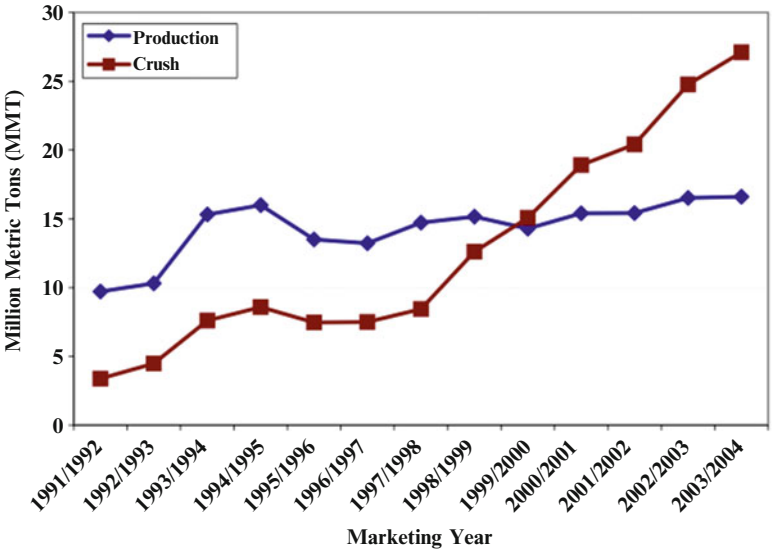

Figure 8: China Soybean Production and Crush
Source: US Department of Agriculture (USDA), Foreign Cultural Services

Fig. 16.4 The shift in China's soybean production and crush (Goldsmith et al. 2004, p. 94)

affected by international prices which fluctuate more than the domestic prices realised by local farmers (Sonnad and Raveendaran 2010). In China, large-scale buyout of domestic crushers happened particularly after the volatile price change of soybean and trade dispute in 2004 (IATP 2011). Statistics show that 5.4 % in the number (unit) of foreign-funded enterprises made 38.0 % of the gross industrial output value in the vegetable oil processing industry – the percentage of output value was highest in 2008 at 44.1 % (China Data Online 2012).

Consumption data in China and India shows that dietary patterns are shifting towards higher-fat, lower-carbohydrate, more processed food (Popkin et al. 2001). In China, for example, daily food intake of oil (g/reference man) increased from 26.0 → 37.0 → 44.0 in 1982, 1992 and 2002, respectively, in urban areas; and from 15.0 →26.0 → 41.0 in rural areas (Ge 2011). In addition to the increase in amount of oils and fats, the types of oils have been shifting especially in India as discussed above. Data shows that imports have been increasing the per capita availability of palm and soybean oils in China and India (Fig. 16.5).

In conclusion, China and India had not only increased their vegetable oil supply with import in order to respond to their population's increasing demand, but they have replaced their domestic production of oilseeds with imported oilseeds and vegetable oil, as they encouraged foreign direct investment in developing large-scale oil crushers and food industry based on imported oils. With the increased availability of oils and fats, fat intake of populations has increased, while the kind and type of oils have been replaced with imported soybean and palm oil, which are industrially extracted and refined.

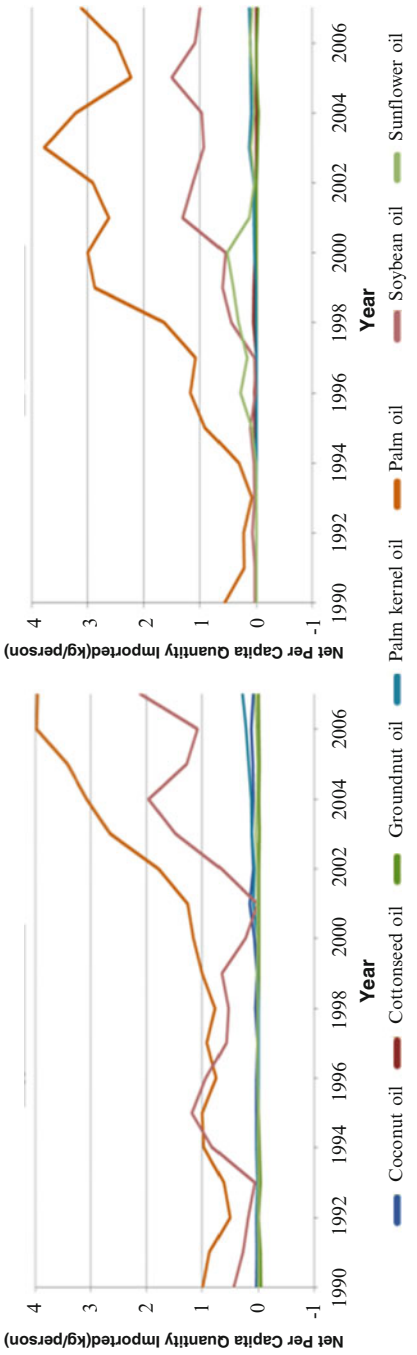

Fig. 16.5 Net edible oil imports on a per capita basis for the USA, EU, China and India (Sanders et al. 2011)

16.6 Conclusion

Asian countries are targeted by the world agricultural and food industries, while global concern on food-related non-communicable diseases rises. Little attention, however, has been paid on the structural changes that facilitate rapid increase in availability and consumption of oils and fats in Asian countries. By integrating into the global vegetable oil complex, China and India, as well as Japan some decades ago, have replaced their domestic foundation of oil production while they developed food industry largely based on imported vegetable oils and oil crops. This research suggested that production and consumption of modern vegetable oils have been increasing with driving forces of colonial powers, nation states and corporations, along with the shifts of food regimes. Structural changes in supply chains, including the rapid development in food industry based on imported oil source, facilitated the increasing availability of oils and fats mainly through processed food. It can be argued that these changes jeopardised food security in oils and fats by weakening domestic production and processing while they increased import dependency of food industry. On the consumer side, these structural changes assumingly jeopardise the public health of the population by encouraging the nation to progress nutrition transition towards higher-fat diet. The global availability of vegetable oils for consumption has been increasing rapidly in the current global corporate food regime while further consolidation into the global vegetable oil complex progresses. Thus, closer attention is required on the rapid changes in vegetable oil and animal feed supply chains in Asian countries, in order to secure food and health of the population.

Acknowledgements This presentation is extracted from the MSc dissertation which was submitted to the Centre for Food Policy, City University London, in October 2012. The author would like to express gratitude to David Barling and Tim Lang for their guidance on the dissertation and to Prof. Shuji Hisano at Kyoto University, who kindly supervises this research for a doctoral thesis.

References

Achaya, K. (1994). Ghani: A traditional method of oil processing in India. *FAO Food, Nutrition and Agriculture – 11 – edible fats and oils*. [Online] Available at: http://www.fao.org/docrep/T4660T/t4660t0b.htm. Accessed 29 Aug 2012.

American Soybean Association (ASA). *Timeline and historic photo*. Available at: http://www.soygrowers.com/soyindustry/timeline.htm. Accessed 31 Mar 2012.

Berger, K., & Martin, S. (2000). II.E.3 palm oil. In Cambridge University (Ed.), *The Cambridge world history of food*. New York: Cambridge University Press.

Berlan, J., Bertrand, J., & Lebas, L. (1977). The growth of the American "soybean complex". *European Review of Agricultural Economics, 4*(4), 395–416.

Best, P., & Jennison, K. (2012). Special report: Top feed companies 2011–2012, *Feed International*, pp. 8–12. [Online] Available at: http://www.fi-digital.com/fi/20120910. Accessed 25 Aug 2012.

Chand, R., Jha, D., & Mittal, S. (2004). WTO and oilseeds sector: Challenges of trade liberalisation. *Economic and Political Weekly, 39*(6), 533–537.

Chhatrapati, A. (1985). *The vanaspati industry: A historical review*. Bombay: Popular Prakashan.
China Data Online. (2012). [Online] Available at: http://chinadataonline.org/. Accessed 10 Aug 2012.
China.org.cn. (2012). *China Ranks No. 1 in instant noodle production*. [Online] Available at: http://www.china.org.cn/business/instant_noodles/2012-05/04/content_25302561.htm. Accessed 23 Jun 2012.
Coleman, W., Grant, W., & Josling, T. (2004). *Agriculture in the new global economy*. Cheltenham: Edward Elgar.
Cordain, L., Eaton, S., Sebastian, A., Mann, N., Lindeberg, S., Watkins, B., O'Keefe, J., & Brand-Miller, J. (2005). Origins and evolution of the western diet: Health implications for the 21st century. *The American Journal of Clinical Nutrition, 81*(2), 341–354.
Dohlman, E., Persaud, S., Landes, R. (2003). *India's edible oil sector: Imports fill rising demand, USDA ERS*. [Online] Available at: http://m.usda.mannlib.cornell.edu/usda/ers/OCS/2000s/2003/OCS-11-07-2003_Special_Report.pdf. Accessed 18 Jun 2012.
Drewnowski, A., & Popkin, B. (1997). The nutrition transition: New trends in the global diet. *Nutrition Reviews, 55*(2), 31–43.
Fan, S., Gulati, A., Dalafi, S., et al. (2007). Ch. 2 Overview of reforms and development in China and India. In A. Gulati & S. Fan (Eds.), *The dragon and the elephant: Agricultural and rural reforms in China and India* (pp. 10–44). Baltimore: International Food Policy Research Institute, Johns Hopkins University Press.
FAO (2009). *Livestock in the balance*. [Online] Available at: http://www.fao.org/docrep/012/i0680e/i0680e00.htm. Accessed 17 Apr 2012.
Friedmann, H., & McMichael, P. (1989). Agriculture and the state system: The rise and decline of national agricultures, 1870 to the present. *Sociologia Ruralis, 29*(2), 93–117.
Ge, K. (2011). The transition of Chinese dietary guidelines and the food guide pagoda. *Asia Pacific Journal of Clinical Nutrition, 20*(3), 439–446.
Ghosh, N. (2009). *Effects of tariff liberalization on oilseed and edible oil sector in India: Who wins and who loses?* (Working Paper No. 2). [Online] Available at: http://www.taerindia.com/pdf/Working_paper_no_2.pdf. Accessed 5 Sep 2012.
Goldsmith, P., Li, B., Fruin, J., Hirsch, R. (2004). *Global shifts in agro-industrial capital and the case of soybean crushing*. [Online] Available at: https://www.ifama.org/events/conferences/2004/cmsdocs/Goldsmith2000.pdf. Accessed 12 Apr 2011.
Gustafsson, F. (2007). *The visible palm: Market failures, industrial policy and the Malaysian palm oil industry, Lund studies in economic history*. Stockholm: Almqvist and Wiksell International.
Grigg, D. (1999). The fat of the land: A geography of oil and fat consumption. *GeoJournal, 48*(4), 259–268.
Hawkes, C., Friel, S., Lobstein, T., & Lang, T. (2012). Linking agricultural policies with obesity and noncommunicable diseases: A new perspective for a globalising world. *Food Policy, 37*(3), 343–353.
Hoda, A., & Sekhar, C. (2007). Ch. 14 Agricultural trade liberalization, poverty, and food security: The Indian experience. In A. Gulati & S. Fan (Eds.), *The dragon and the elephant: Agricultural and rural reforms in China and India* (pp. 301–324). Baltimore: International Food Policy Research Institute, Johns Hopkins University Press.
Hsu, H. (2001). *Policy changes continue to affect China's oilseeds trade mix, USDA*. [Online] Available at: http://www.ers.usda.gov/publications/wrs012/wrs012h.pdf. Accessed 24 Jun 2012.
IATP (Institute for Agriculture and Trade Policy) (2011) *Feeding China's pigs: Implications for the environment, China's smallholder farmers and food security*. [Online] Available at: http://www.iatp.org/files/2011_04_25_FeedingChinasPigs_0.pdf. Accessed 7 Apr 2012.
Ito, S. (2011). *China's economic development and the relationship between China and Taiwan (Japanese)*. Research Institute of Economy, Trade and Industry. [Online] Available at: http://www.rieti.go.jp/jp/publications/dp/11j003.pdf. Accessed 21 Oct 2012.

Ke, B. (2007). Ch. 11 Agricultural marketing reforms in China: Striking a balance between sequencing and speed. In A. Gulati & S. Fan (Eds.), *The dragon and the elephant: Agricultural and rural reforms in China and India* (pp. 239–263). Baltimore: International Food Policy Research Institute, Johns Hopkins University Press.

Landes, M. (2008). The environment for agricultural and agribusiness investment in India (EIB37). *USDA Economic Information Bulletin* [Online]. Available at: http://www.ers.usda.gov/publications/eib-economic-information-bulletin/eib37.aspx . Accessed 8 Sept 2012.

McMichael, P. (2000). A global interpretation of the rise of the East Asian food import complex. *World Development, 28*(3), 409–424.

McMichael, P. (2005). Global development and the corporate food regime. In *Research in rural sociology and development* (pp. 269–303). Bingley: Elsevier Ltd.

NIKKEI (2009). *The king of Chinese instant noodle: The hybrid corporation of Taiwan and Japan (Japanese)*. [Online] Available at: http://business.nikkeibp.co.jp/article/topics/20090703/199352/?P=1. Accessed 22 Jun 2012.

O'Keefe, S. (2000). II. E. 1. An overview of oils and fats, with a special emphasis on olive oil. In Cambridge University (Ed.), *The Cambridge world history of food*. New York: Cambridge University Press.

Ozawa, K. (2011). *'A study on grain majors' agricultural study* (The Nippon Agricultural Research Institute), 23. (Japanese). [Online] Available at: http://www.nohken.or.jp/23ozawa.pdf. Accessed 12 Apr 2012.

Popkin, B. (2002). The dynamics of the dietary transition in the developing world. In B. Caballero & B. Popkin (Eds.), *The nutrition transition: Diet and disease in the developing world, food science and technology international series*. London: Academic.

Popkin, B., Horton, S., Kim, S., Mahal, A., & Shuigao, J. (2001). Trends in diet, nutritional status, and diet-related noncommunicable diseases in China and India: The economic costs of the nutrition transition. *Nutrition Reviews, 59*(12), 379–390.

Prime, P., Subrahmanyam, V., & Lin, C. (2012). Competitiveness in India and China: The FDI puzzle. *Asia Pacific Business Review, 18*(3), 303–333.

Ramsey, D., & Graham, T. (2012). How vegetable oils replaced animal fats in the American diet. *The Atlantic*. [Online] Available at: http://www.theatlantic.com/health/archive/2012/04/how-vegetable-oils-replaced-animal-fats-in-the-american-diet/256155/. Accessed 5 Oct 2012.

Reddy, A. (2009). Policy options for India's edible oil complex. *Economic and Political Weekly, 44*(4), 22–24.

Sanders, D., Balagtas, J., Gruere, G. (2011). *Revisiting the palm oil boom: An examination of consumption in the oils complex*. In 2011 Annual Meeting, July 24–26, 2011, Pittsburgh, Pennsylvania. [Online] Available at: http://ageconsearch.umn.edu/bitstream/103726/2/AAEA%20poster%20-%2013364.pdf. Accessed 19 Jun 2012.

Sonnad, J., & Raveendaran, N. (2010). *Impact of WTO on Indian oilseed economy*. Jaipur: Prateeksha Publications.

Soyinfo Center. (n.d.). Available at: http://www.soyinfocenter.com. Accessed 12 Apr 2012.

Sun, R. (2011, April). Growth and change in the Chinese feed market. In *Feed International* (pp. 12–13). [Online] Available at: http://www.fi-digital.com/fi/20110304. Accessed 26 Aug 2012.

Suzuki, T. (2003). *'US wheat strategy' and diet of Japanese people (Japanese)*. Tokyo: Fujiwara Shoten.

Tan, J., & Sharma, S. (Eds.). (1989). *Trade, protectionism, and industrial adjustment in vegetable oils: Asian responses to North America* (Field report series, Institute of Southeast Asian Studies). Singapore: Institute of Southeast Asian Studies.

Tsuruoka, T. (2006). Japanese instant noodle: Manufacturers and its business in global marketplace. *Journal of Miyagi University School of Food, Agricultural and Environmental Sciences, 1*(1), 1–11.

Usui, H. (2010). *Two 'oils' change the world: World grain marketing in new stage (Japanese)*. Tokyo: Rural Culture Association Japan.

WATT (2012). *2011 WATT executive guide to world poultry trends*. WATT. [Online] Available at: http://viewer.zmags.com/publication/16fdd868#/16fdd868/1. Accessed 25 Aug 2012.

Wei, R. (2008). Brazil becoming the world exporter of agricultural commodities (Japanese). *Norin Kinyu*. [Online] Available at: www.nochuri.co.jp/report/pdf/n0809re1.pdf. Accessed 6 April 2012.

WWF (2011). *Palm oil buyers' scorecard*. [Online] Available at: http://wwf.panda.org/what_we_do/footprint/agriculture/palm_oil/solutions/responsible_purchasing/scorecard2011/index.cfm. Accessed 22 Jun 2012.

Chapter 17
Presentism as an Embedded Temporal Value of Modernity: An Analysis of the Modern Food System from the Energy Perspective

John XXV Paragas Lambino

Abstract Individualism has been widely argued as an essential and even quintessential characteristic of modernity. Modernity's individualism can be traced as far as back to Descartes's proposition of cogito, ergo sum which indicated that individual thought is a sufficient condition to prove one's existence. If the individual is seen as a geometric point in space, individualism can be understood as a spatial characteristic of modernity. The existence of a spatial characteristic suggests the possibility of the existence also of a temporal characteristic. This paper attempts to probe into the temporal characteristic of modernity utilizing the relationship of the food system and energy use as a passageway penetrating through modernity's outward appearances. It initially elaborates on the modern food system and shows its high dependency on energy use. It later shows the temporal focus of energy use by examining modern technology and industrialization. It then analyzes the modern economic system and shows that the production and consumption system in capitalism is predisposed to focus on the present period. Finally, it looks into the formation of presentist values in modernity. Taken as a whole, what the paper contends is that presentism, viz., the view of the primacy of the present period, is the underlying temporal characteristic of modernity. By juxtaposing the temporal and spatial characteristics, the paper contends that modernity upholds the value of the geometric point in both space and time, viz., the individual in the short period of present time.

Keywords Energy usage • Sustainability • Modernity • Presentism

17.1 Introduction

The issues of environmental security and sustainability and many other contemporary issues facing humanity have temporal attributes on the grounds that these issues deal with a movement toward the future. To have a more nuanced understanding of

J.X.P. Lambino (✉)
Kyoto University Graduate School of Economics, Kyoto, Japan
e-mail: john.lambino@econ.kyoto-u.ac.jp; lambinoxxv@hotmail.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_17

the contentions on these issues, it is valuable to examine them as to how they relate to the temporal characteristic of contemporary life. Because this temporal characteristic has not been satisfactorily and fully clarified, the paper attempts to ferret out the temporal characteristic that is embedded in modernity.

17.2 Modern Food System

Food, whose meaning can encompass production, preparation, presentation, aroma, and tastes, has always been important in social gatherings from celebrating life to grieving for the dead. Human beings may live without shelter or clothing, but without food they cannot survive. Food is therefore almost always at the center of both human consciousness and social affairs. Because of this centrality, the author chooses the modern food system as a platform to analyze the temporal characteristic of modernity.

17.2.1 Transformation of the Food Production System

This section discusses the modernization of food production to show that it came with increased dependency on fossil fuels. Before industrialization—i.e., era of modern technology—human beings depended on their muscle power and that of their animals for production. They got their energy from food. More land meant more food that could be produced. At the same time, food production was limited by available land. The industrial revolution was able to overcome this limitation and was able to expand food production significantly. New machines powered by fossil fuels were invented and employed in preparing the land for planting as well as in preparing and bringing the food to the eater. Soon, industrial products encroached into the plants' actual food production process. In particular, the Green Revolution that started in the 1940s made food production more dependent on energy inputs. High-yielding grain varieties were developed and distributed widely to the farmers. However, these varieties of grain were especially dependent on inorganic inputs such as inorganic nitrogen fertilizers and pesticides that were in turn produced using fossil fuels as raw materials. What this means is that the increase in food production in the modern world came with an increase in dependency on energy inputs.

17.2.2 Modern Consumption System

Modern consumption values are very much different from previous eras. The modern man and woman cannot seem to wait for the future. They expect so many things to be fast and for these things to be faster. Food is not an exemption.

Convenience stores have become a feature of urban landscapes and an important food supplier in urban areas. Japan, which is the most developed and the most modern country in Asia, has 48,293 convenience stores in 2013. The year before that, store patrons made 14.9 billion visits and purchased 9.3 trillion yen worth of goods (Japan Franchise Association 2013a). Food was the single most popular item and accounted for 64 % of all purchases (Japan Franchise Association 2013b). Convenience stores also have increasing presence in the developing world. For example, Thailand has 12,246 convenience stores as of 2012 (Jitpleecheep 2013). Another expression of modern food consumption is convenience food, viz., food that is pre-prepared for ease of consumption. The modern world has seen how instant coffee has practically replaced the grinding and brewing of coffee beans and how instant noodles have replaced noodles. This list does not end.

Convenience food and convenience stores follow the logic of efficiency in terms of saving time. The modern world wants *to suck all the marrow out of what life can offer* by living fast and hence supposedly experiencing more.[1] The time between production and consumption is increasingly compressed, even if the distance separating the two is increasing more. To do that, the modern world is further developing industrial technology and with it increasing its use of energy.

Moreover, it is getting more difficult for consumers to distinguish that is in season versus that which is out of season. Fruits and other fresh produce are stacked up in supermarket shelves in many cities all year round. Aside from fresh produce, preserved food can also be found in other sections of the supermarket. Through refrigeration and canning, food harvests can be consumed at a much later time. Through advancements in transportation, zones with different climates are connected such that food is sourced from different corners of the world. Food that is out of season in the northern hemisphere can be sourced in the southern hemisphere and vice versa. Plant factories with controlled environment can even grow fresh but out-of-season produce. What this implies is that food has lost its seasonality in the modern world. The past and the future seem to have become irrelevant to food consumption.

The modern world has realized not just out-of-season consumption but also out-of-place consumption. Apples have become available in tropical countries in as much as bananas have become available in temperate countries. Major cities have overcome food locality and source their food from all over the world.

Traditionally, the production of food had been dependent on the place and the season. The consumption of particular foods had been hindered by conditions of space and time. Modernity has tried to overcome these using industrial technology. It is to be noted that freight trains and ships, plant factories, refrigeration, food pre-preparation, and many other features of the modern food system run through the use of energy. So in order to bring food that is out of place and out of season to the here and now, energy is being used to overcome both the resistance of time and space.

[1] *To suck all the marrow out of what life can offer* was originally a statement of Thoreau to encourage people to live simply and learn from raw experiences in nature. The author used the expression for the opposite meaning.

17.3 Energy

Energy is understood in Physics as the capacity to do work and the capacity to cause changes. In terms of economic production, energy—i.e., regulation of energy transformation—is the means for human beings to manipulate the relationships in the physical world. Through the use of energy, human beings are able to extend their will far beyond their somatic capabilities.

17.3.1 Energy Use in Pre-modernity

At the early stage of human evolution, human beings were dependent on muscle strength to drive their implements. Food was their only source of energy until they learned to domesticate fire. They used forest residues such as dried leaves and branches; they learned to use biomass as another source of energy. As civilization marched on, they learned to employ animal strength to drive their implements. Food for their bodies, fodder for their work animals, and biomass for fire were all products of photosynthesis by plants and other organisms.

As energy was mainly sourced from solar energy, land was a vital resource for economic production. Colonization of new lands became the major means to harness more solar energy. But colonization could not proceed indefinitely as colonization came with conflicts between peoples. This restrained the amount of harnessed energy and economic production.

17.3.2 Energy Sources After the Industrial Revolution

The industrial revolution changed this. Human beings were able to master the regulation of fire and heat to drive their implements. Fossil fuel being a concentrated energy source became the main source of energy. Through the use of fossil fuels, human beings increased their ability to transform matter and the natural environment. Economic production that had been limited by land availability was expanded by industrial technology.

After the industrial revolution, the drive toward the use of more energy accelerated. For instance, between the period of 1970 and 2010, global energy consumption increased from 200 quadrillion Btu to 522 quadrillion Btu. Out of the global energy consumption increase during the same period, natural gas consumption increased from 36 quadrillion Btu to 117 quadrillion Btu. Oil consumption increased from 98 quadrillion Btu to 173 quadrillion Btu. Coal energy consumption increased from 60 quadrillion Btu to 149 quadrillion Btu. Nuclear energy consumption increased from 1 quadrillion Btu to 28 quadrillion Btu. Most of the global energy consumption or 84 % comes from the use of fossil fuels, and only 11 % of

global energy consumption comes from renewable resources (United States Energy Information Administration 1995, 2010). The drive toward more energy led to the utilization of fossil fuels and in recent times to nuclear energy.

17.3.3 Sustainability of Modern Energy Use

What is the temporal characteristic of modern energy use?

As discussed above, modern energy use is highly dependent on fossil fuel consumption. Fossil fuels took millions of years to be formed through the decay of—i.e., chemical changes in—prehistoric plants and animals into organic materials. Moreover, fossil fuels are finite resources. Due to the enormous growth in fossil fuel consumption, it is projected that fossil fuels will be depleted in a couple hundred years. While fossil fuels embody millions of years of stored energy from the sun, fossil fuel consumption covers only a brief span.

Another implication of accelerated fossil fuel use is the excessive emission of greenhouse gases leading to global warming. It has been shown that global warming causes the disruption of the environmental conditions such as worsening of water shortages, salination, soil erosion, and desertification. For these reasons, the modern production and consumption system that is highly dependent on fossil fuels is not sustainable.

Nuclear energy has been promoted as an energy source that is alternative to fossil fuels for the following reasons: first, the production of nuclear energy does not emit greenhouse gases, and second, nuclear fuel from uranium ore has the potential to provide the energy needs of human beings for millions of years.

However, the use of nuclear energy is not a panacea to the problems caused by high dependency to fossil fuels for two reasons: First, the operation of nuclear power plants involves risks of nuclear accidents associated with imperfect information on what and how things—such as terrorism, natural calamities, and so forth—are going to happen. Second, nuclear power plants generate spent nuclear fuel that has a long-lasting lifespan of up to tens of thousands of years in terms of toxicity and radioactivity.

Available technology can only be evaluated as adequate based on past experiences but cannot be perfectly adequate to respond to all things that may happen in the future. Due to imperfect information, a number of nuclear disasters happened in different parts of the world. The major ones are the Three Mile Island accident in the United States in 1979, the Chernobyl accident in the former USSR in 1986, and the Fukushima accident in Japan in 2011. In spite of these disasters, many countries continue to build and operate nuclear power plants. In 2013, 435 nuclear power reactors are currently under operation and 60 more reactors are being built (World Nuclear Association 2013). Increasing the share of nuclear energy increases the embedded risks in operating the nuclear power plants.

Nuclear power plants generate spent nuclear fuel that is considered as one of the most hazardous materials ever produced by human beings. It also has a long-lasting

lifespan of toxicity and radioactivity between 10,000 and 100,000 years. Because of the long-lasting lifespan of toxicity and radioactivity, storage of nuclear spent fuel is extremely problematic. For example, the United States does not have a "permanent" storage facility for 70,000 tons of spent nuclear fuel. In spite of that, the amount is increasing by 2,000 tons every year (United States Government Accountability Office 2012).

17.3.4 Temporal Characteristic of Modern Energy Use

The energy usage in the modern era provides an insight into modernity's temporal value. Energy that has been stored as fossil fuels for millions of years in the past is being depleted within a relatively short period of time. At the same time, the benefit of using nuclear energy at the present time is integral with the production of waste that is hazardous long into the future.

Fossil fuels and nuclear fuel are fundamentally different in the sense that the use of fossil fuels connects the present to the long-distant past, while the use of nuclear fuel connects the present to the long-distant future. Nevertheless, both involve the present. Fossil fuels and nuclear fuel are similar in the sense that their usage supports the economic production and consumption system that focuses on a narrow temporal period of the present.

The modern system is engaged in a shorter time frame compared to the temporal requirements of the energy sources it uses. The convenience available in the modern era has been supported by massive amounts of energy. The amount of time to produce fossil fuels in the past and the amount of time to dispose spent nuclear fuel are mostly disregarded within the calculus of maintaining production and consumption growth in the present time.

17.4 Temporal Characteristic of Modernity

17.4.1 Marx and Weber Redux

The drive toward increasing the use of energy is embedded in the production and consumption system of the modern society. This section discusses the dynamics of production and consumption processes in capitalism.

In the capitalist mode of production, the generation of surplus in the form of profits is fundamental. In this system, owners of profit have to decide what to do with the profit they gained. On the one hand, they can decide to use their profit for personal consumption such as the purchase of luxury articles. On the other hand, they can choose to reinvest to get even more money. But because of competition, the owners of profit in order to remain capitalists do not really have the choice. They

have to generate a profit rate that cannot be lower than the socially acceptable profit rate. Because of this, they have no other recourse but to choose to reinvest their realized profits. By doing that, they accelerate production and the turnover time of capital and with that the accumulation of capital.

Capital accumulation is supported by the ascetic values of self-denial and repression of need. This brand of asceticism, which was originally a religious value within different sects of Protestantism, flowed into areas of secular life such that the values of self-denial and repression of need were transformed toward emphases on hard-work, frugality, and diligence in daily life. In these societies, life's enjoyment became subordinated to the demands of work. They rejected the spontaneous enjoyment of life and all that it has to offer. What this value further asserts are the prohibition on luxury and idle amusements and the limitation of consumption. It obliged people to delay gratifications and to focus on systematic effort for productive ends. This productivist value drove people to work harder, to shun consumption, and hence to save more. These savings became available for the society to reinvest.

Profits and savings are reinvested to purchase new machineries and develop new technologies to reduce production cycles and capital turnover time. As new machineries are employed, more energy is used.

Moreover, for capitalist production to continue, there must be an increase in effective demand to absorb additional productive capacity. Productivist values require concomitant consumerist values. What this means is that societies with productivist values exist alongside societies with consumerist values. As production becomes increasingly separate from the activities of consumption, productivist values compel the workers to focus solely on their present activity of work, while consumerist values compel the consumers to focus solely on their present activity of consumption. Producers and consumers forget the implications of their activity in the past or in the future.

As capital accumulation proceeds or as new machineries and new technologies are employed, businesses have to find new profitable channels as new spaces and new temporalities for capital accumulation. Modern life is being created increasingly as experiences of production and consumption that support capital accumulation. As production accelerates, the time cycle of product life shrinks toward the disposable and the instant. In search of increased profits through the logic of comparative advantage, production networks expand and distancing between consumption and production happen. Friction due to space and time has to be overcome in the production and consumption of goods. Movement of goods across a physical distance requires the expenditure of energy. Acceleration of production and consumption cycles requires the expenditure of energy. The tendency toward increased energy use is thus embedded in the modern production and consumption processes.

The general effect in capitalist modernization is the acceleration of economic processes of production and consumption. Social life is being filled more with consumption and production activities. Workers work more and consumers consume more. Modern men and women are made to believe more and more that the fullness of living is determined by the intensity of their economic activities.

There are two main points in this section: first, the modern economic system is structured under the rules of competition and driven by productivist-consumerist values, and second, the structure and the values are pushing the society to be increasingly absorbed with the short period of the present.

17.4.2 Descartes Redux

Individualism, which has been widely argued as an essential and even quintessential characteristic of modernity, can be traced to Descartes's proposition of cogito, ergo sum. What the proposition is saying is that individual thought is a sufficient condition to prove one's existence. If the individual is seen as a geometric point in space, individualism can be understood as a spatial characteristic of modernity. This suggests the existence also of a temporal characteristic of modernity.

In his proposition, Descartes distinguished the essential self—i.e., the mind—from the body. In this dualism, the self has absolute certainty, whereas the existence of the body and the physical world—including other individual bodies—is in theory doubtful. Based on this thinking, the individual mind due to its absolute certainty is completely independent and supreme over the physical world. Being supreme, the individual mind is free to shape and transform the physical world. At the same time, the mind is free to represent and abstract the qualities of the physical world. Under the Cartesian abstraction of reality and along with the Newtonian mechanistic interpretation, experiential qualities of time and space gave way to homogenized representations. Science has adopted this Newtonian-Cartesian representation to grasp and comprehend reality such that modern science has come to understood reality as something that can be calculated and measured. What this means is that reality is diminished and reduced to physical quantities. The Cartesian proposition provided the modern era with two ideological values: first, by believing in mind's supremacy, human beings sought to subjugate the physical world, and second, reality is understood as a collection of physical measurements.

As argued by Heidegger, Cartesian time is a homogeneous, linear, and infinite collection of present points. These points pass from the past to the present and to the future. The past and the future are interpreted using the present as the basis. That is, the past is the no-longer-present and the future as not-yet-present. What this implies is that the present is supreme. Similar to the Cartesian logic of absolute certainty of the individual mind, only the present is fully certain and completely real. According to this thinking, the past and the future are for all we know merely figments of imagination.

Since the certainty of the individual mind is a sufficient condition for existence, as modernity was being established in Europe, the guarantor of existence shifted from God to the individual. The loss of God in modernizing Europe came with the loss of a temporal horizon that extended to eternity. Existence came to be understood as the time from birth to death. Temporal horizon became extended only up to death. As Heidegger articulated, time comes to an end with death, and being-possible—i.e., the potentiality of being—has the priority. Eternal life was lost.

Along with that, life became short. To live life to the fullest became the compensation for the loss of life after death. The short period that extends to death became the temporal value in modern life.

17.5 To Summarize

The paper has discussed the following: First, modern culture as seen in modern food consumption exalts the present time as it pursues speed and acceleration. Second, the application of modern technology as seen in energy use in industrialization is focused on the short period of the present. Third, the modern economic system uses more energy as it pursues more production and consumption in the present time. Fourth, modern ideology as seen from the development of the Cartesian proposition is founded on the primacy of the present time defined by individual life.

Descartes's proposition marked the start of modernity. While individualism is the spatial characteristic, the author proposes that presentism is the temporal characteristic of modernity. By juxtaposing its temporal and spatial characteristics, the author is saying that modernity upholds the value of the geometric point in both space and time, viz., the individual in the short period of present time.

If the discourse on environmental security and sustainability is to move forward, it will be necessary to understand that modernity is embedded with individualism and presentism. Human civilization needs to find ways to overcome this preoccupation with the individual and the present.

Acknowledgments The author wishes to express that the arguments provided in this paper have to be developed and elaborated to fully present the case of presentism being the temporal characteristic of modernity. The author is offering his analysis since he is motivated by his desire to encourage a discussion on the modern world's appreciation and understanding of time.

References

Japan Franchise Association. (2013a). *CVS tōkei nenkan dōkō (2012 nen 1 gatsu ~ 12 gatsu)*. Tokyo: Japan Franchise Association (in Japanese).

Japan Franchise Association. (2013b). *JFA konbiniensu sutoa tōkei chōsa geppō*. Tokyo: Japan Franchise Association (in Japanese).

Jitpleecheep, P. (2013). *Convenient boom: Retailers are coming ever closer to you and putting even more stuff on their shelves*. Bangkok: Bangkok Post.

United States Energy Information Administration. (1995). *International energy outlook*. Washington, DC: United States Energy Information Administration.

United States Energy Information Administration. (2010). *International energy outlook*. Washington, DC: United States Energy Information Administration.

United States Government Accountability Office. (2012). *Spent nuclear fuel: Accumulating quantities at commercial reactors present storage and other challenges*. Washington, DC: United States Government Accountability Office.

World Nuclear Association. (2013). *Plans for new reactors worldwide*. London: World Nuclear Association.

Chapter 18
The Reality of Food Deserts in a Large Japanese City and Their Resolution Using Urban Agriculture

Yoshifumi Ikejima

Abstract The term "food desert" is a disadvantaged area with relatively poor physical and/or economic access to fresh food. Consumers in a food desert have difficulty accessing food retailers and nutritious food, so they may potentially have health risks from their limited physical access to fresh food. Currently, food deserts have occurred in many developed countries: the United Kingdom, the United States, Canada, Australia, and New Zealand. This paper surveys whether food deserts have formed in a large Japanese city, Hodogaya ward in Yokohama City. To estimate how many people were in a food desert, we used GIS to map the precise locations of local food stores and residents: the food desert map. As a result of GIS analysis, roughly 78,000 people have poor access to fresh food, including 17,000 or so aged 65 years and over. This means that up to 35 % of residents in Hodogaya ward live in a food desert. Then, this paper proposes new resolution that utilizes local resources: urban agriculture and produce stand. To test the effectiveness of urban agriculture, we made the produce stand location map and estimated how many people in the food desert had easy access to fresh food from produce stands. As a result of this calculation, approximately 25,000 people, 5,500 of them elderly, can alleviate their limited access to fresh food using a nearby agricultural outlet. Therefore, urban agriculture can be effective against food deserts: urban agriculture is referred to as an "agri-oasis" against a food desert.

Keywords Food desert • GIS • Urban agriculture • Produce stand • Agri-oasis

18.1 Introduction

Presently, the concept of "the right to food" is recognized as one of the basic human rights in several international declarations and treaties such as the Universal Declaration of Human Rights. The UN Committee on Social and Cultural Rights

Y. Ikejima (✉)
Graduate School of International Social Sciences, Yokohama National University,
79-4 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan
e-mail: ikejima@yun.ac.jp

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_18

stated that "the right to adequate food is realized when every man, woman and child, alone or in community with others, has physical and economic access at all times to adequate food or means for its procurement" (United Nations 1999). Under this concept, people everywhere should have the right to adequate food. We, however, unconsciously tend to use this concept as a basis for improving the living conditions of poor people in the Global South. Most poor and undernourished people are in the Global South. Generally, their food access problems are owing to economic constraints; they do not have sufficient money to purchase food. In contrast, people in developed countries seem to have enough money to live. Nevertheless, in developed countries, quite a few people have difficulty buying food and their numbers are increasing rapidly. Even in developed countries, the right to food is gradually becoming critical to people. Some people in developed countries lack access to food not because of economic constraints but because of lack of physical access, specifically, because of low availability of and accessibility to healthy and nutritious fresh food within a certain walking distance. This situation is called a "food desert."

18.2 Low Access to Food in Developed Countries: A Food Desert

The term "food desert" was first used in the early 1990s in Scotland in planning a public housing project. The term appeared in a 1995 United Kingdom government report from the Low Income Project Team of the Department of Health. Since then, the term has been used increasingly by academics, policy makers, and civil organizations to explain how residents do not have adequate and healthy food (Cummins and Macintyre 2002: 436). Currently, in addition to the United Kingdom, food deserts occur in the United States, Canada, Australia, and New Zealand. In these countries, food deserts are linked with "food insecurity" because the health consequences of undernourishment owing to lack of access to food are similar to those of health inequalities owing to lack of money.

The term food desert has been used differently and is not defined clearly, although a factor common to all definitions is that consumers in a food desert have difficulty in accessing food retailers and nutritious food. Food deserts are created by a number of factors, as Walker (2009) categorizes: access to stores, income disparities, race/ethnicity, food store density, costs, retailer locations, store types, availability, perception, quality of available foods, and impact. The situations in food deserts in each country are all different, and therefore, food deserts are rooted in their own localized factors. Researchers focus on the specific factors controlling local food access to shed light on food deserts. For example, researchers in the United Kingdom define a food desert as an area with relatively poor access to adequate food provision, related not just to the lack of grocery retailers but also to the large number of low-income households (Wrigley 2002; Clarke et al. 2002). In contrast, researchers in the United States define it as an area with limited access to affordable and nutri-

tious food in low-income neighborhoods and communities, related not only to poverty and race but also to dietary habits and obesity (USDA 2009; Gordon et al. 2011). Because both definitions are rooted in socioeconomic conditions, the term should refer to solutions to the problems themselves, taking local divergence into consideration. In this paper, we define a food desert simply as a disadvantaged area with relatively poor physical and/or economic access to fresh food to analyze the reality of food deserts in Japan.

In Japan, problems related to food deserts first emerged in depopulated rural areas where old people without cars had trouble purchasing food because of the withdrawal of neighborhood grocery stores (Sugita 2008). However, similar situations have recently occurred even in urban areas (City Planning Institute of Japan 2011; Iwama 2011). In many cities, a number of local grocery stores have closed since the 1990s. Moreover, even large supermarkets that play a central role in food provision in downtown and suburban areas have begun to withdraw across the country. In particular, since the recession in 2008, residents in urban areas including older people, the disabled, expectant mothers, and working couples have gradually faced deteriorated shopping environments to the extent that the public administration needs to address the situation. An advisory council of the Ministry of Economy, Trade and Industry of Japan (2010) estimates the population with poor access to daily food to be roughly six million. Similarly, a project team from Food Access Study, Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries of Japan (2012), and Yakushiji and Takahashi (2012) minutely analyzed food deserts in all parts of the country using regional census and commercial mesh statistics and estimated those who have no cars and no fresh food stores within 500 meters to be 44 million. Of these, roughly 9.7 million were aged 65 years and over.

Although these reports and studies effectively describe food deserts and report the number of people living in these severe environments, they only report estimates based on macro and regional data; there is a lack of concrete, objective case studies with field surveys. Thus, we cannot grasp the full picture of food deserts in Japan. To implement a political response, we should trace exactly where food deserts occur in a concrete area from an academic perspective.

Iwama (2010, 2011) are pioneering studies about food deserts in Japan that analyze the problem at a concrete municipal level from the perspective of geography, employing a geographical indication system (GIS). These studies regard food deserts as social problems attributed to the collapse of food provision systems for the socially vulnerable leading to health problems. Collapse of the food provision systems means not only increased travel distances because of the exodus of local stores but also the increased economic distance of poverty and the psychological distance of social isolation. Therefore, food deserts are one aspect of social exclusion issues (Wrigley 2002: 2035; Iwama 2010: 8). Because studies about food deserts in Japan have only recently been conducted, there are many unknown causes and mechanisms of the phenomenon. Under these circumstances, we need to confirm the reality of food deserts in Japan without excluding big cities, which are apparently far from poor access to food.

18.3 Purpose of This Research

The first purpose of this paper was to survey whether food deserts have formed in Yokohama City. Yokohama is situated on a peninsula on the western coast of Tokyo Bay approximately 30 km south of Tokyo, the capital of Japan. With a population of 3.7 million or so, Yokohama is now the largest municipality in Japan except for Tokyo's 23 wards. For this objective, we used GIS to map the precise locations of grocery stores and residences and estimated where there were likely to be food deserts as well as the number of people in these areas. To support this result, we studied how people in the identified food desert areas experienced inconvenience in accessing their food by conducting a field survey. The second purpose was to examine how urban agriculture is useful in resolving food deserts by using GIS and interviewing local farmers. The resolution of a food desert could be coining an "agri-oasis," within a food desert.

18.4 Outline of Study Area and Database Analyzed

Although previous studies typically targeted entire cities or large areas within a city, this paper focused on a relatively narrow area to examine a real-world situation based on detailed data collection and a factual field survey. This paper looked at Hodogaya ward, which is located in the central part of Yokohama and had a population of 206,000 in 2010. Hodogaya ward combines urban and suburban areas and consists of a steep hilly zone, a tableland, and a small lowland area. Most people live in the hilly zone or on the tableland, whereas supermarkets and other stores are around the lowland. Consequently, residents must go up and down daily to get food. This vertical interval affects residents' behavior. In particular, debilitated elderly people and women with small children have difficulty carrying heavy packages after shopping. In fact, access to supermarkets and small grocery stores is crucial for living in this area.

In spite of this geographical feature, on the one hand, the population has been increasing year by year. On the other hand, commercial facilities in this ward have been decreasing since the 1990s, as Fig. 18.1 shows. In 1994, 54 food stores (general merchandise supermarkets and grocery stores) were open, but only 21 such stores were open in this area in 2007. Although previous studies about food deserts mainly targeted supermarkets and grocery stores as food retailers, other types of food stores also play an important role in providing fresh food in Japan: meat and poultry stores, fresh fish stores, and vegetable and fruit stores. Even with the addition of these fresh food stores, the downward trend in food retailers has essentially remained unchanged in this area.

For analysis, we used the most current data available at the time of this study: first, the basic 2010 population census data based on the minimum unit of the Japanese census tract for this study; second, the geographic information data about

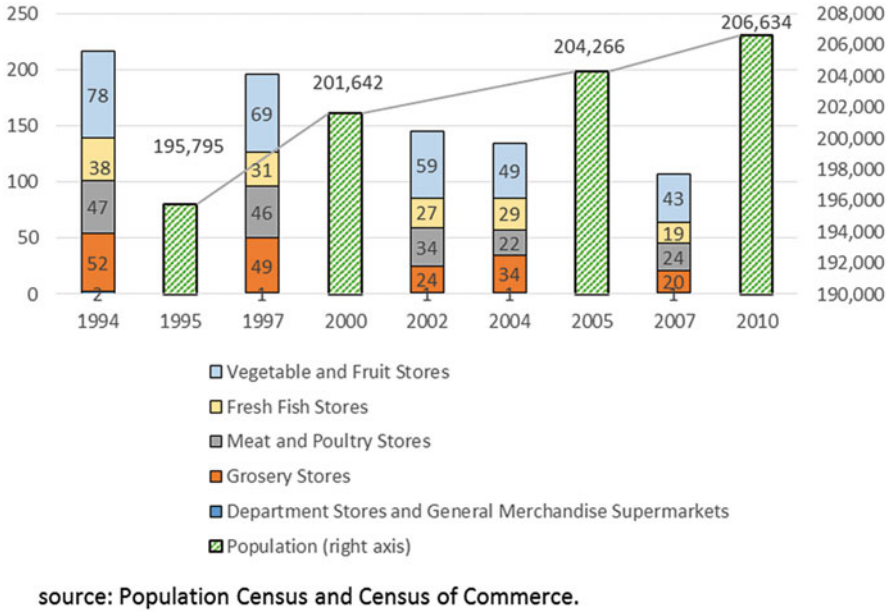

Fig. 18.1 Trend of population and food stores

building locations as of 2005 provided by the local administration, including information such as the shape of each building and the architectural area of every floor number; and third, retailer point data as of 2012 gathered from online business directories and geo-coded within GIS.

18.5 Measuring Access to Food Stores in GIS

We chose a simple way to identify a food desert based on GIS analysis under the assumption that people in Hodogaya ward were most affected by the physical conditions, that is, access to food stores by walking. To estimate how many people were in a food desert, we first selected residential buildings from among all buildings including public facilities, business offices, factories, amusement facilities, and so on. Next, the architectural areas of every selected building in the minimum unit of the Japanese census tract were aggregated and divided by the population of this minimum area unit available. Multiplying the numbers in the minimum unit by the area of each building gave the number of residents per building.

Based on this result of population per building, access to food stores was measured. Access by foot was measured as the distance from a food retailer to a residential building (i.e., to homes). In previous food desert studies, a distance of 500 meters was commonly used to assess access by walking because 500 meters is supposed to

be a distance that people are comfortable walking to get to a food retailer; it is roughly 10 min each way (Furey et al. 2001; Iwama 2010; Kristian and Gilliland 2008; Wrigley 2002). Conversely, a food desert is assumed to be an area in which people have little access to a food retailer within 500 meters on foot. This paper also adopts this distance as a basic indicator. Thus, we can use GIS to create circles of 500-meter radius—a buffer—at the location of a supermarket or a grocery store to calculate the number of people within a food desert area. Of course, as Kristian and Gilliland (2008) criticize, a circular buffer measures a straight-line distance from a retailer and does not identify the precise distance people actually move along streets. Nevertheless, because many footpaths run throughout this area, using the buffer approach was plausible in this study. Figure 18.2 displays the locations of supermarkets and grocery stores and their buffers within a 500-meter radius. In the figure, we can see that these food stores are located along highways or near stations and that people within these circles can easily reach them.

18.6 Searching for Areas Identified as Food Deserts

A spatially referenced GIS database as discussed above was used to identify what were likely to be food deserts. GIS spatial mining analysis was employed to calculate the number of residents outside of the buffer of each food retailer. Based on

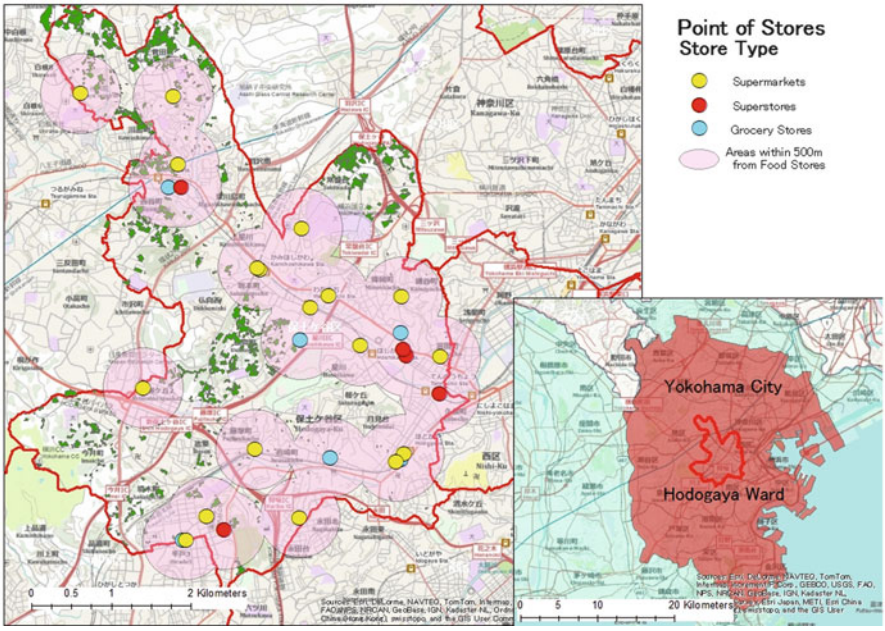

Fig. 18.2 Location of food stores in Hodogaya ward, Yokohama

that, the number was estimated to be 78,423; the number of residents within all buffers was estimated to be 128,210 on the food desert map (see Fig. 18.3). Roughly 78,000 people have poor access to fresh food, including 17,000 or so aged 65 years and over: the elderly population in Hodogaya ward is 22.0 % of the total population. Moreover, superimposing the zone of elderly people in the minimum census tract on the map clearly identifies where there is likely to be a food desert. In the northern, western, central, and northeastern areas, the elderly population is higher than it is in other areas. This means that the residents in these areas are far from food stores and likely to have difficulty obtaining fresh food. In Fig. 18.4, the elevation data for this area were added to the map. As a result, those areas identified as food deserts in Fig. 18.3 coincided with high-altitude areas. Therefore, the residents in those areas not only are geographically distant from food stores but also must ascend a steep hill after they purchase fresh food. Of course, even some of the elderly people have automobiles or public transportation, and some residents do not mind walking long distances, so it is not necessarily true that all 78,000 people have trouble obtaining fresh food. However, it is also true that up to 35 % of the residents in Hodogaya ward live in a food desert, and these people may potentially have health risks from their limited physical access to fresh food.

In some of these food deserts, we interviewed residents about whether they found it inconvenient to obtain fresh food at food stores. According to a report on Hodogaya ward (2012), inhabitants put emphasis on "location of stores, proximity, or stop-off (57.5 %)" rather than "price (42.9 %)" or "wide variety of goods (41.6 %)" when

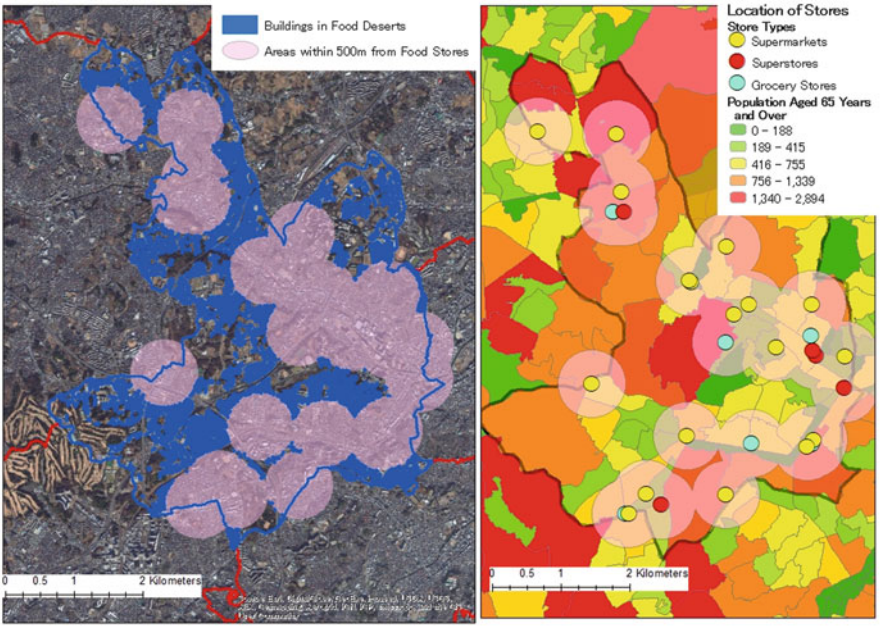

Fig. 18.3 Residents in food deserts and dense areas of elderly people

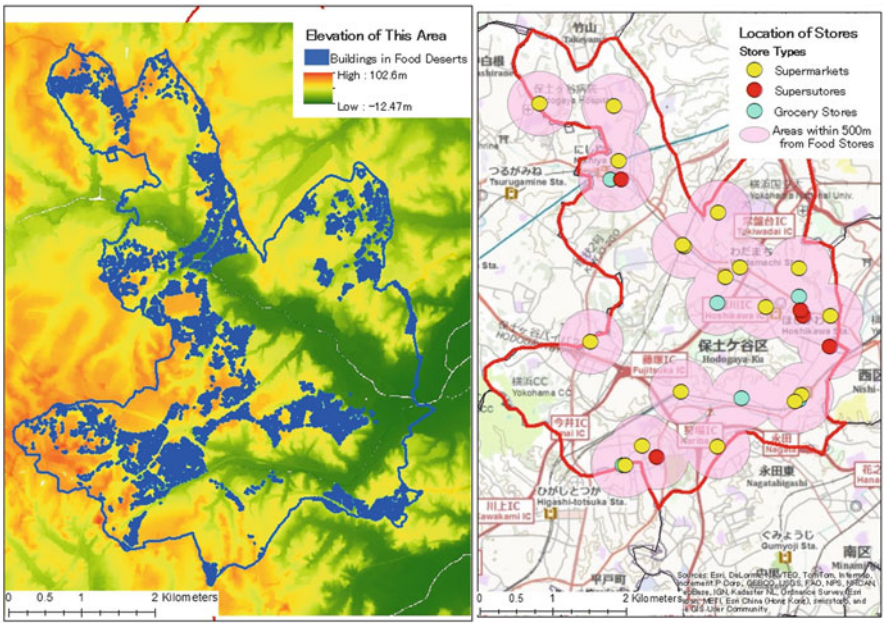

Fig. 18.4 Elevation of point data in food deserts

they decided where to buy things (multiple answers were allowed). This official report shows that more than half of the respondents felt that access to stores was important for their daily lives, and the residents could not compare commodities based on price or quality if there were no stores in the neighborhood. This also means that they sometimes felt inconvenient and discontented when shopping. In the northern area, Kamisugeta town, where there are many steep slopes and stairs, residents in their 60s and 70s without an automobile suffer inconvenience in their daily shopping. They have no choice but to visit the nearest food store and to try to save up for food for a few days in order not to go shopping frequently even though they live within a 500-meter radius of the store. Other residents in their 30s or 40s with an automobile can go to more distant stores and feel less inconvenient, but it is fairly difficult to drive because of the narrow roads. Even younger residents would suffer inconvenience without automobiles.

Similarly, in the central area, Bukko town, where there are no stores in the hilly zone (although there are some stores and a shopping center on the lowland near the station), the older residents in the hilly zone in their 60s and 70s have difficulty getting to food stores on foot. As a result, they tend to buy packaged and frozen food rather than fresh vegetables, fruits, meat, and fish, and they are reluctant to go out. Finally, these older residents tend to be isolated from the neighborhood community. In contrast, some residents who can easily access food stores communicate with neighbors when they meet at the store, and they enjoy exchanging words with them. Because the number of single households of 65 years and over accounts for 9 % or

so (8,495 as of 2010) of all households in Hodogaya ward, the opportunity to communicate with others could make those single households healthy mentally: food deserts can deprive residents of not just access to fresh food but also the chance to communicate with others.

18.7 Can Urban Agriculture Resolve a Food Desert?

Generally, as solutions to food deserts, new stores, home meal delivery service, and other options are suggested from the viewpoint of supply on the one hand, and on the other hand, new types of transportation (community buses, demand taxis, etc.) to support volunteer shopping activities are also examined from the viewpoint of demand (City Planning Institute of Japan 2011; Iwama 2011; USDA 2009). Some of these solutions in fact would be useful; a home meal delivery service and support activities are now being implemented by some social welfare corporations and individual grocery stores in this area, supported by government subsidy. These current solutions, however, have only limited effects in the food deserts in this area because there are fees for their use and also residents must take the initiative to ask for support. That is to say, these solutions are adaptations to the food desert (reducing the damage from it), not mitigations (eliminating the root of the problem). This paper explores another mitigation technique that utilizes local resources: urban agriculture.

Yokohama is a very large city, but it is also famous for its vibrant agriculture. In Hodogaya ward, 144 farming households (95 commercial farming households and 49 noncommercial) cultivate 90 ha farmland to produce mainly outdoor-grown vegetables. Overall, farm sizes are relatively small, and 69 % of farmers use less than 1.0 ha of farmland. Although most farmers are small, they ship high-quality fresh vegetables to wholesale markets, agricultural cooperatives, and farmer's markets, taking advantage of their proximity to the large metropolitan population; 68 % of farmers sell their products directly to consumers at their own produce stands or via home delivery services (mobile agricultural product vending).

To test the effectiveness of urban agriculture as a solution to food deserts, the point data on produce stands and on agricultural lands were added to Fig. 18.2 map to create Fig. 18.5. Agricultural lands are distributed mainly from the hilly zone of the central area to that of the northern area, and naturally, produce stands have been set up in those areas. In Fig. 18.5, 18 produce stands that opened their location information are plotted. Although Hodogaya ward has more than 18 produce stands, some farmers refrained from opening their locations. These produce stands are located in the steep hilly zone where other supermarkets or grocery stores do not exist. Of course, these produce stands provide fresh vegetables and fruit in season, and some of them also provide fresh meat, milk, eggs, etc. Thus, if residents used these produce stands as neighborhood food stores, inconvenience in food shopping would be alleviated to some extent.

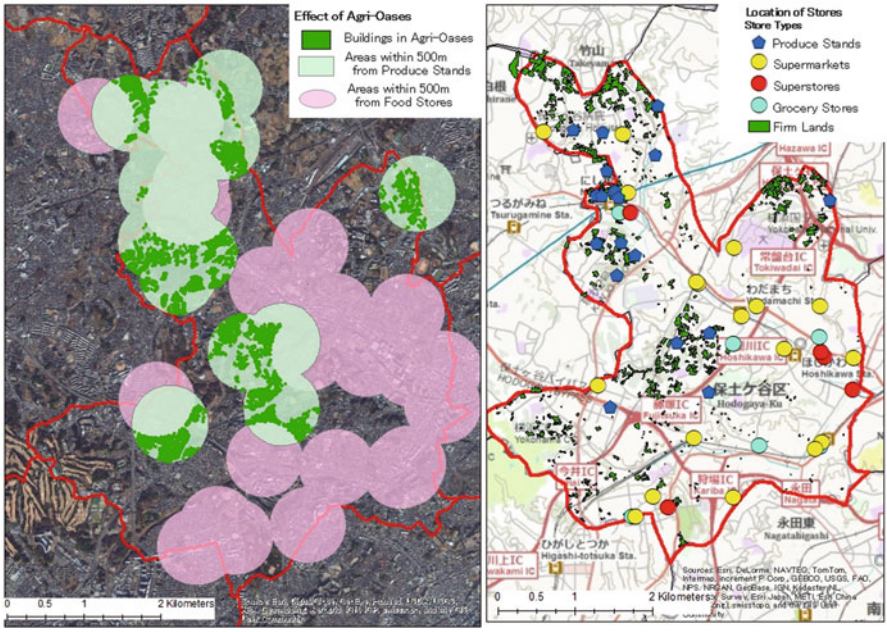

Fig. 18.5 Urban agriculture and the effect of agri-oases

Similar to the method above, we drew the buffers of each produce stand in the GIS database to measure the residents' access based on a walking distance of 500 meters. We then compared the food desert map (Fig. 18.3) with the produce stand location map (Fig. 18.5) to estimate how many people in the food desert had easy access to fresh food from produce stands. As a result of this calculation, the number of residents within those buffers was 25,355, as shown in Fig. 18.5, including roughly 5,500 people aged 65 years and over. This means that approximately 25,000 people, 5,500 of them elderly, can alleviate their limited access to fresh food using a nearby agricultural outlet. This is equal to 32.3 % of the population living in areas identified as food deserts. Of course, produce stands are a type of small food retailer that provide mainly vegetables and fruits, and residents cannot purchase daily necessities there. Nevertheless, they can at least obtain fresh, nutritious foods at neighborhood produce stands. Therefore, urban agriculture can be effective against food deserts: urban agriculture is referred to as an "agri-oasis" against a food desert. Although we did not represent other urban agriculture facilities on the map, some farmers deliver fresh vegetables directly to consumers' homes via mobile agricultural product vending, and there are more produce stands than are plotted on the map.

This function of urban agriculture is indeed effective, in that according to local farmers, many old people with no car come to the produce stands to obtain fresh, tasty vegetables. However, most of the farmers we interviewed did not establish

produce stands to alleviate urban residents' limited access. Farmers have been using produce stands to supply fresh, high-quality products to urban consumers, and some farmers maintain that their products are desirable because of their quality or palatability, not only because they are close to consumers; in fact, regular customers appreciate the quality of the products and purchase them regularly. On the one hand, existing produce stands providing high-quality fresh food are one effect of the agri-oasis on food deserts. On the other hand, the more agricultural products are purchased by local people at produce stands, the more income local farmers earn; otherwise, most farmers would decide to stop providing their crops at produce stands, and the agri-oasis would soon disappear. Thus, we can say that both residents in food deserts and urban farmers receive mutual benefit from the produce stands.

18.8 Conclusion

This paper attempted to confirm that food deserts exist even in large cities by using a GIS survey and a field survey. We estimated that approximately 78,000 people, including 17,000 elderly people, have poor access to fresh food in their neighborhoods. This result seems all the more serious because large cities are regarded as prosperous and convenient for society in general. In Japan, income disparity, race/ethnicity, and the quality of available foods are less serious, but the aging of the population is a more serious problem than it is in other developed countries. Thus, proximity to stores and topographic disadvantage can be key food desert elements for older residents. Although these elements may be overcome by using taxis or delivery services, the economic burden would be heavy for daily shopping.

This paper also verified whether urban agriculture has the potential to help resolve food deserts. According to the estimate, 32 % of the residents in areas identified as food deserts would be benefitted by access to fresh food from local produce stands. By creating these agri-oases, urban agriculture would help urban people have easy access to a fresh and healthy diet and such oases are a good solution to the problem of limited access to fresh food. This effect of agri-oases is part of the multifunctionality of agriculture.

Even though people in urban areas appear not to have difficulty obtaining food, they actually tend to lack access to fresh, healthy foods. Therefore, even in developed countries, we must attempt to secure the right to food for everyone and to improve community food security. On this occasion, we paid attention to urban agriculture; future studies would need to scrutinize more closely the effects of agri-oases, in theory and in practice.

Acknowledgment This work was supported by JSPS KAKENHI, Grant Number 25850159.

References

City Planning Institute of Japan. (Ed.) (2011). Special issue: Can the food desert problem be solved?. *City Planning Review*, *60*(6), 4–59.

Clarke, G., Eyre, H., & Guy, C. (2002). Deriving indicators of access to food retail provision in British cities: Studies of Cardiff, Leeds and Bradford. *Urban Studies, 39*(11), 2041–2060.

Cummins, S., & Macintyre, S. (2002). 'Food deserts' – Evidence and assumption in health policy making. *British Marketing Journal, 325*(7361), 436–438.

Furey, S., Strugnell, C., & McIlveen, H. (2001). An investigation of the potential existence of 'food deserts' in rural and urban areas of Northern Ireland. *Agriculture and Human Values, 18*(4), 447–457.

Gordon, C., Purciel-Hill, M., Ghai, N. R., Kaufman, L., Graham, R., & Van Wyea, G. (2011). Measuring food deserts in New York City's low-income neighborhoods. *Health & Place, 17*, 696–700.

Hodogaya-ward. (2012). The Hodogaya satisfaction survey in 2012.

Iwama, N. (2010). What's a food desert problem? *Geography, 55*(8), 6–14.

Iwama, N. (Ed.). (2011). *Food deserts: The product of indifferent societies*. Tokyo: Association of Agriculture & Forestry Statistics.

Kristian, L., & Gilliland, J. (2008). Mapping the evolution of 'food deserts' in a Canadian city: Supermarket accessibility in London, Ontario, 1961–2005. *International Journal of Health Geographics, 7*(16), 1–16.

Ministry of Economy, Trade and Industry of Japan. (2010). *Report by the study group on the role of distribution systems in community infrastructure: Distribution systems in the context of local communities*. Tokyo: Ministry of Economy, Trade and Industry of Japan.

Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries of Japan. (2012). *The reality and countermeasures for food access problem*. Tokyo: Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries of Japan.

Sugita, S. (2008). *Shopping refugee*. Tokyo: Otsuki Shoten Publishers.

United Nations. (1999). *Substantive issues in the implementation of the international covenant on economic, social and cultural rights: General comment 12 the right to adequate food (art.11)*, Economic and Social Council (E/C.12/1999/5)

United States Department of Agriculture. (2009). *Access to affordable and nutritious food: Measuring and understanding food deserts and their consequences*. Washington, DC: Economic Research Service.

Walker, R.E. (2009). *Food desert versus food oasis: An exploration of residents' perceptions of factors influencing food buying practices*. A dissertation submitted to the Graduate Faculty of the Graduate School of Public Health, University of Pittsburgh.

Wrigley, N. (2002). 'Food deserts' in British cities: Policy context and research priorities. *Urban Studies, 39*(11), 2029–2040.

Yakushiji, T., & Takahashi, K. (2012). Estimation of population classified by distance to the nearest fresh food store: Using grid-square statistics of population census and census of commerce. *Theory and Applications of GIS, 20*(1), 31–37.

Chapter 19
Choosing our Food Futures Through Participation? A Critique of 'Scenario Workshops' in Lofoten

Anne Blanchard

Abstract With a growing population, climate change and competition for space, the global food system is facing important transformative challenges. These pressures on our global food system demand that we pursue profound transformation, in order to feed a growing population with a limited space. But how should these transformations be undertaken and towards which 'food futures'? Over the past 50 years, we have relied on science to define our food futures. However, this paper argues that in order to choose our food futures, we should consider going beyond the current science-based politics of food and also include other relevant sources of knowledge (such as local and traditional forms of knowledge) through participatory mechanisms. But participation is not a panacea and needs to be used with caution. Some critiques of participation argue that it is not critical enough. Others emphasise that participation may actually constitute a means to reinforce power structures that are already in place. It is therefore important to continuously and critically challenge the purposes and methods of participation. This paper attempts such reflection on a specific participatory method called 'scenario workshops'. Within the framework of a research project funded by the Norwegian Research Council, we ran a scenario workshop during fieldwork in June 2013 in Norway, on the topic of opening petroleum areas in the wild, pristine and fishery-rich area of Lofoten (northern Norway). This paper applies five key critiques of participation in analysing the performance of the Lofoten scenario workshop, including the opportunities and challenges that became apparent.

Keywords Scenario workshops • Participation • Values • Food futures

A. Blanchard (✉)
Centre for the Study of the Sciences and the Humanities, University of Bergen, Allegaten, 34, Postboks 7805, 5020 Bergen, Norway
e-mail: anne.blanchard@svt.uib.no

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_19

19.1 Introduction: Uncertain Futures and Emerging Pressures – An Incentive to Rethink Our Global Food Systems

With a growing population, climate change and competition for space, the global food system is facing important transformative challenges. First, according to the most recent revision of the United Nations Population Fund, the world population of 7.2 billion today is projected, with an average fertility rate, to reach 10.9 billion by 2100 (UNFPA 2013). The second pressure, that of climate change, is predicted by the latest IPCC report to impact significantly on food systems around the world. These impacts include elevated CO_2 concentrations in the atmosphere, altered temperatures and precipitation, increased frequency of extreme event, as well as modified pest and pathogen pressure on crops and plants (IPCC 2007a). In particular, increases in extreme precipitation events are very likely in the major agricultural areas of Southern and Eastern Asia (IPCC 2007b). In addition to a growing population and impacts of climate change, a third pressure on food systems is the competition for space. Areas dedicated for agriculture are anticipated to be reduced by, among other things, an increase of areas for habitation, potential impacts of sea-level rise and desertification or competing sectors such as petroleum activity (through oil drilling or fracking) or agro-energy and biofuels. In particular, recent studies (see, e.g. Rathmann et al. 2010) argue that the emergence of biofuels is drastically changing the way land is used, with large areas traditionally allocated to food production now being set aside for biofuels.

Because of these pressures on our global food system, we are challenged to rethink the way we produce and consume food, and we are invited to embark on a profound transformation to feed a growing population with a limited space. But how should we transform our 'food futures'? Through a science-based politics of food or through participatory means with attention to values? And towards which '*food futures*' should we head? A future arguing for food security? A future prioritising food safety? Or a future optimally reconciling both?

19.2 From Science-Based to Participatory Designs of Food Futures?

Over the past 50 years, we have been relying on science to provide an answer to these complex questions and define our food futures. A key example is the Green Revolution that had a global influence last century, especially in greater Asia. However, the Green Revolution, based on principles of industrial agriculture and progresses in science and technology, has been denounced by a number of scholars for having 'led to reduced genetic diversity, […] soil erosion, water shortages, […] rural impoverishment and […] tensions and conflicts' (Shiva 1991, pp. 57). This science-based approach to agriculture has also been criticised for having

marginalised 'traditional' relationships between communities, nature and their food and the knowledge systems that underlie them.

This paper asserts that, in order to choose our food futures, we should consider going beyond the current science-based politics of food, supported by scientific models and relying on technology. It can be argued that as there are as many perceptions and experiences of food as individuals, choosing sustainable food futures should involve participatory processes, nurturing a reflection about how our values are embedded in our food and agriculture. There are at least three reasons for arguing for participation in choosing our food futures (Fiorino 1990):

1. *Normatively*, it gives effect to principles of (deliberative) democracy. This is justified by ethical claims for fairness and justice, according to which people who are directly concerned by food safety and/or security should be involved in the design of their food futures.
2. *Substantively*, it recognises the legitimacy of multiple knowledge systems, which together offer a more comprehensive understanding of the complex issues of food security and food safety. Indeed, expert assessments and top-down policies often neglect important uncertainties and complexities that typically arise when processes and technologies are embedded in a sociocultural reality.
3. *Instrumentally*, it lends more credibility and legitimacy to political decisions as they include other forms of knowledge alongside science. Indeed, the design of our food futures and their underlying practices and institutions is influenced by many different factors, and only few of them are scientific or technological. Including consideration for identity, traditions or values would strengthen the legitimacy of the decision-making process.

In sum, involving local and traditional forms of knowledge in designing food futures allows the decision process to be more democratic, better informed and more widely accepted. Nevertheless, participation for designing our food futures is not a simple journey.

19.3 Five Key Critiques of Participation

Normative ideals of public participation have increasingly found their way into decision-making processes around many sustainability issues, as illustrated by the recent Rio+20 outcome document 'The Future We Want' (2012, p. 2): 'We recognise that people's opportunities to influence their lives and future, participate in decision making and voice their concerns are fundamental for sustainable development'. Participation is today seen as a response to the shortcomings of top-down techno-scientific approaches to complex problems, by including the experiences, knowledge and values of those who previously had a limited voice and influence in decision-making processes. On a more critical note, we can argue that participation today has become a 'buzzword' in development policies, bringing with it the promise of a better future: 'Harnessed in the service of 'poverty reduction' and decorated

with the clamours of 'civil society' and 'the voices of the poor', [participation] speak[s] of an agenda for transformation' (Cornwall and Brock 2005, p. 1043).

However, participation is not a panacea and needs to be used with caution. Therefore, while this paper argues for participation when choosing our food futures, we present here five key critiques of participation, which will allow us to employ participatory mechanisms in a more careful, reflexive and informed way.

19.3.1 Participation Is Not Critical Enough

One main critique of participation argues that it is not critical enough. Many participatory methods used in social sciences are presented as 'reflexive', 'flexible' and 'context-sensitive'. However, this continual self-appraisal of the methods against their own set of criteria does not represent a critique of participatory methods in themselves and can be argued to elude more profound reflection on the actual *purposes* and *means* of participation (Cooke and Kothari 2002).

One such reflection could be on what causes 'stakeholder fatigue'. Often, the researcher has a greater interest in running a participatory exercise than the participants themselves. This can lead to a lack of critical reflection on the *purposes* of the participatory mechanism. The researcher need ask herself: Is the participatory exercise adapted to the issue? Whose interests is the exercise serving? Will the outputs support an upcoming decision-making process? Who (which institution, discipline, etc.) is waiting upon the results? Researchers organising participatory activities should engage in such critical reflections to ensure that participation is justified and adapted to the issue at hand.

19.3.2 Participation Reinforces Existing Power Structures

A second tier of critique argues that participation may actually constitute a means to reinforce power structures that are already in place. First, at the community level, group dynamics during participation exercises may reinforce the interests of the already powerful groups of a community (Cooke and Kothari 2002). Second, at the policy level, participation today is invoked to lend legitimacy to development policies. When these policies note that they are derived from participation, they are arguably (too) quickly accepted as right and fair. However, according to Cornwall and Brock (2005), this may be dangerous, as it leaves no space for questioning and criticising the entrenched ideas and practices of the development industry. In addition, since development policies often allow for interpretation on how they should be implemented, participation can be argued to be a tool to improve the effectiveness of these policies, rather than empower actors against top-down policies.

19.3.3 Participation as 'Scientisation' of Local Knowledge

Third, it can be argued that attention to local and traditional knowledge through participation does not always correspond to empowerment. On the contrary, local and traditional knowledge is at risk of being 'cleaned up', 'scientised', 'catalogued' and incorporated into models of natural or social sciences (Gadgil et al. 2000; Mosse 2002). In this case, it loses its intrinsic value and integrity. Rather than forcing local and traditional knowledge into already-existing scientific frameworks, it would be interesting to explore ways they could *coexist*.

19.3.4 Not All Knowledge Claims Are of Equal Quality

Even though knowledge diversity is substantively very valuable, we must recognise that some knowledge claims are of lesser quality than others. While a fisheries scientist may, for instance, have a significant overview of global fish stocks, a local fisherman may have better knowledge of the local fishery; the relative quality of their knowledge perspective is contingent on the issue at hand. While both perspectives are legitimate, the quality of their contribution is variable. In participatory processes, the *quality* of the knowledge or evidence drawn on is crucial, and participants are charged with acting in a peer review role, appraising the quality of the evidence used by their fellow participants. This can extend to agreeing on a set of key criteria to evaluate the quality and legitimacy of different knowledge claims. These criteria ensure the salience, credibility or legitimacy of the knowledge claims relative to the issue and can include criteria of 'robust science' alongside other norms associated with local knowledge (see, e.g. the work on 'post-normal science' of Funtowicz and Ravetz 1993).

19.3.5 Individual Citizens Will Not Always Promote the Public Good

Similarly, participatory activities often work on the assumption that the involved participants know both what is best for them and, by extension, what optimally promotes the public good. However, NIMBY (Not In My Backyard) arguments are often used, where citizens refuse a development that would have negative externalities on their living area but a positive effect on the wider community or society. We can therefore wonder to what extent citizens can go beyond their particular interests and preferences to design sustainable food futures. Participation is thus not suited to all issues, and it is important to keep in mind that it *in no ways* replaces the democratic decision-making process undertaken by competent authorities or elected bodies (Sørensen and Torfing 2003).

In sum, it is crucial to remember that participation is not an end in itself, and its instrumental and substantive character should always be made transparent. It is important to continuously, critically challenge the purposes and methods of participation, and the paper attempts just such a reflection on a specific participatory method: 'scenario workshops'.

19.4 Challenges and Opportunities of 'Scenario Workshops': An Example from Norway

19.4.1 Context of Our Scenario Workshop: Lofoten, Norway

Lofoten (see Fig. 19.1) is the scene of a contentious political debate, with key resources competing for very limited space. First, there are *economically and culturally important fisheries*, as Lofoten is an important spawning ground and nursery for numerous fish species, including cod, herring and haddock. In addition to their economic value, these fisheries, active since the Viking Ages, are part of Lofoten's identity and constitute hundreds of years of tradition and culture. Second, Lofoten boasts *unspoilt landscapes* internationally recognised by UNESCO. Lofoten hosts migratory seabirds, more than 20 species of marine mammals (such as whales and dolphins), and the world's largest cold-water coral reef. This natural diversity

Fig. 19.1 Lofoten's archipelago in northern Norway (Map from Wikimedia Commons)

supports a lucrative tourism sector. Third, exploratory drillings in Lofoten have indicated the presence of *petroleum reservoirs* amounting to 1,300 billion barrels of oil equivalent.

Due to its ecological and cultural value, Lofoten has not yet been opened to petroleum production. However, petroleum activity in this area brings the prospect of socioeconomic development, with new infrastructure and the creation of employment opportunities. Therefore, the opening of Lofoten to petroleum activity is on the political agenda for many decision-makers in Norway.

19.4.2 Description of Our Scenario Workshop in Lofoten

This issue of potential petroleum developments in Lofoten is timely and contentious, and local citizens are directly affected by the implemented policies. For these reasons, it seemed that the Lofoten issue was adapted to the participatory method of 'scenario workshops'. This participatory method for designing futures, and food futures in particular, was developed in the 1990s and used to more actively engage citizens in problems or challenges that concerned their everyday life (such as pollution, new technologies and sustainable food production and consumption) (Fixdal 1998). The objective of these scenario workshops is also to encourage citizens to make their preferences and values explicit regarding possible futures.

In scenario workshops, participants are presented with a set of three or four qualitative scenarios, describing alternative futures with respect to some issue. It is important to mention that the scenarios do not seek to be the most realistic possible. They are heuristic tools, designed to structure discussions and help people reveal their values and imagine their preferred futures. During our scenario workshop, we used three scenarios describing alternative futures with respect to the Lofoten issue: (1) the first scenario pictured a future in which petroleum production and its economic benefits are the priorities over the potential environmental harm (e.g. due to an oil spill); (2) the second scenario represented a future where petroleum activity is authorised in Lofoten but under the condition that it is highly regulated and based on the best scientific studies only, thus leaving cultural, identity and traditional aspects somewhat on the side; and (3) the third scenario described a future that puts the absolute priority on preserving and protecting Lofoten's natural and cultural heritage, thus protecting the fisheries and the wild landscapes of Lofoten but with no economic growth from the petroleum activity.

After having presented the three scenarios to the participants, they gathered in three groups to discuss what they feared and valued in each scenario. At the end, all participants gathered together and each group presented their thoughts about each scenario. The participants proposed *an alternative scenario for Lofoten*, *based on a sustainable economic development through renewable energies* (*such as tidal power plants or wave energy*) *rather than oil*, allowing thus to preserve their nature and fisheries, which are the key pillars of their identity and cultural heritage. This proposed scenario and the outputs of the workshop have been communicated to

decision-makers through a report and a short film, recording the key messages from the participants.

Our workshop took place in Svolvær, a town of about 4,000 inhabitants in the centre of Lofoten. The workshop lasted for a day and a half, from Friday midday to Saturday afternoon, in June 2013. We had ten participants, across a variety of age categories (from about 17 to 70 years old), a moderately acceptable gender balance (three women for seven men) and a variety of professional backgrounds, including teachers, high-school students, an employee from the tourism sector, priests, local politicians, a member of a local environmental NGO and a retiree. All the participants were local citizens from Lofoten and interested or engaged in the issue of petroleum development in their region.

19.4.3 Challenges of Scenario Workshops

This workshop revealed three key challenges linked to the five key critiques of participation: (1) *a stakeholder fatigue*, *impacting on the representativeness and quality of the results*, (2) *a simplification of the* '*technical*' *aspects of the issue and* (3) *the difficulty to reconcile local values with political agendas*.

First, while trying to recruit participants for our scenario workshop, we faced a case of 'stakeholder fatigue' (see Sect. 19.3.1). We sent a total of 61 invitations by email (and phone when needed), with only seven participants responding positively. Until the very last moment, we were concerned about the low level of participation. Fortunately, once in Lofoten, we were able to directly invite three further participants from the Svolvær community. We also contacted the local newspaper 'Lofotposten' to publish an announcement of our workshop, but without success. We analyse this low number of participants as due to a feeling of resignation and irritation among Lofoten citizens: even though the topic of petroleum development in Lofoten is largely covered by the media, citizens have the feeling of not being heard by their government. Among those who we sent invitations to, some may have thought that it was another attempt to give a voice to the locals, without real political impacts. For this reason, we really focussed our attention on communicating the results of our workshops to decision-makers, both through a report and through short films, to add more immediacy and concreteness to the messages. Despite our efforts, this 'stakeholder fatigue' made our outputs less representative of the diversity of opinions in Lofoten. In particular, the strong pro-oil voices were not represented, and we ended up with a group that was mostly against oil. This may be an important weakness when trying to legitimise these outputs to decision-makers. Nevertheless, we can argue that the size of the group allowed for in depth discussions.

The second challenge of our scenario workshop was a simplification of the 'technical' aspects of petroleum developments in Lofoten (see Sect. 19.3.4). By having a workshop only comprising local citizens, without scientists or experts present, this resulted in important simplifications in the technicalities of petroleum activities and

their potential impacts. The participants had a general overview of the potential impacts (such as a harm to the fish stocks, marine mammals and seabirds), but they had no precise ideas on the mechanisms linking these causes and effects. In addition, they only had broad ideas about the petroleum infrastructure. This at times led to discussions that were grounded only on suppositions and hypotheses and would have benefitted from more knowledgeable input to inform the debates. This shows two things: first, that an effort should be made to better inform the general public on the technicalities of the issue (even though the debate should not only be limited to these), and second, that expert knowledge and local knowledge are complementary. Both knowledge sources focus on different aspects that should all be taken into account in the decision-making processes.

The third challenge of our scenario workshop is that local and national interests and agendas can often be diverging and difficult to reconcile (see Sects. 19.3.2 and 19.3.5). For instance, while the participants in our workshop put forward the importance to preserve their cultural heritage and their fisheries, decision-makers have in political debates prioritised the national interest of Norway, which would benefit from the economic outputs of petroleum development in Lofoten. Even though it is important to make these local interests and priorities explicit, scenario workshops are not a guarantee that participants' messages will be taken into account and followed up by decision-makers.

19.4.4 Opportunities of Scenario Workshops

Despite the challenges, our scenario workshop had two very meaningful advantages that relate to the substantive, normative and instrumental values of participation (see Sect. 19.2). Indeed, the workshop allowed us to (1) *access nonmonetary dimensions that citizens value and* (2) *go beyond* '*risk*' *and address uncertainties in a more transparent way*.

First, our scenario workshop contributed to extend the public debate to aspects that are rarely addressed in the media or in decision-making processes around the Lofoten issue: identity, tradition, cultural heritage, harmony, global responsibility and sustainability. Hitherto, political decisions are mainly taken on the basis of expert assessments, which focus on the scientific, technical and economic aspects of the Lofoten issue. However, by giving a voice to local citizens in Lofoten, we could access nonmonetary and incalculable dimensions that are at least as important as the scientific and economic aspects. In addition, taking citizens' values and preferences into account may allow for more sustainable and legitimate policies, as they are supported by a wider range of actors.

The second advantage of our scenario workshop was that it allowed a more transparent discussion of the uncertainties around the issue of petroleum developments in Lofoten. Indeed, there are many uncertainties around this issue, especially on the potential impacts and harm to the marine environment. These uncertainties are, in expert assessments that support political decisions, often reduced to risks.

For instance, let us consider a worst-case scenario oil spill in Lofoten. According to current calculations (OED 2012), the probability of an oil spill occurring is 2×10^{-4} or, in other terms, once every 5,000 years. This is of course a very low probability, which discredits the importance of the potentially irreversible damages. Local citizens add a different dimension to uncertainty. Instead of considering the probability as very low, they rather focus on the potential harm to their region and consider this risk as unacceptable, as it might irreversibly damage their local identity and threaten thousands of years of culture and tradition related to their fisheries. We argue that, to take sustainable political decisions, attention must be given to both expert assessments and local citizens' values and risk perceptions.

19.5 Conclusion

To sum up, participation for deciding upon our futures, and food futures in particular, brings numerous opportunities, including the achievement of a greater understanding of the issue and a broader acceptance of policies that are both 'top-down' and 'bottom-up'. However, participatory methods, such as scenario workshops, should be accompanied by reflexive thinking on the very purposes and means of participation.

References

Cooke, B., & Kothari, U. (2002). The case for participation as tyranny. In B. Cooke & U. Kothari (Eds.), *Participation: The new tyranny?* (pp. 1–15). London: Zed Books Ltd.

Cornwall, A., & Brock, K. (2005). What do buzzwords do for development policy? A critical look at 'participation', 'empowerment' and 'poverty reduction'. *Third World Quarterly, 26*(7), 1043–1060.

Fiorino, D. J. (1990). Citizen participation and environmental risk: A survey of institutional mechanisms. *Science, Technology and Human Values, 15*(2), 226–243.

Fixdal, J. (1998). *Public participation in technology assessment: An analysis with focus on three European models for public participation and their contributions to a well-informed and democratic governance of technology*. Oslo: University of Oslo.

Funtowicz, S., & Ravetz, J. (1993). Science for the post-normal age. *Futures, 25*(7), 739–755.

Gadgil, M., Seshagiri Rao, P. R., Utkarsh, G., Pramod, P., & Chhatre, A. (2000). New meanings for old knowledge: The people's biodiversity registers programme. *Ecological Applications, 10*(5), 1307–1317.

IPCC. (2007a). *Contribution of Working Group II to the fourth assessment report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.

IPCC. (2007b). *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.

Mosse, D. (2002). 'People's knowledge', participation and patronage: Operations and representations in rural development. In B. Cooke & U. Kothari (Eds.), *Participation: The new tyranny?* (pp. 16–35). London: Zed Books Ltd.

OED. (2012). *Knowledge acquisition about the impact of petroleum operations in the northeastern Norwegian Sea*. Ministry of Petroleum and Energy [OED: Olje- og Energidepartementet].

Rathmann, R., Szklo, A., & Schaeffer, R. (2010). Land use competition for production of food and liquid biofuels: An analysis of the arguments in the current debate. *Renewable Energy, 25*, 14–22.

Shiva, V. (1991). The green revolution in the Punjab. *The Ecologist, 21*(2), 57–60.

Sørensen, E., & Torfing, J. (2003). Network politics, political capital and democracy. *International Journal of Public Administration, 26*(6), 609–634.

UN. (2012). *The future we want: Outcome document adopted at the Rio+20 conference on sustainable development*. Rio de Janeiro: United Nations.

UNFPA. (2013). *World population prospects: The 2012 revision – Key findings and advance tables* (No. ESA/P/WP.227). New York: United Nations Population Fund, Department of Economic and Social Affairs, Population Division.

Chapter 20
What Are the Moral Codes for Seed-Saving? From the Interviews with the Practitioners in Japan

Aki Imaizumi and Motoki Akitsu

Abstract The aim of this study is to provide an overview of the moral codes which help farmers to continue seed-saving. We collected qualitative data from fieldwork and analysed the cases considered to be representative for four incentives with respect to seed-saving. We examined that the justification of seed-saving varies and is related to two factors, viz., the characteristics of the learning process of the skills to save seed and (in)tolerant attitudes to crossing varieties. Furthermore, the sense of a plant/nature shared amongst the practitioners is based on their attachment to the plants as an animate life form despite of their justification.

Keywords Seed-saving • Japanese agriculture • Agricultural ethics • Agro-biodiversity

20.1 Introduction

The purpose of this study is to elucidate the moral codes for seed-saving, which is a key for its perseverance. Developing agro-biodiversity at the gene level is one of the crucial results of farmers' seed-saving on farm, but enduring seed-saving is not common practice anymore, especially in agriculture in the Global North. However, in Japan, some farmers and hobby gardeners have continued seed-saving and sometimes exchange seed amongst one another or through a network supported by local governments, agricultural extension centres and NGOs (Nishikawa 2005; Imaizumi 2011; Tomiyoshi 2011; Imaizumi and Hisano 2013). Some practitioners claim that their seed-saving should be understood as a manner to hand down their culture to

A. Imaizumi, Ph.D. (✉)
Independent Scholar, Amsterdam, The Netherlands
e-mail: imaizumi_aki@yahoo.co.jp; akiimaizumi@gmail.com

M. Akitsu
Graduate School of Agriculture, Department of Natural Resource Economics, Kyoto University, Kitashirakawa Oiwake-cho, Sakyo-ku, Kyoto 606-8502, Japan

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_20

the next generations or share the culture of seed preservation amongst the people in their society. Previous studies have identified these claims as being the most important incentive for seed-saving. According to Nazarea (2005), a memory of the selection of varieties is important for the conservation of agro-biodiversity as a *biocultural* diversity, that is to say, a relationship between biological and cultural biodiversity. Almekinders and Louwaars (1999) have also mentioned that farmers' practices and knowledge for handling seed are considered to be the fourth constitutive element of agro-biodiversity, after "farming system/agroecosystem diversity; crop, animal and other species diversity; and varietal and other genetic diversity" since different agroecosystems are instituted by different societies and cultures.

The former studies, however, have insufficiently highlighted that despite the following difficulties, people in Japan have not given up on the practice of seed-saving. In order to gain better insight into their incentives for doing so, we have conducted fieldwork and discussed their moral code. The first difficulty is the fact that seed-saving requires skills on how to cultivate crops and knowledge about crops. Further, farmlands do not generally generate suitable conditions for seed production and storage. In fact, it has been claimed that such social issues in farm villages as the ageing of farmers foster the extinction of traditional knowledge regarding plant genetic resources (Andersen and Winge 2008). The second difficulty is that the quality of seed affects agricultural productivity and farm management. With regard to this, seed production is considered to be a profession in its own right, and it is considered to be more pragmatic to purchase seed on the market, particularly for farmers in modern agricultural systems or for people with gardening as their hobby. Nevertheless, some people have prolonged to keep saving seed on farm or in a home garden, even in countries in the Global North, and these networking activities are still expanding globally.

20.2 Methodology

From the former studies relevant to the practice in Japan, farmers' motifs for seed-saving can be categorised into four groups:

Category 1. *Self-consumption*

People explain seed-saving to be a way to get their favourite taste of vegetables and other crops.

Category 2. *Succession*

People state that they have to conserve seed from generation to generation, following the path set by their ancestors.

Category 3. *Conservation of local/traditional varieties*

People aim to keep growing and stimulate others to get interested in the old/traditional varieties since these varieties are believed to be a heritage of a local area and culture.

Category 4. *Demonstration against capitalism*

People practise seed-saving to express their political positions or to live in alternative ways from dominant political trends.

We conducted semi-structured interviews with eight respondents including representatives of NGO and farmers' groups in the periods from September to November in 2009 and in July and August 2013 to assess the reasons for the practitioners to save seed, and then a representative case of each category was chosen.

20.3 Analysis of Cases

The four cases are representative for their particular category and analysed to discuss moral codes undergirding seed-saving. The cases are summarised in Table 20.1 at the end of this section; the qualitative data are analysed with the three points which are reasons for seed-saving, the skills of saving seed and thoughts on cultivation.

20.3.1 Case 1 [An Example of Category 1]

The woman, 83 years old, has grown vegetables and other crops in her garden for her and her family to eat, but used to sell them to the market.

20.3.1.1 Reasons for Seed-Saving

She practised seed-saving since it is necessary for keeping a daily life. For this reason, it is included in a farmer's ordinary work procedures. Saving seed is regarded as beneficial to her; she can sow it whenever she wants to. She also explains that her seed-saving is rational economically because by saving seed, she cuts on expenses. At the same time she does not hesitate to buy seed of plants which she cannot save technically and sometimes exchanges seed with her neighbours. She concludes that it is the life in a farm village. She, however, claims her thoughts on seed are not understood by the younger generations anymore because they think seed is something to buy. For instance, she always leaves some potatoes for the next planting, while the young eat all of them and buy seed potatoes.

20.3.1.2 Skills of Saving Seed

She says, "A person who was born a farmer learns everything on farm naturally". It means that she had known how to save seed from watching her parents' work even though she did not join them since she had no interest in the work. She began to save

Table 20.1 The summary of the cases

	Attributes of interviewees		Conditions of farm management				Seed-saving	
Case	Age	Sex	Scale (ha)	Style	Purpose	Crops	Careers (years)	Varieties (number)
1	83	F	0.15	Home garden*	Self-subsistence	Vegetables, potatoes and flowers	>60	>19
2	60s	M	0.8	Family farm	Commercial	Vegetables of the traditional/ conventional varieties	>40	>5
3	69	F	0.5 (totally 5.0 in the group)	A producer group with 11 members	Commercial	Matsusaka-Akana (a local variety of red radish)	>13	1
4	65	M	5.0	Family farm under organic faming	Commercial	Vegetables, potatoes, beans, wheat and rice	>17	>126

* means a field used to be cultivated for a commercial shipping

seed after her marriage in consonance with her parents-in-law's wishes. Since her husband worked for the municipality office, she had to work with the other family members on the farm. She acquired concrete skills of seed-saving from them on the spot.

For seed-saving, she appears not to care for crossing varieties so much. For example, she gives one name in the list of seed saved on her farm, but the name does not mention any specific variety nor her originality in its cultivation. Besides, she says the green leaf had been crossed with other varieties.

20.3.1.3 Thoughts on Cultivation

When she grows crops, she feels like she is raising children. She says, "Raising children and taking care of vegetables are very similar to each other. If I took care of the vegetables too much, they would be spoiled". Furthermore, since she thinks wasting farmland is not good, she cultivates voluntary on her neighbour's farm.

20.3.2 Case 2 [Category 2]

The farmer is the 14th generation of his family farm lasting for more than 400 years in Kyoto City and is known as a producer of *Kyo-yasai*, a traditional vegetable in Kyoto. He is also responsible for saving seed of the traditional variety of pumpkin on the conservation programme of traditional vegetable varieties by the municipality office.

20.3.2.1 Reasons for Seed-Saving

He understands his saved seed as heirloom or assets in his family and thus sees it as his duty to pass the varieties down to the next generation as assets of his family. With this in mind, he continues to produce vegetables in the same manner and taste that he has taken after his father. Therefore it is considered one of the essential works to save seed from his vegetables on the soil which have been cultivated by his family.

20.3.2.2 Skills of Saving Seed

His seed-saving is designed to reduce the risk of loss or degeneration of the seed by crossing or bad quality of seed. For instance, only the farmland behind his house is used for seed-saving to enable him to intensively work in the season of seed-saving. The other method is that three times the amount of seed he needs in a season is harvested at once, and a third of it is sowed and two thirds is stored. Only if he could grow vegetables which were like the ones last season would the seed be saved by

them in this season. Otherwise, he would use half the amount of the stored seed. His care of seed is also seen in the way in which he introduces new varieties. For example, he says that he would not save seed from the new variety of green onion in order to prevent its family variety from crossing with the new one.

As above, saving seed is one of the skills in his production of vegetables. He learned it through his daily work on the farm. He says, "saving-seed is not like a theory to be taught but something to learn by working with my parents since my childhood".

20.3.2.3 Thoughts on Cultivation

His works on producing vegetables and seed-saving appear not to be influenced by his own taste since he recognises himself as a successor of the cultivation of the heirloom seed and techniques for planting. For example, the yellow tomato is saved continually though he does not eat it himself due to the bad taste, only because he has received it from his family.

Despite his careful work, there are some lost varieties and he feels sorry for his ancestors that he failed to take care after them. He says, "I apologize about the lost seed to my ancestors when I visit to my ancestors' grave".

20.3.3 Case 3 [Category 3]

The interviewee is a leader of a farmer's group established in 2000 to produce *Matsusaka-Akana*, a local variety of radish, and there are 11 members, aged from 50s to 70s, who are working on the production of the radish and process them into Japanese pickles. In the beginning, nobody in the group knew the radish nor how to grow it. Moreover, since the production had stopped already in the area, the radish was about to be lost, and only the seed of the radish remaining was at the local agricultural research centre. The members attempted to revive it with a new name and the production has been kept within the groups.

20.3.3.1 Reasons for Seed-Saving

The interviewee gives a practical reason for seed-saving, namely, that the seed is unavailable on the seed market. In the beginning, the seed was given by the research centre to start growing the radish and then has been saved on the farm amongst the members. With ageing of the other members, seed-saving was turning into a hard work for them, and now only she is in charge to do it and her husband helps her.

20.3.3.2 Skills of Saving Seed

Her seed-saving appears to succeed after a process of trial and error, since she did not have the experience of seed-saving before. In addition, no one in the group knew the original shape or taste of the radish. They had to imagine the original traits from stories conferred by the researchers at the research centre. She used to think that seed-saving was an easy job, but now she realises it is difficult to prevent the crossing of some varieties. She says, "The green coloured one comes out from the seed harvested in the same season when I fail in seed-saving (while it originally has bright red colour of which the members are proud)".

Her concerns about crossing are expressed in other words. She says, "Akana (the name of the radish) would be judged worthless if radish with low quality was produced by people outside of the group. The case would make me sad. That is why I do not want to give the seed to others until the idea of Akana is understood well enough".

20.3.3.3 Thoughts on Cultivation

She is attached to the radish for several reasons. She is, of course, proud of the group's work to revive and make it popular. Moreover, she recognises herself as a "foster parent" of the radish. She states that she has cared for the radish as her child and loves the figure and colour. She says, "This radish, even still a little plant, is so lovely owing to a blight tiny red root". Moreover, since she believes people can use the radish in many ways (e.g. enjoying the colour by growing it in water or making salad with it), she states the radish has great potential.

She has gained another perspective on cultivation through her seed-saving, namely, that something old is worth to be preserved as long as even a small number of people believe the old is valued as good. The concern whether local varieties can remain in production in the near future, since seed companies easily stop supplying seed of the older "worse" or unpopular varieties, is debunked by her statement that breeding better is good but that there are also older varieties still having good traits. These varieties have to be preserved by somebody who knows the value. She says, "I want to save something to match my taste but I do not think the taste would be preferred by all people. For the radish I grow, I have to think about consumers' taste but it is not necessary for the vegetable to be chosen by all consumers".

20.3.4 Case 4 [Category 4]

The farmer has been following a philosophy of nonviolence and had demonstrated against Sanrizuka-toso, which was a protest in the 1970s to building the Narita International Airport in Chiba Prefecture, Japan. He started with organic farming in 1974 after he took over the farmland in the protested area from a farmer in order to

prevent it from being expropriated. He aims to "Junkan Nougyou", which means everything is circulating within the farm and believes it is a guiding idea of the nonviolence movement. The farmer hardly uses other inputs and, for example, stopped using animal manure since they came from animals fed with imported grains and corns which have been produced with chemical fertilisers and pesticides. Plastic materials are not used either to avoid pollution caused by burning them.

20.3.4.1 Reasons for Seed-Saving

Although seed-saving, initially, was for him to handle seed without chemical treatments, he gradually got the conception that ideally a farmer does everything on the farm himself. It means his concept of being a good farmer includes preserving seed-saving by nature. He states, "As far as saved seed, a farmer can be a farmer. There is no interest to buy everything we need". Two reasons appear to be behind his words. One is that being self-sufficient is valued highly. Regarding his viewpoint, a seed company produces hybrid seeds, and the users of the seeds have to buy seed every season since they cannot reproduce seed from their crops. That system makes a seed company gain profit while it lets farmers focus on crop production without caring of the seed. In spite of the understanding that organic farming varies from a subsistence farmer to an industrial with the commercial seed and plastic materials, he wants to be and stay as a self-sufficient farmer. Furthermore, he thinks seed-saving is also a part of the cycle on the farm and a natural work as a farmer.

He also tries to let his consumers know which varieties have grown with the saved seed with putting a mark of two leaves on a list delivered with his vegetables, but they hardly give comments on the mark or seed-saving.

20.3.4.2 Skills of Saving Seed

The farmer has not provided an account of his skills to save seed in detail, but he states that it would be better to move the mother plants of a seed to the suitable area for saving the seed, such as an edge of the field, but his busy work inhabits him to do so. He, however, appears not to reject crossing varieties so much while a pure line is valued in general. He says his seed is not handed to other farmers because it does not keep a pure line and is crossed with others. Instead, he has told people who desired to acquire his seed to get seed from a seed company and then save seed from it since seed is not something to be given but to be saved by the farmer himself/herself.

20.3.4.3 Thoughts on Cultivation

He appears to think that a good farmer is "to take care of all a plant's life from sowing seed to saving seed. A good farmer feels happy with the plant's growing, joys to see its flower, eats it with thank for the plant and sows seed as its offspring" (Koizumi 1995).

20.4 Discussion

From our research, these cases show that the activities undertaken, despite uniformity in action, can be incited by a plurality of reasons. In other words, these thoughts function as moral codes to help people who save seed to behave in a similar manner in taking care of crops and nature. Now, we focus on these points to assess the moral codes for seed-saving. While our argumentation regarding these points appears to be relevant to agrarian stewardship as a part of agricultural ethics, which is considered to be one of the concepts shared by farmers particularly in Christian-based societies (e.g. Thompson 1995), a key factor of the moral codes in this study is equivalent to a manner of treating a plant as a quasi-autonomous life form rather than an inanimate one. Thus, we discuss this point from two perspectives: first we study the mutual connections between the cases and, second, how the practitioners understand the relation between a plant and nature.

20.4.1 Mutual Connections Between the Cases

Three points of similarity are found as mutual connections between the cases in the results: reasons for justification of seed-saving, learning process of skills to save seed and attitudes to crossing varieties. The mutual connections are shown in a map (Fig. 20.1).

1. Justification of Seed-Saving: A Natural or Specific Work

   The reasons for seed-saving in four cases show how the interviewees recognise their seed-saving as something intrinsically good. In both cases 1 and 4, seed-saving is understood as one of the natural works of a farmer, while the reasons appear to be different from each other. In case 1, the farmer desires seed as an essential resource for her and her family's daily life, and seed-saving is based on a sort of common sense to fulfil this basic need. In contrast, the farmer in case 4 sees it as a practice undertaken by a good/an ideal farmer. To be a good farmer, saving seed is a sufficient and necessary precondition.

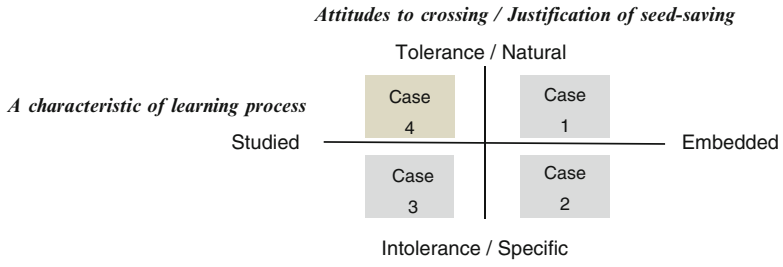

Fig. 20.1 The mutual connections between the cases

For the farmers in cases 2 and 3, however, seed-saving is the only way to continue the production of the vegetables which they would like to pass to the next generation ongoing. Thus, it is a specific work for them to complete their aims.

2. Characteristics of Learning Processes of the Skills: Embedded in a Lifestyle or Studied

   This viewpoint focuses on the way to acquire the skills of and the relevant knowledge about seed-saving characterised by being embedded in the practitioners' daily life or studied particularly for some purpose. The farmers in cases 1 and 2 are examples for the embeddedness of seed-saving and have learned and gained their skills and knowledge through their work on the farm with their family. On the other hand, the farmers in cases 3 and 4, who acquired the skill by studying, recognised seed-saving for seed production and have succeeded at seed-saving after a process of trial and error.

3. Attitudes to Crossing Varieties: Tolerance/Intolerance

   The four farmers form two groups with regard to their (in)tolerance to crossing of varieties. While the farmers in cases 1 and 4 exhibit a tolerant attitude to crossing, the farmers in 2 and 3 show low tolerance or intolerance to crossing their vegetables in order to preserve the vegetables with the particular trains.

Now we set up four phases in Fig. 20.1 to clarify relations amongst the cases. Although the vertical axis is shared by the two viewpoints, it does not always signify a causal relation between the two. For instance, understanding seed-saving as a natural work might not cause a tolerant attitude to crossing. This is an interesting result but it is still not clear what exactly influences what. The other point is that embedded skill does not always give recognition as being natural for seed-saving to the practitioners. In fact, the studied skill can be seen natural for a farmer through the practice.

20.4.2 How Do the Practitioners Understand a Plant and Nature?

We focus on the practitioners' attachments to their agricultural products as a key to understand their conception of a plant/nature. Although the farmer in case 2 has not stated the feeling in our interview but a feeling of duty of the successor, the other cases show two trends in the feelings embedded in their thoughts on cultivation. Firstly, growing plants are compared to raising children, and secondly, there is a responsibility to treat a lifetime of a plant. Both trends show that these farmers see a plant as life. In other words, they respect it as an animate life form by itself and are attached to them.

Similar characteristic of the conception of a life form is observed in a discussion about what difference of understanding of animal welfare exists between Japanese and European societies. According to Sato (2005), in Japan, an animal is understood

as a "living being" and that is stated in the Act on Welfare and Management of Animals:

> In light of the fact that animals are living beings, no person shall kill, injure, or inflict cruelty on animals without due cause, and every person shall treat animals properly by taking into account their natural habits and giving consideration to the symbiosis between humans and animals. (Article 2: Fundamental Principle)

In contrast, animals are described as sentient beings in Protocol of Welfare of Animal in the treaty of Amsterdam (Official Journal C340 1997). Sato (2005) summarises: as the result from these different viewpoints that people in Japanese society tend to be attached to animals as a life, and the others, people in European society, feel compassion to animals and want to ensure their welfare.

The point of the attachment or respect here is that the practitioners have put plants on the same horizon as human beings, since both of them are life in the same manner. That is one of the reasons why the practitioners believe that a plant is something to be treated like their children or friends.

20.5 Conclusion

This study clarified three elements that appeared to influence the moral codes for seed-saving, but they still need to be examined with other cases. One of the codes for lasting seed-saving can be relevant to the feeling of attachment based on the understanding of a plant as a life. We will discuss this with comparison to cases in other cultures later.

Acknowledgement This study is supported financially by Grants-in-Aid for Scientific Research (S) 'Risk Perception and Risk Communication, and the Establishment of Food and Agricultural Ethics/Profession' from the Japan Society for the Promotion of Science, represented by Dr. Yoko Niiyama, Professor at Graduate School of Agriculture, Kyoto University.

References

Almekinders, C., & Louwaars, N. (1999). *Farmers' seed production new approaches and practices* (pp. 62–63). London: Intermediate Technology Publications Ltd.

Andersen, R., & Winge, T. (2008). *Success stories from the realization of farmers' rights related to plant genetic resources for food and agriculture* (p. 7). Finland: The Fridtjof Nansen Institute.

Imaizumi, A. (2011). A case study of "on-farm seed saving for the next planting", GCOE International joint research. In M. Akitsu (Ed.), *What kinds of ethics support food communities?: Intimate and public relations between farmers and consumers* (pp. 28–38). Kyoto: Nakanishi Printing Co., Ltd.

Imaizumi, A., & Hisano, S. (2013). Institutionalization of genetic resource management with farmers: Case of traditional vegetables in Japan. *Journal of Agricultural Science and Technology B, 3*, 399–413.

Koizumi, H. (1995). *A story of earthworm (the original Japanese title: Mimizu monogatari)* (pp. 9–10). Tokyo: Aosorabunko.
Ministry of Justice. (1998). Act on welfare and management of animals, Act No. 105 of 1 Oct, 1973, amendment Act No. 68 of 2005, Japan.
Nazarea, V. D. (2005). *Cultural memory and biodiversity*. Tucson: The University of Arizona Press.
Nishikawa, Y. (2005). *Farmers' participatory management of crop genetic resources-from economic development to human development*. Tokyo: Rural Culture Association Japan.
Official Journal C 340, 10 November 1997, Treaty of Amsterdam amending the treaty on European Union, the Treaty Establishing the European Communities and Related Acts.
Sato, S. (2005). *Animal welfare* (pp. 1–31). Tokyo: University of Tokyo Press.
Thompson, P. B. (1995). *The spirit of the soil agricultural and environmental ethics* (pp. 72–93). Hoboken: Routledge.
Tomiyoshi, M. (2011). *NPO's activities and its issues in agricultural and rural area in Japan*. Dissertation, PhD. dissertation at Kyoto University. Japan.

Chapter 21
Management, Food Preparation, and the Ethical Dimension at the Khao Kaewsadet Education Center

Phramaha Min Putthithanasombat and John Walsh

Abstract The canon of Buddhist scripture contain many passages dealing with workplace relations through describing appropriate means of structuring the employer-employee relationship. These instructions are read with many other forms of ethical precepts concerning the ways in which interpersonal relationships should be managed. However, it is apparent that there is an onus upon managers to establish appropriate workplace conditions and relationships so as to facilitate the desired response from employees. Throughout history, the vast majority of workplace relationships have been abusive and exploitative and so it is not surprising that most employees show little if any loyalty to employers or to the organization involved. In Thailand, this has contributed to the culture of deference, based on fear, behind the traditions of the Land of Smiles. Food, in other words, is directly linked by Buddhist scripture with the proper establishment of organisational relations and the means of enabling employees to locate themselves within the hierarchy of which they are a part and, also, providing them with a means of determining their own standing and performance.

One particular occasion on which this situation has been put into practice has been in the case of the Khao Khaewsadet Education Centre (KKEC), which is a centre for practicing and promoting Buddhist meditation that draws participants from around the world. Extensive qualitative interviewing of the workforce took place as part of a more extensive programme of research aimed at uncovering the connections between contemporary management practice and the lessons of Buddhist dhamma.

Results of the study to date, which is ongoing, indicate that there is an understandable tendency for workers to stick to their home countrymen during the initial period of their stay and this, combined with a measure of mutual incomprehensibility, represents the possibility for some interpersonal conflicts. Instead, workers are integrated into the philosophical and religious environment of the place of work and, to some extent, it might be expected that most if not all of the workers involved were willing to be engaged with these religious and philosophical components or, at

P.M. Putthithanasombat (✉) • J. Walsh
School of Management, Shinawatra University, Bangkok, Thailand
e-mail: minbuddhi@gmail.com; jcwalsh@siu.ac.th

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_21

the very least, to be receptive to attempts to draw them into it. This has, in any case, been a focus for the management who have sought to use food and the occasions on which communal dining is involved to incorporate also religious elements. Such a process might combine meditation with a communal meal or short sermon might also be used. These are juxtaposed with favourite foods – papaya salad or som tum in various incarnations – which are not only enjoyable for everyone involved but also require collaboration for production. Since all the people involved are accustomed to the production of food for groups, cooperative food production represents a form of discourse which all people can share and learn from each other. The cultural norms of food production in the Mekong Region transcend national and cultural borders

Keywords Food • Management • Religion • Thailand

21.1 Introduction

Within the canon of Buddhist scripture, there are many passages dealing with workplace relations through describing appropriate means of structuring the employer-employee relationship. It has been written that employers should select the correct people for the work required to be done, should treat employees with decency, and should reward employees with holidays and, for special occasions, with feast foods. These instructions are read alongside many other forms of ethical precepts concerning the ways in which interpersonal relationships should be managed, and it is clear that there are responsibilities that each party should observe. However, it is apparent that there is an onus upon managers to establish appropriate workplace conditions and relationships so as to facilitate the desired response from employees: throughout history, the vast majority of workplace relationships have been abusive and exploitative, and so it is not surprising that most employees show little if any loyalty to employers or to the organization involved. In Thailand, this has contributed to the culture of deference, based on fear, behind the traditions of the Land of Smiles. Food, in other words, is directly linked by Buddhist scripture with the proper establishment of organizational relations and the means of enabling employees to locate themselves within the hierarchy of which they are a part and, also, providing them with a means of determining their own standing and performance. The more often employees are rewarded with food, that is, taking into account the quality of that food, the more will those employees be able to understand something about their own performance and about the moral standing of their employers. This takes place, of course, within the context of a Buddhist cosmology.

One particular occasion on which this situation has been put into practice has been in the case of the Khao Khaewsadet Education Center (KKEC), which is a center for practicing and promoting Buddhist meditation that draws participants from around the world. The KKEC is located in Prachinburi province in Thailand. Participants travel to the center for extended periods of time to study and practice

meditation techniques who require, therefore, board and lodging during their stay. Given the nature of the activities involved, it would be anticipated that the catering would tend toward the simple but healthy and wholesome and should have a degree of authenticity relating to the ingredients and methods most commonly used in the place of production. This should, of course, be balanced by the needs to provide food which is not too alien to travelers from far afield. To provide the catering, a mixed team of workers is employed on a semi-voluntary basis. The team numbers are 48 in total and 22 are from Cambodia, 19 from Laos, and the remaining 7 from Myanmar. All are men, which is a result of the presence of the KKEC within a wat. Extensive qualitative interviewing of the workforce, in a combination of English and Thai with some recourse to interpreters, took place as part of a more extensive program of research aimed at uncovering the connections between contemporary management practice and the lessons of Buddhist Dhamma. Personal interviews and focus groups were accompanied by ethnographic observation as the principal investigator was a leading manager in the organization motivated by the desire to improve workplace relations and to increase the ethical component of management techniques. This should be understood in part, therefore, as an example of action research in addition to being exploratory research. The concept of employing mixed methods and mixed epistemologies is comparatively common in management studies, in which this study is located.

Results of the study indicate that there is an understandable tendency for workers to stick to their home countrymen during the initial period of their stay, and this, combined with a measure of mutual incomprehensibility, represents the possibility for some interpersonal conflicts. This is, in itself, hardly surprising as there is a long history of interpersonal conflicts among cohorts of migrant workers, especially when they are predominantly or exclusively men. It is known that men in such situations who come from the Mekong region countries might seek to mitigate the boredom of their existence with such means as gambling, fighting, drinking alcohol, and recreational sex which are antithetical to residence within an environment such as the KKEC. Instead, workers are integrated into the philosophical and religious environment of the place of work, and, to some extent, it might be expected that most if not all of the workers involved were willing to be engaged with these religious and philosophical components or, at the very least, to be receptive to attempts to draw them into it. This has, in any case, been a focus for the management who has sought to use food and the occasions on which communal dining is involved to incorporate also religious elements. Such a process might combine meditation with a communal meal, or a short sermon might also be used. These are juxtaposed with favorite foods – papaya salad or som tum in various incarnations – which are not only enjoyable for everyone involved but also require collaboration for production. Since all the people involved are accustomed to the production of food for groups, cooperative food production represents a form of discourse which all people can share and learn from each other, even if they have little language ability or background knowledge. The cultural norms of food production in the Mekong region transcend national and cultural borders.

Management of food production at the KKEC involves internal and external relationships as food is the principal means by which center participants are served and also the means by which employee relations are administered. From a Buddhist perspective, it would not be possible for these relationships to be managed successfully if the quality of the food itself and the means by which it has been harvested have been in any way compromised in the ethical context. Since each act has consequences for the production of merit and demerit (i.e., positive and negative karma) and those consequences are passed along the chain of cause and effect, only properly prepared agricultural inputs will be considered acceptable.

21.2 Buddhist Management

It is problematic to try to speak of a specific Buddhist management style because, in the case of Thailand, as considered here, Buddhist Thais are also Thais and also accept elements of belief from other systems, such as animism. The willingness of people to accommodate apparently contradictory belief systems is usually referred to as "syncretism" (Muecke 1992), although this concept has been challenged by the opposing notion of "hybridization" (Kitiarsa 2005). The difference is that in the former approach the systems are independent and unchanged, while in the latter they affect each other through standing in a dialectical relationship to each other. These effects are also mediated by the influence of culture, which has brought about a certain way of tending to avoid conflict (e.g., Boonsathorn 2007) as a result of a culture of deference on the one hand and impunity on the other, and that means most people's public lives are based on fear (Lee 1972). Further, the globalization of business and management practices has meant that convergence between firms around the world has taken place, within some limits (Gertler 2001), and most executives in Thailand have some international education exposure and, so, have incorporated non-Thai and non-Buddhist approaches to their personal approaches (e.g., Wailerdsak and Suehiro 2004).

It is evident that many Thai executives are able to compartmentalize their lives so that they can follow Western-style rational objectives during their working lives and to follow Buddhist epistemologies in their personal lives. Buddhism values knowledge and knowing as being very important in the eradication of suffering and the progress toward enlightenment through no-substance ontology and internal generation of understanding (Bhatt and Mehrotra 2000). There are some examples of managers trying to incorporate Buddhist principles into some aspects of their managerial practice (cf. Lovichakorntikul et al. 2012), although such attempts often resemble not so much Buddhist compassion as Confucian paternalism (Chen et al. 2014). Where there can be a Buddhist management style, therefore, it is likely to be manifested in differences in philosophical and epistemological backgrounds which then have an impact on cognitive processes and sense making of external phenomena (Kase et al. 2011).

This style is affected by certain specific Dhamma lessons, including the following. Disa 6 is the Dhamma principle that explains human relationships in six dimensions whereby each person is surrounded by other people. Similar to Confucian relationship management, it also explains the duties and responsibilities that people must perform to other people as well. In this respect, below are the employer's duties for his or her employees:

1. Assigning them work according to their strengths and competencies
2. Giving them reasonable salary or wages, as well as food and benefits
3. Caring for them during periods of sickness
4. Sharing with them unusual luxuries from time to time
5. Giving them holidays and personal leave at suitable times for the organization

A second set of principles which should be considered is the Sangahavatthudhamma 4, also known as the 4Gs. This is the Dhamma principle by which people can live and work happily with others in society, and it has the following elements:

1. Giving things to support physiological needs
2. Giving word power to support belonging and esteem needs
3. Giving knowledge to support self-actualization needs
4. Giving the right to live in safety

In Buddhism, the Dhamma teaching that is related to management always focuses on the implementation of Dhamma practice which aims to help each person improve work performance. Rahim (1990) observed that social support may reduce the likelihood of conflict, stress, or job burnout, since positive relationships can make work situations less stressful. Social support has positive effects on the physical and mental health of a sample of factory workers. Similar results have been found with respect to nurses, teachers, and police and fire department staff. Dhamma practices, therefore, have been found to be supportive of employees in different contexts. Of course, good and healthy social relations are not limited to Buddhist Dhamma but may be found in slightly different variations in all the major philosophies and religious traditions of the world.

21.3 Food in Buddhist Thought

In Theravada Buddhism, emphasis is placed on personal acts as a means of achieving enlightenment (nibbana). A central feature of such acts is giving, which is interpreted as a form of sacrifice and which generates karmic exchanges. Giving to a religious person or institution, dana, is associated with a better spiritual future, since the act is practiced by those who wish to be reborn as a human being or supernatural creature in the next cycle of samsara. It is sila (self-restraint) that is more closely associated with the attempt to achieve nibbana (in addition, the higher-level virtues are also practiced). The act of giving requires a recipient, and, in Theravadin societies such as Thailand, this position is taken by the monks and the wats where they

reside. It is an internationally known phenomenon which sees monks processing early every morning to give the laity the opportunity to make merit by providing donations. Since the nature of the recipient affects the generation of karma, giving to a monk has a positive sum effect, since the monk is a virtuous person. Giving is also the basis of relationship building and so contributes to social solidarity. Such acts of donation are replicated at various levels in society, from parents giving items to their children's teachers to the creation and recreation of social relations in patronage networks. It can free the mind from defilement when conducted with morality and with thought to the requirements of the recipient. In popular Buddhism, this act of giving is incorporated into all kinds of activities and with an often quite broad definition of who a virtuous person is, since *luk tung* (country) singers join the pantheon of members of the royal family and venerable monks for this purpose. Various other animist spirits might also be involved, both for pragmatic reasons and to generate good karma. The nature of the gift should also be appropriate for the occasion since it can be contradictory to give something to someone that more strongly anchors them to the samsara. It is clear that food plays an important role in this gift-giving process, and it both sustains the physical body and also causes it to persist in the universe of suffering. The historical Buddha rejected extreme asceticism in his quest for enlightenment, and the monks and others will follow this example by eating food but only in limited amounts and without forming attachments to it: monks must eat only before midday, for example, and all types of food may be mixed in a single bowl so that it offers healthful qualities but not luxurious ones. Lay people, of course, have more scope to enjoy their food.

21.4 Food Management and Motivation Theories

One of the management approaches which is compatible with Buddhist perspectives and theories of general behavior is motivation theory. It is clear that the importance of food to human survival means that it is one of the most critical factors in determining behavior and that this will apply to all people, irrespective of any cultural or societal aspects because access to food is essential to everyone. This is incorporated into management of employees in that food is a central part of the benefits provided by employers, either directly or indirectly, and, in the case of low wage-paying organizations, the direct provision of food could be of considerable importance. This is the case for KKEC, since this is a nonprofit organization which relies on donations from stakeholders. Most employees are prepared to work on an at least partly voluntary basis, but they must eat nevertheless. The monthly stipend and allowance received by employees is only sufficient for them to buy a small range of necessities. On the other hand, the organization provides room and board to those employees, as long as they want to continue working there. Since the organization is religious in nature, many of the employees receive additional benefits from being associated with it in terms of spiritual development which counteracts to some extent the low wages and modest workplace conditions. These conditions would be unlikely to be accepted in a commercial setting. However, many

respondents did report feeling a strong sense of belonging with the Foundation, and this contributes to their sense of well-being. This conforms with the Dhamma teaching of Sing-ka-la-ga-sut, which relates to the principle of taking care of staff employees and in which food is a central component.

The volunteers at KKEC are mostly from the Mekong region, and they are citizens of Thailand, Cambodia, Laos, and Myanmar. This means that, although there are some differences in language and culture, the volunteers are united in their profession of Theravada Buddhism and similarities in their cuisines. Theravada Buddhism places particular importance on doing good deeds in the desire to find enlightenment, and this is most commonly expressed through providing food to the monks who undertake daily morning rounds so that people have the opportunity to do this. This makes the role of the monk of particular importance in society, and they are, as a result, generally much revered. Nevertheless, the presence of the monks and the nature of KKEC are not sufficient in themselves to prevent the incidence of the interpersonal conflicts that break out from time to time. This is not surprising, since even with good workplace relations, generally there are various inflammatory political differences between the countries from which the volunteers come, and these occasionally add some fire to personal disputes or conflicts over the distribution of what resources there are available. Sometimes these disputes can be resolved through appeals to common religious beliefs and the moral authority of the monks, perhaps in addition to the judicious application of som tum (spicy papaya salad), variants of which are available in all the countries concerned and which act as a means of uniting the workforce to a greater extent than any other item.

In each organization, human resource is the most important factor to push the organization to move forward so as to reach its goal. Hence, to efficiently manage the human resource process, which includes the recruitment, training and development, career development, appraisal and evaluation, retention, etc., can lead the organization to the effectiveness eventually.

The core factor for each person to work for one organization depends on that organization that can provide one's needs in terms of what kinds of need fulfillment. To do so, it means that organization will receive the employees' satisfaction, engagement, and loyalty. Food is the basic need of all human beings according to the Maslow theory. As mentioned above, the fringe benefits including food and compensation are very important factors to retain their employees to stay with the nonprofit organization.

According to the drive theory of motivation, people are motivated to take certain actions in order to reduce the internal tension that is caused by unmet needs. For example, you might be motivated to drink a glass of water in order to reduce the internal state of thirst. This theory is useful in explaining behaviors that have a strong biological component, such as hunger or thirst. The problem with the drive theory of motivation is that these behaviors are not always motivated purely by *physiological needs*. For example, people often eat even when they are not really hungry (Kendra Cherry 2013). Maslow explained that the original hierarchy of needs five-stage model includes basic or physiological needs, safety needs, social needs, esteem needs, and self-actualization needs (Maslow 1970). Furthermore, another scholar also specifies that one must satisfy lower-level basic needs before

progressing on to meet higher-level growth needs. Once these needs have been reasonably satisfied, one may be able to reach the highest level called self-actualization (McLeod 2007). Food, according to the physiological needs, is the basic need for human beings. In the case of each organization which could not provide this kind of need to its employees, it would be very difficult to bind the employees' heats to be with the firm for a long-term period.

In addition, the research study of Aon Hewitt has conducted the survey on the engagement of employees from worldwide organizations in 2013. It found that there were eight factors in the work experience, e.g., work, people, opportunities, total rewards, company practices, and quality of life. Hence, in the nonprofit organization, it can be assumed that food and compensation are included in the total reward component in terms of benefits providing to its employees.

21.5 Methodology

21.5.1 The Case Study Approach

The purpose of the paper is to study a management of food service and food preparation for volunteers from the Mekong subregion, Burma, Lao PDR, and Cambodia through Buddhism perspective in KKEC.

21.5.2 The Sample

There are forty-eight volunteers who work in KKEC, which 22 are from Cambodia, 19 are from Lao PDR, and 7 are from Burma. All volunteers are male, which age varies from 18 to 60 years.

Khao Kaewsadet Sadet Education Center has been a center for training and teaching moral principle and ethical behavior for Buddhist priest and novice, Buddhist layman and laywoman, as well as ordinary people from any religions. Every year there are approximately 72,000 people coming to KKEC to learn and train about ethics and morality. In KKEC, there are not only Buddhist priests and novices, but also more than 300 volunteers both Thai and foreigners live here. The compensation in terms of salary for volunteers in KKEC is not so high; however, there are fringe benefit, accommodation, apparel, and food provided for all volunteers.

Research methods: There are two methods for studying this research paper. Firstly, the study has been conducted by group interview. Secondly, all relating theories and documents about food service management through Buddhism perspective have been analyzed.

The research sites: Volunteers are from Burma, Lao PDR, and Cambodia who have been working in KKEC more than 6 months.

21.6 Findings

21.6.1 Characteristics of Foreign Volunteers

The numbers of volunteers working for the Khao Kaewsadet Education Center are 200 people who came from Myanmar, Laos, and Cambodia. Forty-eight persons have been working in Thailand for more than 6 months which is the sample of this study. Most of them have never ever worked before coming to Thailand except doing the chores, housework, and agricultural farm. More than 90 % have finished high school. They also have their relatives, friends, or some connections in Thailand. Therefore, when they first start working in Thailand, it means that they just start their working life. As a result, they need to adjust themselves and create lots of problems such as relationship conflict and responsibility.

Generally, most of the volunteers which are about 50 % are living near the border. Hence, they can communicate in Thai fluently. Another 50 % cannot understand Thai language at all, and then they need their friend to be a translator. After 2 or 3 weeks later, they can understand more Thai words. And after passing 3 months, they can receive the orders or assignments from their supervisors.

The Khao Kaewsadet Education Center also wholly provides salary, room and board, attire, and fringe benefits to them. Their working hours are from 8:00 am to 5:00 pm. Most of their responsibilities are cleaning up and other chores. For the ones who work in the kitchen and the garden, they will start their day from 4:30 am to 1:30 pm. Some of the volunteers who never work with the systematic organization will get some tension and stress. They feel like working under high pressure, strict rules, and regulations. Moreover, they are faced with cultural conflicts which they do not understand much on some Thai cultures. They also feel unsatisfied with the working environment. Once they have their free time as well as the stress, they are fascinated with drugs and gambling.

21.6.2 Food Service in Khao Kaewsadet Education Center

There is an open-air canteen provided for all volunteers. There are 14 tables, which can sit from five to seven people per table. Self-service is a practice of serving. In the morning, breakfast will be provided from 6:30 to 8:20. Breakfast is always a light food such as porridge, noodles, or one-dish rice. Lunch and dinner will be provided as buffet from 11:00–13:00 to 18:00–19:00, respectively. There are 3–4 main foods and two types of fruit together with one dessert. Nonetheless, volunteers in different teams have different working hours, which do not allow them to have simultaneous breaking hours or lunch hours, and food will always be provided in order to serve whenever whichever teams need to have it. After each meal, volunteers have to wash, clean, and dry their own eating utensils as a discipline.

21.6.3 Discipline and Learning Behavior Through Food Service Management

Each society is a combination of various beliefs, aspects, and cultures; problems could be unwillingly arisen as people have to live and to work together. An organization that has multinational employees would definitely encounter many different issues. It is significant for an organization to create a rule or discipline in order to prevent those problems, which could affect the performance of the organization. Moreover, vision in dealing with problems and communicating and motivating skills and the ability to unite people to work as a team are required for an executive head of the organization to perform. In addition, it would be even tougher for an organization, where wages is not a main driving factor for its employees. As a result, it is required for a head of the organization to perform not only the task mentioned above but also to create employees' loyalty to the organization.

In KKEC, food is considered as a significant fringe benefit. According to the fact that everyone needs to have three meals a day, food has to be hygienic, sufficient for everyone, and tasteful enough that is edible for all volunteers from every nation. However, it is found that only volunteers who lived in the border of Thailand and his/her country can eat Thai food, and those who lived far away from the border cannot eat much because they are not used to Thai food. Moreover, not only food that they are not used to eat but also communication language and socializing with new people are the factors that demotivate volunteers and lead to homesickness eventually.

In order to resolve all these problems, universal goodness and Buddhist principles have been implemented in practicing and training by senior and experienced volunteers. In addition, the monk and mentor also act as a prototype for volunteers by:

- Creating a hygienic behavior from every single task of preparing food, cleanliness of cooking equipment and eating tools as well as staff apparel
- Discipline about storing and keeping working equipment and personal belongings
- Learning how to respect, give, and dedicate himself/herself to others, as well as to behave in a good manner
- Punctuality in working and having meals as of the fact that people need to have three meals a day

Providing food service always consists of providing sufficient amount of food. The taste must reach national standard and there has to be a food survey and preparing the voted foods such as som tum or papaya salad or changing the meals every week according to main dish of each countries.

Managing of this adjustment will reduce the conflict of the volunteer's coordination; moreover, volunteers can develop themselves in order to be ready for other practices, which are assigned by mentors. Homesick problems reduce accordingly as the volunteers have a strong attachment to the organization.

21.6.4 Aspect from Volunteers to the Food Service Management in KKEC

From a personal interview with a 60-year-old Burmese volunteer who is the oldest foreign volunteer in KKEC, he explained that in the first few weeks, he could not eat Thai food, much of which affected his energy to work and created homesickness. Later on, the executive head had brought a Burmese chef to cook for all Burmese volunteers. The impact of having homeland food led him to work happily with full of energy. Besides, he had learned eating manners and, moreover, learned to work with other foreign volunteers, which bring him many foreign friends causing his homesickness to fade away.

From a group interview with six Cambodian volunteers, aged from 22 to 30 years old, they had mentioned about the first few weeks that they still could not adjust their eating taste with Thai food causing frustration and unwillingness to work. Consequently, the menu had been adjusted in terms of type of food, taste, and varieties to satisfy them so that they could eat more. In brief, this is a vital key bringing their willingness to work back and creating unwillingness to move away to other organizations.

From a group interview with five Lao PDR volunteers, aged from 18 to 45 years old, they had no problem about communicating with Thai volunteers regarding the similarity of Thai and Lao. In terms of food, they are all fond of Thai food. Their favorite dish is som tum or papaya salad the same as other nations' favorite. The only noticeable thing about Lao volunteers is that they like to add chili to every dish they had.

21.7 Conclusion

From the research, it is found that volunteers from each country have the same needs, four main living factors; however, food still plays a main role that affects human living. Since people can survive by consuming foods, if they do not eat food, they will become exhausted and depressed and die. Khao Kaewsadet Education Center does not pay any compensation to the volunteers in order to attract them to work with KKEC. However, KKEC aims to provide other benefits to volunteers especially food, and this will relieve the volunteers from their distressed living and will take good care for all volunteers. This service providing will make volunteers reluctant to work for other organizations, and the relationship between KKEC and the volunteers is intimately developed.

However, this research studies on nonprofit organization, so managing food service and other benefits to volunteers are fully completed. In common business sectors, especially big, industrial, producing in mass quantity and using labors as a main source of producing products, food service will count as one type of controlled cost. Providing nutritious foods which leads to better physical and mental health is

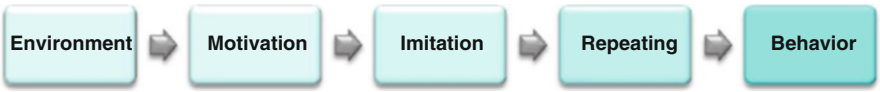

Fig. 21.1 Processing of developing morality through food providing service

not considered in profit organization. There are many hidden costs that emerge from neglecting worker's health such as the mistake from working due to a health problem; these inefficient workers cause lower production, and the company has to train new workers to support line production. Companies end up not only losing money but also it is time consuming. Fringe benefit cost should be appropriately managed; though expenses increase, the firm's revenue will substantially increase in the long run that will overcome the loss; moreover, the attachment between workers and organization is tightly developed.

21.7.1 Implanting Morality Through Food Providing Service

Due to the fact that each volunteer is different, administrators must develop joint centers at which people can receive training and guidance in ways in which they can support each other and work together. The significant part of the research is that all volunteers are Buddhists and they respect Dhamma from Buddha, so they have the same faith in their hearts. Since a cafeteria is the place where volunteers have to have meal three times per day, Khao Kaewsadet Education Center inserts ethical behavior, while volunteers do activities in this place. Hygiene, discipline, sharing, and punctuality are all behaviors that must be implanted to all volunteers by imitating or following other volunteer's behaviors. Monks and mentors must act as a good prototype for the volunteers to observe their behaviors and follow their actions. As the time passed, these practices will develop to habitual action that the volunteers will not have feelings of resistance. However, this habitual action will make all volunteers have a good manner in their daily life. In order to implant morality in volunteers, administrators have to understand the difference of each person and culture and develop standard methods that must be taught to all volunteers so that they can learn and develop themselves the habitual action that will last long with the volunteers (Fig. 21.1).

21.7.2 Universal Principles of Goodness Which Can Be Applied to All Organizations

The four principles for training through universal goodness are (1) cleanliness, (2) orderliness, (3) politeness, and (4) punctuality (PhadetDattajeevo 2012). These are basic principles which can help in developing the habits that are necessary for human development. Universal goodness will reduce conflict in society, which in

turn causes corruption, temptation, and divisions between all living people. Though universal goodness cannot completely eliminate the problems of society, it is nevertheless an important tool for people who live peacefully in this world.

In 2015, Thailand is scheduled to join the ASEAN Economic Community which will permit more freedom of movement for skilled workers in some categories in which qualifications may be mutually recognized. Thailand still needs unskilled and semi-skilled workers from neighboring countries to work in the low-cost industries which Thai people now generally do not want to do. As a result, organizations that depend on foreign workers have to adopt universal action standards that may be used to reduce conflict in organizations and to help in achieving the organization's ultimate goals.

References

Afzalur Rahim, M. (1990). *Theory and research in conflict management*. Available at http://www.questia.com/read/25985320/theory-and-research-in-conflict-management

Aon plc. (2013). *2013 Trends in global employee engagement*. Available at http://www.aon.com

Bhatt, S. R., & Mehrotra, A. (2000). *Buddhist epistemology*. Westport: Greenwood Press.

Boonsathorn, W. (2007). Understanding conflict management style of Thais and Americans in multinational companies in Thailand. *International Journal of Conflict Management, 18*(3), 196–221.

Chen, X.-P., Eberly, M. B., Ting-Ju Chiang, Jiing-Lih Farh, & Bor-Shiuan Cheng. (2014). Affective trust in Chinese leaders: Linking paternalistic leadership to employee performance. *Journal of Management, 40*(3), 796–819.

Cherry, K. (2013). *Theories of motivation: A closer look at some important theories of motivation*. Available at http://psychology.about.com/od/psychologytopics/tp/theories-of-motivation.htm

Gertler, M. S. (2001). Best practice? Geography, learning and the institutional limits to strong convergence. *Journal of Economic Geography, 1*(1), 5–26.

Kase, K., Alesia Slocum, & Ying Ying Zhang. (2011). *Asian versus western management thinking: Its culture-bound nature*. Basingstoke: Palgrave Macmillan.

Kitiarsa, P. (2005). Beyond syncretism: Hybridization of popular religion in contemporary Thailand. *Journal of Southeast Asian Studies, 36*(3), 461–487.

Lee, D. (1972, January–February). The Thai Coup. *New Left Review*, no. 71, pp. 36–43.

Lovichakorntikul, P.,, Walsh, J., & Anurit, P. (2012). Buddhist social work: A case study of the Samrong General Hospital. In *Proceedings of the 2nd International Association of Buddhist Universities Conference* (pp. 27–43). Ayutthaya: IABU.

Maslow, A. H. (1970). *Motivation and personality* (2nd ed.). New York: Harper & Row.

McLeod, S. A. (2007). *Maslow's hierarchy of needs – Simply psychology*. Retrieved from http://www.simplypsychology.org/maslow.html

Muecke, M. A. (1992). Monks and mediums: Religious syncretism in Northern Thailand. *Journal of the Siam Society, 80*(2), 97–103.

Phrabhavanaviriyakhun (Phadet. Dattajeevo). (2012). *The main thought of education correctly*. S. M. K. Printing Co., Ltd, Bangkok Thailand, 3, 48.

Wailerdsak, N., & Suehiro, A. (2004). Top executive origins: Comparative study between Japan and Thailand. *Asian Business and Management, 3*(1), 85–104.

Chapter 22
Intellectual Property Rights and Food Security: The Role of External Relations

Soraj Hongladarom

Abstract Intellectual property rights (IPRs) have become an important tool in ensuring food security; however, if used inappropriately, it could well create the reverse. This paper looks at the concept of IPRs in order to find a way to harness their use so as food security is ensured. A tentative argument proposed here is that IPRs do not exist in a metaphysical or epistemological vacuum; on the contrary, research and development leading up to patentable products is often related to social, economic, or political contexts in such a way that the relation is constitutive. Thus, it is appropriate that claims to IPRs should acknowledge these relations through a scheme of benefit sharing that is fair to all parties. In the course of the paper, I will discuss the four major theories of IPRs according to Fisher—the consequentialist theory, the Lockean theory, the Kantian/Hegelian theory, and the democratic order theory. The aim is to criticize each of them very briefly in terms of the constitutive external relations. If it is the case that IPRs are even partly constituted by relations to outside contexts, then elements of these contexts should have a share in the benefits that accrue through the use of IPRs also.

Keywords Intellectual property rights • Ethics • Food security • External relations • Benefit sharing

22.1 Introduction

The main concern of this paper is to sketch a possible answer to the question whether, and if so how, food security can be obtained through the use of some kind of intellectual property rights (IPRs). Many scholars have tried to link up the two concepts. For example, Blakeney (2009) devotes a whole book to the topic. Cullet (2004) looks at the issue from the perspective of the developing South. Chapman (2002) links up IPRs and human rights and argues that the former cannot proceed

S. Hongladarom (✉)
Department of Philosophy and Center for Ethics of Science and Technology, Chulalongkorn University, Bangkok 10330, Thailand
e-mail: hsoraj@chula.ac.th

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_22

without due recognition of the latter. Since access to food is considered a right, IPRs are linked to food security along this channel. In his book, Dutfield (2004) discusses the use of IPRs, more specifically, protection of plant varieties, and how they could ensure food security in the developing world. The question is important because, on the one hand, it seems that IPRs could foster food security in some way. For instance, technological inventions that are designed to solve food security problems could be protected with IPRs so as to, according to the view of some of their proponents, make it possible for investors in the research and development of the technologies to recoup their investment and to provide incentives for further development. On the other hand, however, uses of IPRs have been accused of preventing local farmers from maintaining their traditional ways of life and independence, as is the case when they come to rely on some forms of these technological inventions in their farming practices. What I would like to do in this paper, then, is to have a closer look at the whole concept of IPRs and the theory behind it, with an aim toward the problem of food security. What kind of theory and what type of possible modification of how IPRs should be understood is perhaps most amenable to preventing and solving the problem of food security?

I would like to argue that the use of IPRs should be more open. What I have in mind is that instead of restricting the claim of ownership of an intellectual property to the traditional owners according to most available laws, namely, to the investors and the firms that employ those inventors, the rights to intellectual property should be expanded, in some form to be sketched out in this paper, to a wider circle which includes the beneficiaries of the invention, the state, and the public as a whole. This by no means implies that the whole concept of IPRs is being destroyed. On the contrary, inventors still retain a right to ownership of their intellectual creation, but they have to realize that they alone are not the ones who have a stake in those creations. The fact that they are around implies that they owe the fact of their existence to the wider circle. Since nothing and nobody exists in a vacuum, what happens anywhere tends to ripple across all the space everywhere. Thus, the wider circle indeed has a say and a share in the intellectual creation that the inventor comes up with. Hence it seems fair that the wider circle should take part in the rights to the intellectual property also.

My approach, then, is similar in spirit to the proposal by Posey and Dutfield (1996, p. 3), when they aim at refocusing on "Traditional Resource Rights" (TRRs) rather than IPRs (See also Posey 1990). However, Posey and Dutfield do not aim at analyzing the concept of IPRs nor criticizing the underlying theories as I intend to do in the paper. In fact the argument I am proposing looks rather simple; yet it is surprising that not many works in the literature deal directly with it. According to Fisher, there are four major theories of intellectual property rights: one that deals with consequentialist reasons (that IPRs bring about desired consequences and provide incentives for innovation), with the right to property arising from one's effort (that one has a right to a piece of property, intellectual or not, if one exerts one's effort and labor in producing or acquiring it), expression of one's personality (that IPRs are an extension of one's own creativity and personality), or a democratic social order (that IPRs are consistent with the kind of social order that is democratic

and respectful of individuals' role in it) (Fisher 2013). However, none of these four major theories take into account the rather obvious fact that in order to produce the kind of innovation that merits being granted IP protection, the context is necessarily involved in such a way that to ignore it entirely in claiming the rights to IP would seem to be incoherent. As a result, claims to IPRs have to acknowledge these external relations and the benefits that accrue due to the claim should be shared accordingly.

22.2 Role of External Relations

Let us look at each of these four major theories in turn. The first one is the most familiar one and perhaps the most cited by corporations benefiting from IP protection as well as by legal scholars and the court in general. IPRs are needed as a guarantee, so to speak, that investments on research and development leading up to the patented product produce adequate return. Furthermore, they are also necessary as an incentive for further effort in innovating. However, effort in innovating, research and development seldom, if ever, exists in a vacuum such that no wider social or political contexts are involved. A firm that develops a technology that would ensure food security, such as a hybrid seed that is resistant to drought and has high yield, exists as a node in a complex web of social, economic, cultural relations to other firms, other agencies, as well as the public. These relations do not obtain only at the obvious level of the firm's usual dealings with outside agencies, e.g., paying taxes to the community, buying stuff from suppliers, selling products to consumers, sharing profits to their shareholders, and so on, but the very activity of research and development for the kind of technology that is going to be patented is constituted by these relations to the wider context too. It is highly implausible nowadays that any kind of sophisticated research and development of this kind can start entirely from the ground up. Researchers cannot shut themselves up in their laboratories and can still produce any kind of technology that works in the real world. In order to produce the seed, at least researchers have to rely on past studies, and then the resulting seed has to be extensively tested in the field; unless the corporation owns a large tract of land, testing the seeds would have to be done in open fields, and in order to do that, permissions from the relevant authorities have to be obtained. Furthermore, the laboratories have to employ a number of people and engage in various economic and other kind of relationships with other agencies outside of the corporation to which the laboratory belongs. Perhaps the corporation may have had performed a survey of need of the farmers in order to ascertain exactly what kind of seed would be the most preferable to them. All these mean that input from the outside in fact constitutes the very activity of research and development as well as the patentable product that comes up afterwards. The consequence is clear. Claims to IPRs would have to be in some way shared among these wider circles also; if it were possible for the laboratory to shut itself up entirely depending absolutely on nothing from the outside world, then it might be possible for them to claim exclusive rights to their

IP. But since the world seldom works that way, the usual claim to IPRs, which is almost always exclusive, would have to be modified.

An obvious rejoinder to this argument is, of course, that to come up with innovation that is patentable might depend in some way on these outside factors, but the product itself must be shown to be sufficiently innovative in order to be able to be patented. The fact that activities leading up to the innovated product require a number of links to the outside world alone is not, so the rejoinder goes, sufficient in guaranteeing that the links and the external relations do have a share in the IPRs that result from the work of the laboratory. However, that is a rather narrow look at how innovation comes about. Even a lone thinker who shuts himself up in a room and thinks up a new idea has at least to base his thinking on some prior ideas that are around at the time which form, among other things, an input to the problem that he has set out to solve through the innovation in the first place. It is commonly acknowledged that Descartes' Cogito Argument is the epitome of an original argument in the sense that according to the content of the argument, Descartes or the cogito thinker does not need any external relations in order to let the argument go through toward its famed conclusion (Descartes 1996). The fact that Descartes himself has to eat to survive and is situated in a room in a house, which presupposes that he either owns it or is allowed to remain there, does not imply that the farmer who produces his food, or the relation he has with the authorities to prove his ownership of the house, or the owner of the house who allows him to remain to think, has any role to play in the Cogito Argument. However, one of the familiar objections to Descartes' argument is precisely that the Cogito itself presupposes these very external relations for it to go through. Even if we allow that the house and the food might have been cooked up for Descartes by the evil demon, the very fact that Descartes thinks in a language, which presupposes that he has to have learned it through speaking it with others, shows that external relations are constitutive of the Cogito from the beginning. According to Wittgenstein, private language, namely, a kind of language that in principle only the one who speaks it knows it and no other, is not possible, so Descartes' language is not private either (Descartes 1996). This means that other people are necessary in the content of the Cogito in the first place. Thus, if the requirement for constitutive external relations is necessary for Descartes' Cogito, then it is obviously the case for a much less stringent argument and practical development that takes place in the laboratory.

The second major theory of IPRs, the Lockean one, states, roughly, that IPRs are justified as a rightful fruit of labor that should belong to the one who has expended it in order to arrive at the intellectual property. This argument is rather similar to the consequentialist one that we have just considered. And as in the case of the former argument, it is rarely the case that one alone or even one corporation, without any relations or any help from the outside, could secure any kind of sophisticated intellectual property that abounds today. If it is the case that any attempt at research and development for patentable product has to rely on a number of contexts and external relations, then it means that it is not the labor or an effort on oneself alone (or that of one group alone, for that matter) that is responsible for the success of finished

product. Hence the benefits that accrue through the use of the claim of IPRs should be fairly shared among those who are involved, both directly and indirectly.

The development of technologically advanced hybrid seed that can grow in unfavorable conditions is a case in point. The common assumption is that, since the corporation has invested a sum of money into the research and development for the seed, they are entitled for a period of patent protection where the IPR to the seed is respected. However, in order for the seed to be made meaningful to the majority of the world's farmers who stand to benefit from the seed, the price of the seed needs to be low enough to be affordable. Furthermore, the farmers should be able to save some seeds so that they can grow them in the next season. The practice of some corporations of engineering the seed so as to become sterile is thus not in line with the argument adopted here. The Lockean position would view the research and development for the seed as an investment, an exertion of labor to stake a claim in a piece of property. But in order for the practice to get off the ground, the firm and the team of scientists who do the actual work need to interact with the outside world in one way or the other. Most of all, if the idea is to develop a kind of seed that would help the majority of the farmers, most of whom are poor and live in the tropical countries, then prior research on how the seed would respond to these particular climate conditions is absolutely crucial. Recognizing that the resulting technology is a result not of the work of the scientists alone but that other factors are critically involved would mean that fair sharing of the benefits should be an important factor in deciding who gains what in the use of the technology in question. Since the scientists do not, and cannot, do their work alone without input and all kinds of relations obtaining between them and the outside world, including the farmers themselves who are on the receiving end, ways need to be found in order to acknowledge the roles that these external relations play in the process of research and development.

The third major theory states that IPRs are justified as an extension, or an expression, of the personality of the creator. Usually this view is used more to justify copyrights than patents, but it has also been used by some scholars to justify patents too. Here one needs to recognize, again, that an entity, be it an individual, a firm, or a scientific laboratory, does not exist in vacuum in total independence from all other factors. Hegel is usually cited as a source of this third major type of IPRs theory, but it is Hegel himself who, in the *Phenomenology of Spirit* (1977), famously presents an analysis of an individual in such a way that an individual, to be the individual he or she actually is, has to be defined through relations with other individuals. In the case of objects, this means that an object can only be what it is through whatever lying outside of it, so that a boundary between the object and what is outside of it is defined. Something that has no externally defining boundary would not be an individual object at all. The same analysis also goes for individual persons. A person is the person he or she is only through *recognition* that other people have toward him or her. Without the recognition, there would be no person since there would be no consciousness that this is a particular person with whom one can deal with. This is just another way of saying that a human person cannot be understood as such with-

out reference to his or her community, family, or group. The relation of recognition in this sense is a typically Hegelian notion (Cf. Taylor 1977).

The upshot is that firms cannot consistently hold the claim to IPRs justified through the notion of extension of their "personality" and claim that no external relations are involved. The result then is structurally the same as what I have been trying to say so far regarding the previous two theories. In order to consistently claim IPRs to a product, external relations need to be factored in, and in the next section, I will sketch a very rough form of what the factoring in of these external relations consist in.

The last major theory of IPRs is perhaps the most intriguing. The idea is that IPRs are needed to ensure that we live in a fully democratic society where the rights of individuals and presumably corporations are respected. This argument thus recognizes from the first moment the constitutive relation that IPR claims have to their external factors. In order to say that IPRs are necessary for a democratic society, one obviously needs a society to begin with; hence IPRs according to this theory are justified through their relations to the outside factor. That is why it is intriguing, because the previous three theories do not, prima facie, seem to admit the relations to external factors as does the fourth one here. Thus, a discussion of this theory has to be a little different from that of the previous three. Here the focus is on whether and how respect of IPRs contributes to a democratic society. However, it is quite clear that a narrow interpretation of IPRs in such a way that the majority of the world's farmers would be worse off because they have to buy expensive drought-resistant hybrid seeds, the kind that may one day be needed in order to stave off food insecurity, would be a decidedly less palatable option than a broader one which, as I have been trying to say, includes the role of external factors including stakeholders such as the farmers themselves and other organizations and agencies in the process of developing a patentable product. A fair benefit sharing scheme where the farmers, the community, the local and national authorities, the firms, and the wider public are all stakeholders is needed in order to ensure food security in the longer run. The scheme is not a radical one where the firms are disincentivized from developing new products, but as it ensures survival of all factors, the scheme is in the long-term interest of the firms themselves.

22.3 Conclusion

What I have been trying to argue in the short space provided for this paper is that external relations play a constitutive role in IPRs claims. Any attempt to ensure food security through a reliance on IPRs does not even get off the ground, I believe, without the kind of benefit sharing scheme that is based on the recognition of the role external factors play. An upshot of my argument is that one cannot consistently claim a right to an intellectual property and at the same time hold that one has ultimately an exclusive ownership of the property in question with no need to regard any external factors that are obviously involved. It is true, nonetheless, that in a

genuine case of innovation, the product has to be proven to be sufficiently distinct from all others that have been invented before. This is the linchpin of the whole idea of intellectual property rights. However, being able to claim innovation is not the same as depending on all others in such a process, and this means that, though one has a right to one's own invention, one does not have an obligation to the world or the context in which such process is possible in the first place. This necessitates a kind of fair benefit sharing scheme that all stakeholders should have a part, including the inventors themselves, the firms that employ the inventors, the farmers, the local and national authorities, and the wider general public. Recognizing a list of stakeholders this wide does not disincentivize the firms from developing future patentable products. Firms still hold on to their IPRs, but they have to realize that their long-term interests do depend ultimately on sharing of benefits of the technology to the wider circles. Holding on to IPRs in order to drive up the price and create a vicious monopoly could only benefit the firms in the short term, as the instability that ensues would create an environment in which further research and business dealings become increasingly difficult.

So what does a fair benefit sharing scheme look like? For one thing, the price of the hybrid seed (or any other agricultural technologies for that matter) should be made affordable to the farmers who need them. Since farmers are at the forefront of the fight to ensure food security, they need to be more fully supported than they are now. The whole idea is that we are living on the same planet earth. As of now there is no possibility of packing up and moving to other planets yet. So firms should lower their profit expectations and look at a broader notion of profit where well-being of people who are not stock holders be taken into account. It certainly requires a tremendous amount of work to sort out in detail who should get what and in what proportion in the fair benefit sharing scheme sketched out in this paper. But if we are to think about how IPRs should play a role in ensuring food security, I believe that this is about the only way to go.

Acknowledgment I would like to thank Helena Röcklinsberg and Per Sandin for their comments on an earlier draft of this paper, which led to many improvements. I would also like to thank the executive committee of the EurSAFE for inviting me to the conference in Uppsala. Research for this paper has been partially supported by a grant from the Thailand Research Fund and the National Research University Project, grant number BRG5380009 and AS569A, respectively.

References

Blakeney, M. (2009). *Intellectual property rights and food security*. Oxfordshire: CABI.

Chapman, A. R. (2002). The human rights implications of intellectual property protection. *Journal of International Economic Law, 5*(4), 861–882.

Cullet, P. (2004). Intellectual property rights and food security in the South. *Journal of World Intellectual Property, 7*(3), 261–286.

Descartes, R. (1996). *Meditations on first philosophy* (J. Cottingham, Trans.). Cambridge University Press.

Dutfield, G. (2004). *Intellectual property, biogenetic resources and traditional knowledge*. London: Earthscan.

Fisher, W. (2013). *Theories of intellectual property*. Available at http://cyber.law.harvard.edu/people/tfisher/iptheory.pdf. Accessed 3 Jun 2013.

Hegel, G. W. F. (1977). *Phenomenology of spirit* (A. V. Miller, Trans.). Oxford: Oxford University Press.

Posey, D. (1990). Intellectual property rights and just compensation for indigenous knowledge. *Anthropology Today, 6*(4), 13–16.

Posey, D., & Dutfield, G. (1996). *Beyond intellectual property: Toward traditional resource rights for indigenous peoples and local communities*. Ottawa: International Development Research Centre.

Taylor, C. (1977). *Hegel.* Cambridge/New York: Cambridge University Press.

Chapter 23
The Holistic Ethics of Sustainability

Jürgen W. Simon

Abstract The article raises the question for an ethical model for the continuous mixed forestry. Among the plethora of approaches reaching from individualistic to holistic ones especially, the question of the dignity or integrity of plants is discussed. This important approach has been regulated since many years in the constitution of Switzerland. The problem is still that the term "dignity" contains too many uncertainties to be exactly described. Another approach to forest ethics is the one of social or Christian ethics. This approach emphasizes the position of the human being as the guard of the creation, and his task is to take care of animals and plants for the common sake. The holistic model finally stresses the interconnectedness of all living beings and their social obligation toward the others. An approximation to it can be found even in some statutory provisions, for example, in § 1 of the German Federal Nature Conservation Act. There, goals of nature conservation and landscape management are that nature and landscape have to be protected because of their **own value** and as a basis for life and health of people in responsibility for future generations. The holistic model fulfills all expectations and demands for a sustainable world. It also contains the more individualistic aspects of plant dignity or integrity as well as social or Christian ethics and is the optimal approach for the realization of the "continuous mixed forestry" model with all its requirements of an ethically responsible, sustainable forest management.

Keywords Holistic view • Dignity and integrity of plants • Indras net • German Federal Nature Conservation Act

J.W. Simon (✉)
Leibniz Universitaet Hannover, Hannover, Germany
e-mail: simon@leuphana.de

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_23

23.1 Introduction

"Our earth is breathing – and this is manifold. Its thin envelope of air pulsates to the beat of different rhythms: When in the spring (in Europe for example) the nature thrives, the CO_2 content of the atmosphere decreases, because the fresh green sequesters carbon. In autumn the fallen leaves decompose and release greenhouse gas. Something similar happens when methane that rises from thawing Siberian swamps and flooded Asian rice fields, only to be slowly reduced in the atmosphere" (Asendorpf 2013: 37). But there are also other rhythms: the breathless tide around the globe or the ocean currents and ice ages in the rhythm of millennia or the sudden impact of human activities. Thinking about it, or from the perspective of a satellite of 50 km distance, changes thinking. Thus, the director of the Earth Science Advisory Board of the European Space Agency called on the Living Planet Symposium in Edinburgh this year that a global Earth Management System should be created to control the "breathing" of the earth as a whole (Asendorpf 2013: 37). Aside from that, if that will ever be realistic, the demand firstly shows that also in the natural sciences a holistic understanding of the earth is existing. Secondly, it is also clear that the nature in general, especially trees and forests, plays a central role in the "breathing" of the earth.

This function of the forests Wilhelm Bode describes very strongly in his previous presentation. And he suggests a specific silvicultural management system that is environmentally and economically effective. The subsequent question is an ethical justification for his model of continuous mixed forestry. This question was investigated by ethicists of various angles of view. The point of view may be plant or forest ethics or the social, Christian, other religious ethics, or environmental ethics. This is a field of applied ethics which deals with the questions of moral obligations to the forest and the responsibility toward the forest. Anyway, there is a plethora of approaches to reason, but they are overall very little mature and come due in part to significant resistance. Included are philosophical, economic, theological, historical, and psychosocial approaches. But the holistic view on ethics of sustainability is an important, perhaps the most important, theory compared with the ethical value standards that have been discussed in relation to the forest in a large number of facets reaching from individualistic ones to the holistic. It is impossible and not necessary to treat all in this presentation but I want to tackle the most important ones that also finally lead to the holistic view.

23.2 Dignity and Integrity of Plants

One for the European discussion important and especially in the German-speaking countries of Switzerland, Germany and Austria discussed approach to the responsibility for the creation of a Forest Ethics is the individualistic one of an independent dignity of plants taken from the dignity of the human and the animal. While human

dignity is generally accepted even in different formations, some with many restrictions, and the dignity of the animal is increasingly theoretically recognized, we are doing ourselves much harder to plant dignity. Thus, the ethicist, who will concede plants a dignity, will be surprised and critically asked if you are not allowed anymore to pluck leaves from a tree or the farmer could not harvest anymore because the plants would be damaged. In short, the approaches to plant ethics have still come to terms with the fact that they are referred to by opponents as groundless and absurd, although recent studies even speak of a "plant soul" (Gill 1992: 9). Gill, for example, refers to studies on different plant species, among other things, mimosa, showing that they have a nervous system, a short-term memory, and a musculoskeletal system (Gill 1992: 9). In contrast, scientists deny exactly these features for plants not only by common sense. Thus, Birnbacher, a bioethicist, like others, notably Peter Singer, measures the moral status of living beings based on their neuronal equipment, that "plants are not capable of suffering. Neither makes a disease in plants evolutionary any sense, since plants cannot specifically evade any pain stimuli, nor any physiological evidence of a mental life of plants exists" (Altner 1992: 43). In this respect, a claim to protect each "individual plant" appears to be unrealistic, especially that the protection of plants has been previously regulated essentially anthropocentrically, that is, in regard of the people and its food, the gene pool, as medicinal plants, or for their aesthetic value.

That is why it so far also failed to develop generally accepted criteria for the use of plant in the context of genetic engineering interventions on the base of the concept of the dignity of the plant. But in this regard, the dignity of the creature had been regulated in the Swiss Constitution. The Swiss Federal Constitution has regulated the protection of plants comprehensively by the conservation of biodiversity, the protection of biodiversity and the protection of the species, and the commitment to take into account the dignity of the creature in dealing with plants. The concept of the creature in the Constitution includes animals, plants, and other organisms.

Although Switzerland had governed the dignity of the creature in the constitution in 1992, commissions and academies have been attempted in this country with more or less success, to flesh out the concept of plant ethics (ECNH 2008; Stöcklin 2007; Koechlin 2009). Anyway, it is clearly regarding the regulation of the Swiss Federal Constitution that with the introduction of Article 24 novies SBV, a general objective standard is given, which includes humans and the environment and has to ensure the protection of the dignity of creature. Plants are explicitly mentioned (Odparlik 2010: 17). The question which arises is whether plants will be so directly protected for its own sake or only in relation to man. A direct protection could constitute an obligation to respect the dignity of the plant (Odparlik 2010: 119). This protection is not absolute, but can be seen in certain limits. Thus, an intervention may be justified by overriding legitimate interests, because otherwise the cultivation of plants or their harvest could be problematic. An adequate nutrition must also be secured. A limit on the other side is the formulation that plants may not be "arbitrarily" damaged. There is still a lot of uncertainty in the orientation between these two poles.

Odparlik, in contrast, justifies such protection of plants with the "own good" of vegetable organisms (Odparlik 2010: 119), that is, that plants can be regarded as

living beings that "are created for their own prospering" with an individual value. This "own good" should be taken into account in dealing with them. This provided man as a rational and moral being who is obliged to pay attention for their own sake and to treat them properly without doing this only for its own interests (biocentral approach, Odparlik 2010: 119). What does that concretely mean? There are different views. A plausible notion, and basing on this approach, which was proposed in an alternative formulation in the discussions on Article 24 novies Swiss Federal Constitution, is to refer to the concept of freedom from bodily harm or (vulnerable) integrity of living beings that need to be protected (Baranzke 2002: 349). Integrity is more understandable for the natural sciences. In the French version of the Swiss Federal Constitution, the concept of "dignity of creature" was therefore replaced by "intégrité' of organisés vivants" (Lötscher 2000: 137ff; Odparlik 2010: 126). Integrity is not to be equated with the term "own good" but to be understood only as a basic condition for the realization of one's own good, "so that the 'own good' is to be preserved in its integrity" (Odparlik 2010: 135). Thus, Odparlik concludes: "Insofar as… (the morphological species concept) is able to receive and convey information about the way in which organisms are assigned to their characteristics or their descent of a certain species, their integrity usually maintain, it may be helpful to make a statement prior to an interference in a particular plant, whether as a result the impairment of their integrity is to be expected, and if so, to what extent" (Odparlik 2010: 135).

This raises the fundamental question whether the concept of "dignity" in connection with plants at all is in order here or, if not better, the concept of the integrity of living organisms is to be preferred, so a different and better determinable concept should be applied (Richter 2007: 9). This seems to be a more plausible approach, as it escapes the difficult discussion about differentiating the concept of dignity, which is already "loaded" by the extension to animals.

This argumentation may have its place, if it is, for example, genetic manipulation of individual plants or maybe still is a larger group. In the case of the use of forests, it is difficult to argue with the term "its own good or integrity", because the tree crops have just been set to fulfill their purpose of use of wood after a certain time. Therefore, it is useful here to choose a more comprehensive approach that involves the whole environment, that is, humans, animals, and plants, from the perspective of sustainability, and the precautionary principle. Also the argumentation approach from Kallhoff regarding the "prosperity" of the plants as such is still less comprehensive. However, she extended this approach beyond the individual plant or species also essentially when she formulated: "The prospering of plants should be respected morally and anthropogenic changes in the vegetative nature should also be evaluated to determine whether they allow or harm the growth of plants" (Kallhoff 2012).

23.3 Social or Christian Ethics

Social ethics, as more or less most intensively discussed ethics model for forests in Germany, are focused on the social (Christian) conditions of a good life. This includes sustainability, for example, as an important part for the further existence of

human mankind. Thus, social ethics are not primarily focused on single persons with their isolated activities but on the cooperation of responsible persons or groups. And those responsible persons, the citizens, should be enabled by the governments and the possibilities of the different law systems to cooperate together as citizens who take care of their own assets, here forests, in a sustainable manner in this model. From the Christian point of view, this model takes into account that all life, also that of plants, is given by the creation and should be protected as an important part of it.

This approach especially Hangartner (2002) represents in Germany, when he assumes that the biblical story of the creation is not facing man the creation, but he is understood as a part of it. The creation is then entrusted to the human being for their "rule," but only in the sense that he has to maintain it and keep it. Hangartner says that the human being is "delegated"; he is appointed by God as the guardian of the world (Hangartner 2002: 382). This means that the human being is responsible for ensuring that all creatures, including plants, obtain their intended place on earth. In this way, he is obliged to preserve the "common good of creation." The "being-delegated" of the human being is so important that it becomes the fundament of human life (Hangartner 2002: 384). This enables the living beings including plants to reach a kind of harmony, a harmony between man and ultimately the whole creation (Hangartner 2002: 397).

In contrast to the individualistic reasons for the dignity, the intrinsic value or the integrity of plants that can be counted as the first experiments to release plants more tangible and make them better regulative on a general level, such as a constitution, the social and ethical approach goes far beyond when it (according to the understanding of Hangartner) seeks to involve the creation as a whole, the common good and human responsibility for it and to create a qualitative different framework for a plant and forest ethics. Because if creatures, animals and plants, are to receive their allotted space, then this approach goes beyond a static to an organic structure, such as how Alfred Möller formulates it specifically for the forest.

23.4 On the Way to Holistic Forest Ethics

Alfred Möller is regarded as the founding father on the way to holistic forest ethics in Germany (1922). Turning away from the classical theory, he demanded the move to thinking back the "continuity of forest organism" to the center. He stressed the shelf-life of the forest, biodiversity, and forest aesthetics, in short, the sustainability of all forest functions. Just the thought of this falls on the continuous mixed forest.

One of the most important pioneers of this is also Aldo Leopold, who lived about a hundred years ago in the USA and was influenced strongly by the German forestry, where they faced the "Försterwald" (clear-cut forest) critically. In his essay entitled "Land Ethic," he assumes that ethics should be extended on the interpersonal relations in times of ecological crisis: "The land ethics merely extends the boundaries of the community and includes soil, water, plants and animals, that – combined – is the country. (…) A land ethics of course can not prevent change, management and exploitation of natural resources, but in fact, it reaffirms their right

to continued existence, and that, at least in some places, in their natural state. A land ethics transform the role of Homo sapiens from conqueror of the land community to a simple member and citizen in it. This requires respect for his fellow man and also respect for the community as such" (Leopold 1992).

Thus, Leopold returns from the ruling understanding of nature in Europe since the Renaissance, according to which nature is more or less understood as a machine and that all physical processes can be causally explained mechanically, including the human body (Kather 2008). The animated organism becomes a clock mechanism without intrinsic value, judged by its functionality, so for precision and efficiency. In a nutshell, this is the philosopher Christian Wolff with the words: "A machine is a composite work whose movements are due to the nature of the composition. The world is like a composite thing, the changes are founded in the nature of the composition. And therefore the world is a machine." When nature is but a lifeless thing, which is used to satisfy human needs, then the man only occurs as an outside observer to the nature (Kather 2008). Or as Kant formulates it: "Man rises infinitely above all other living beings on earth. He is one by rank and dignity entirely separate entity of *things* as it is the unreasoning animals with which you can switch and control at will" (Kant 1968; Kather 2008).

In the meantime at least in Europe, a "reverse perspective" (Kather) held the view that nature is the foundation of our culture. It is increasingly understood as an organism, in which man is interwoven. He and all other living beings are connected like threads in a network in the biosphere. According to this understanding, it is fitting to preserve the habitat of all species, if you want to protect the organism as a whole. With every dying species, stability and regeneration ability of an ecosystem are decreased until it eventually collapses: "Every species depends on other species for food and for providing its habitat. Thus, species are connected to each other like branching rows of dominoes. Just as toppling one domino in a row will topple some others, so too the extermination of one species may lead to the loss of others, which may in turn push still others over the brink. … Nature consists of so many species, connected to each other in such complex ways, that it's virtually impossible to foresee where the ripple effects from the extinction of any particular species may lead" (Diamond 1993).

As a result, the understanding of nature as an organism and the embedding of the human being in it leads to the conclusion that the entire biosphere claims its share of respect against the encroachments of the people, the share of respect "that everything deserves that bears his purpose in itself, that means all living beings" (Jonas 1987: 46). "The entire biosphere, 'as Jonas said,' demands its share against the encroachments of the people, the share of respect they deserve that bears his purpose in itself, that means all living beings."

23.5 Holistic Forest Ethics and Indras Net

"Indra's Net" is a powerful metaphor for it. Indra, according to the Vedas, the God of the universe has an infinite net, which contains shiny and translucent gemstones in each of its many nodes. In their cut facets, all other gems reflect and also the

entire network. This net Indra has infinitely ejected from his sky palace on Mount Sumeru in all ten directions of heaven so that it encompasses the entire universe. This means that in every appearance, everything, every being, and all other symptoms are present. Part and whole contain and penetrate each other. Nothing in the universe exists, which does not have the whole universe to the condition. If only one appearance does not exist in the whole anymore, so the whole is not the same as before. Thus, the interconnectedness of all living beings and their social obligation toward the other will be emphasized, and plants are not excluded.

In this holographic reality and cybernetic model, the reality is an extensive net of relationships. Concrete object of our respect is the whole of nature, which is an infinitely differentiated system, the ecosystem and the higher biosphere. To act sustainably means, in this context, to take responsibility for the consequences of the decisions for everyone else, for nature in the present and future.

This also means that the human being is responsible for everything and everything for the human being. Myself and my life are not separable from the suffering and happiness of our world; not from the life and death of the plants, the trees, and the animals; not from the suffering and the overcoming of suffering of the people; and not from the conditions that are underlying all. This means to recognize the global human society as what it is and to live what it is: a network of infinite interconnectedness with each other.

Christianity and Buddhism is common that the world is a gift to the people and the earth is God's cosmic body, so a very sensitive organism. The human being must be assigned to it and to hear into it with mindfulness. Thus, the human being can win a new relationship to the world. He may feel that all life and the world belong together, that they are dependent on each other and that he must be reinserted into the net of the living. This network he must serve in charge of all life and the world (Kaupp).

The environmental crisis has its cause not only in certain technical imperfections or political mistakes, it is rather "an expression of our damaged, unhappy relationship to ourselves, to others and generally to reality altogether" (Litsch). The mindfulness to himself, the nature, and toward things is therefore a central rule for good life according to both Christian and Buddhist ethics.

An approximation to it can be found even in some statutory provisions, for example, in § 1 of the German Federal Nature Conservation Act. There, goals of nature conservation and landscape management are that nature and landscape have to be protected because of their *own value* and as a basis for life and health of people in responsibility for future generations.

To come again to forest ethics, with the realization of the "continuous mixed forestry" model, all the requirements of an ethically responsible and sustainable forest management would be fulfilled. This result of a centuries-old successful forest management should be implemented to ensure the preservation of biodiversity, to better address climate change and eventually be able to generate maximum returns from the forest.

On the philosophical-ethical level, the model of "continuous mixed forestry" is universal for all countries with such a kind of forest. (For the rain forest, we need a

special argumentation; thus, we should not include it in this model here.) Also on the general political-legal level, we can find the possible mutual agreement of all involved parties for this model. And finally, on the casuistic level, we do not have any problem in organizing such a continuous mixed forestry combined with an effectively working foundation.

23.6 Conclusion

The continuous mixed forest inserts the forest management in the natural system loops of the biosphere and leads to cybernetic self-optimization of forest culture by the biological "maturity" of the permanent community of the forestal living. This economically and ecologically optimal design of the economic forest can be understood as the realization of the biblical mandate to the people from the ethical side at the same time, to subdue the earth in a responsible and permanent way and to preserve it for future generations. Thus understood, the term sustainability used by Bode is comprehensive and ethically charged simultaneously. It is a holistic view of the creation, and in it the relation of man and nature. If the forest is expected to develop toward the continuous forest, it means that the responsibility for the design of its environment which is given to man as a decision maker is used by him, and he is thereby in accordance with ethical value standards to maintain, develop, and make the natural environment permanently useful.

References

Altner, G. (1992). Ethische Aspekte der gentechnischen Veränderung von Pflanzen – Gutachten erstellt im Auftrag des Wissenschaftszentrums Berlin.

Asendorpf, D. (2013). Der atmende Planet, Die Zeit, 19. September, p. 37.

Baranzke, H. (2002). Würde der Kreatur? Die Idee der Würde im Horizont der Bioethik, Würzburg.

Diamond, J. (1993). *The third Chimpanzee. The evolution and future of the human animal*. New York/London et al.: Harper Perennial.

ECNH (2008). *The dignity of living beings with regard to plants*. http://www.ekah.admin.ch/en/topics/dignity-of-living-beings/index.html.

Gill, B. (1992). Pflanzen und Ethik – Zur Kulturgeschichte der "Pflanzenseele" und den ökologischen Folgen ihres Verschwindens. B-gill.userweb.mvn.de/publika/PFLANZS2.pdf.

Hangartner, G. H. (2002). Waldethik. Theologisch-ethische Überlegungen zu Wald- und Forstwirtschaft – Eine wissenschaftliche Arbeit im Bereich der Umwelt- und Sozialethik, München.

Jonas, H. (1987). *Technik, Medizin und Ethik. Praxis des Prinzips Verantwortung*. Frankfurt/M.

Kallhoff, A. (2012). Antrittsvorlesung Wien, 23.5.2012, nach Martin Kugler, Die Presse v. 26.5.2012 (Online-Nachrichten).

Kant, I. (1968). Anthropologie § 1, BA 3–4, 407, Werkausgabe (W. Weischedel, Ed.). Frankfurt.

Kather, R. (2008). Von der Umwelt zur Mitwelt. Die Wiederentdeckung der Natur, Marburger Forum. Beiträge zur geistigen Situation der Gegenwart, Jg. 9, Heft 2., www.Philosophia-online.de/mafo/heft2008-2/Kath_Nat.htm. Accessed 17 Sept 2013.

Koechlin, F. (2009). The dignity of plants, plant signaling & Behavior 4:1, Landes Bioscience, Letter to the Editor.
Leopold, A. (1992). Am Anfang war die Erde. München.
Lötscher, A. (2000). "Würde der Kreatur" – "integrite' des organismes vivantes". Sprachanalytische Betrachtungen zur Bedeutung und Auslegung zweier umstrittener Ausdrücke, LEGES 2.
Möller, A. (1922). Der Dauerwaldgedanke. Sein Sinn und seine Bedeutung. Berlin.
Odparlik, S. (2010). Die Würde der Pflanze. Ein sinnvolles ethisches Prinzip im Kontext der Grünen Gentechnologie, Freiburg.
Richter, D. (2007). Die Würde der Kreatur. Rechtsvergleichende Betrachtungen, ZaöRV 67, pp. 319–349.
Stöcklin, J. (2007). Die Pflanze. Moderne Konzepte der Biologie. Bern.

Chapter 24
Biosphere and Syntropy: What Has Forestry to Do with?

Wilhelm Bode

Abstract Forests are more than just wood! They are the engine of biosphere syntropy, which makes it stable and livable. Forests worldwide are not only threatened by overexploitation and loss of land but also by bad forestry, which builds up cultural forests, so named age-class forests, that are neither stable nor robust without any resilience. The challenge for the forestry sector is to mimic the mechanisms of the biosphere to be culturally consistent. In Germany exists since 100 years an alternative model of forestry close to nature. This movement culminated in the apt term "permanent forest" of the revolutionary silviculture professor Alfred Möller (1991), who looked at the forest economy in its entirety as a tree and the wood to be harvested only as its fruit. That means the forests should be regenerated naturally according to the rules of continuity, without clear-cut and on the basis of mixed forest stands only used by selective cut. This economic model is now leading in more than 200 large German private forest enterprises to a cultural forest with high nature value, not only optimizing wood production but also ensuring their high profitability. The result is a very high resilience to biotic and abiotic hazards, tree species richness, biological and genetic diversity, and very high stocks of standing living wood. It is an assimilation strategy to save the global forests with high biological efficiency for future generations with its wonderful syntropic services and makes simultaneously the forests usable for efficient wood production.

Keywords Permanent forestry • Age-class forestry • Syntropy • Biosphere • Energy balance

24.1 Introduction

Around 1970 Lynn Margulis and James Lovelock developed their Gaia hypothesis. Then the Earth and its biosphere are regarded as a living being, and it can control itself by the totality of organisms, preserve and create, and even promote the

W. Bode (✉)
Dauerwald Foundation, Stralsund, Germany
e-mail: wilh.bode@gmail.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_24

conditions for more complexity. The Earth system is then capable of self-organization. Up to a certain tolerance limit meets internal and external interference by the ability to resilience and can thus stabilize.

First, the authors were ridiculed and criticized as unscientific. But the global environment and increasing skepticism about reductionist explanations seemed to confirm their theory more and more. Today, the Gaia hypothesis is nearing its probative value, because many younger findings indicate out of view of climate history her ability of self-organization and capabilities in terms of cybernetics. A previously little-studied part of these biosphere properties is the question of the role of the global forest area for stability and performance of the Earth. World's forests are thus turning its attention to the science.

This raises the question which forestry we need to take advantage of the economic forest on one hand and on the other to save and optimize the growing share of the global forest area in its biosphere functions.

24.2 Wood: A Central Resource Par Excellence

It does not require any detailed explanation of what fantastic raw material properties are typical for wood comparing to all other materials. For centuries, it provided the basic material for construction, tools, weapons, carts, household, furnishings, and much more. For the wealthy world today, it is still the private household facility with solid wood furniture (also such as antiques) as a matter of course also as a status symbol. As saw timber or chipped, frayed and chemically dissolved, wood is an universal material for countless indispensable consumer articles, for example various paper types or fiberboard insulation, particleboard and cordwood, at least for tissues made of wood, composite materials and raw materials for the chemical industry. In addition, worldwide the wood technology sciences are going on to improve the spectrum usage of the raw material and to expand it – day by day. Timber is aesthetically good to touch and has a quite different look with versatile surfaces. It is universal to deploy and to use.

Finally, wood is still the world's most important energy source for the preparation of daily food and for heating of houses and cottages in the Third World. Even in rich nations, wood is back as a renewable energy source in the focus of energy policy. As firewood for the fireplace, it is an unbroken status symbol of a pleasant living atmosphere at home. For millennia, wood was the central resource of all cultures on the globe, and it will remain as it is in the future too, because it is still the quantitatively most important renewable raw material, which is available for the cultures in long term around the globe. For this reason, the annual wood consumption (m^3/per person) is a great code number for the development of prosperous societies. In affluent Western states is an average of 1–1.5 m^3/per person for wood consumption annually, and it will be needed to ensure the high standard of living. And all other developing nations are following this trend step by step (Fig. 24.1).

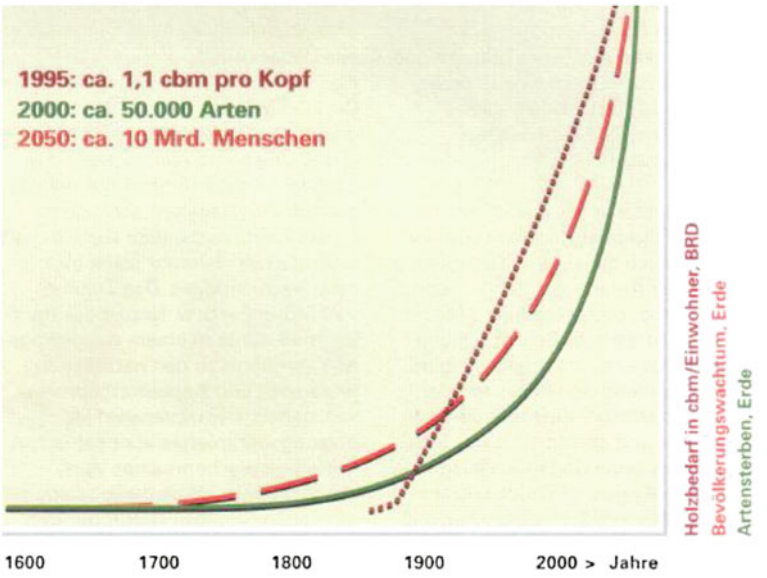

Fig. 24.1 Exponential increment of wood consumption, world population, and species extinction since 1600 (W. Bode u. CH. Heinrich, Das NABU-Waldkonzept, Bonn 1995, S. 5)

Against this background, any attempt to preserve the global forest area before wood production is unrealistic. This is regardless of the motives that somebody may have to protect the forests – all may be sincere and honorable, but for the result, it doesn't matter; the saw and axe are certainly coming. The global forest area will be mainly used for wood production and nothing else. In the near future, there are 12 billion human beings on Earth and there will be no way to use forest land for wood production and to satisfy the life needs of the people.

24.2.1 Destruction of Global Forests

It is also a fact that global forests are highly endangered – especially as a predominant terrestrial vegetation (Figs. 24.2 and 24.3).

The problem is visible if you distinguish between the developments of different regions on the globe (Fig. 24.2). Forests are disappearing, especially where they are still largely in a natural state and therefore particularly valuable in terms of biodiversity (so-called hot spots). There are particular regions where the forests in a special way affect the global climate and also guarantee the habitat of indigenous peoples.

On the other hand, the increment takes place where the forests were destroyed often a long time before. The reforestation takes place there on devastated soils and therefore also with usually only one tree species. These forests are so-called

Fig. 24.2 Annual loss of forest cover and increment 2005–2010 (FAO 2010)

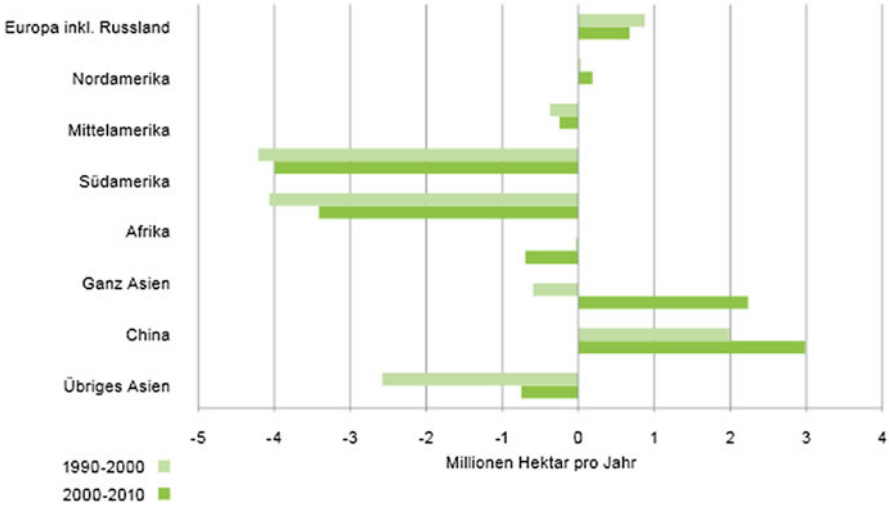

Fig. 24.3 Loss and increment of forest areas in different regions (FAO 2010)

age-class forests in forestry jargon. The result cannot satisfy finally because the results are species-poor forests, with poor morphological structure, without any timber production during the youth decades but labor intensive in the meantime and at least with the tendency to biotic and abiotic calamities before they are ready to harvest (Fig. 24.4).

In reality, it is disaster forestry, often only worthwhile because it is subsidized by the governments on one hand and on the other concentrated on the production of industrial wood, which is particularly easy and cheap to harvest with special heavy machinery.

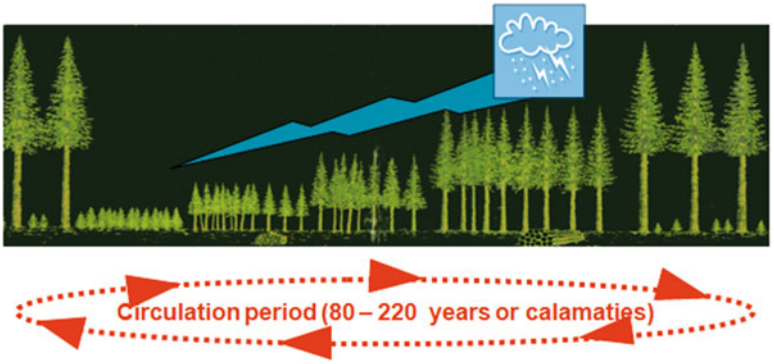

Fig. 24.4 Rotation of age-class forests (Bode 2010)

24.2.2 German Forestry: Not More Than Tree Farming

No one offends German foresters when you call them "tree farmers" because of the cardinal home country of sustainable forestry they are proud of. The result of their efforts is mainly a monocultural tree farm and not more. More than 90 % of the forest area is age-class forest as described above. The indicators of the quality state of German forestry are treacherous:

- About 70 % of all wood production is industrial round wood (for chemical or semichemical wood pulp, chipboard, etc.).
- Only about 30 % is for use with higher added value (stem wood).
- Only 40 % of the forest area is broadleaf or mixed forests; by nature it would be more than 90 % beech mixed stands.
- The mother tree of the German forests, the beech, has an area ratio of just 15 %.
- Less than 1 % of the beech forests are older than 160 years; of nature would be the average age of all stands more than 200 years (Fig. 24.5).
- Therefore, 60–70 % of all species living in the forest are endangered.
- At least only four tree species (more than 60 % nonnative tree species) occupy a share of more than 90 % of the forest area (Fig. 24.6).

But the most regrettable feature of the German forests is the susceptibility to calamities. Silviculture is at first done by storm, snow, and bark beetles and not by foresters. Since the 1960s of the last century is a steadily growing share of timber harvesting caused by calamities (Fig. 24.7). Of regular forestry now no longer can be spoken in 90 % of all forest enterprises – and that makes for the future in the face of climate change – expect nothing good.

Meanwhile Germany has the highest market prices worldwide for wood logs, while forestry is highly mechanized and the forest stands grow mainly on best natural sites comparing to all other European countries. The most of the public forest enterprises are barely profitable. Nevertheless the age-class forestry was paid by more than 95 % of all jobs by capital-intensive mechanization in the last 60 years. And an end is not in sight.

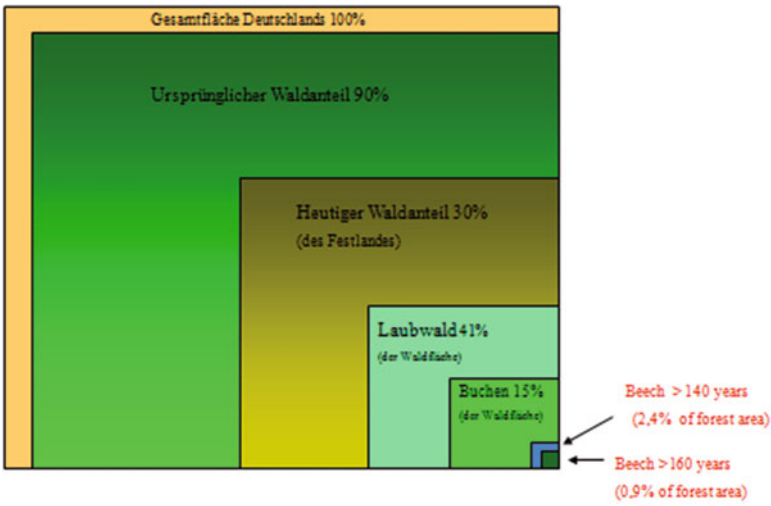

Fig. 24.5 Beech, the natural mother tree of German Forests (Sperber 2004)

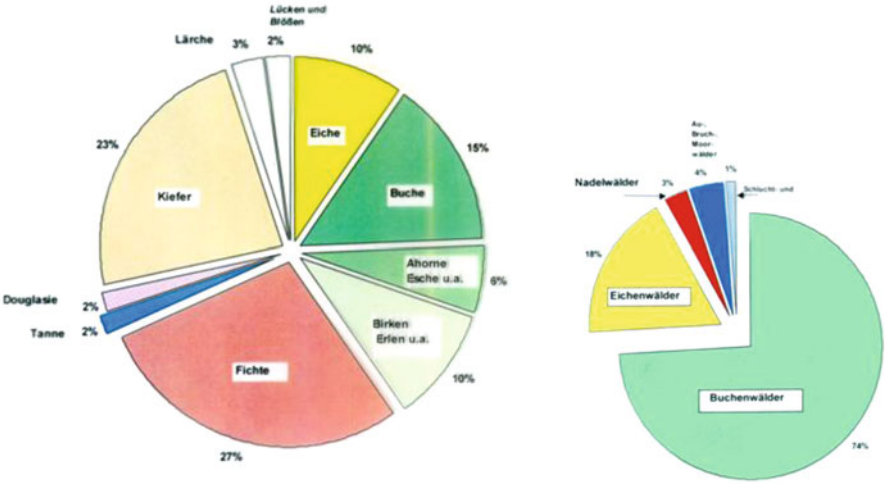

Fig. 24.6 Tree species distribution in German forests; *left* pie chart actual and *right* one natural distribution (BWI)

24.2.3 Sustainability in Age-Class Forestry

Not only the expression "sustainability" is a German invention. Today, 300 years ago, namely, in 1713, the German forester Hans Carl von Carlowitz first formulated a concept of sustainability. Let's see what has become of the forest economy in reality. The forest area in Europe is stable or even growing. This is certainly a great success in the context of the global surface loss which the global forest is suffering

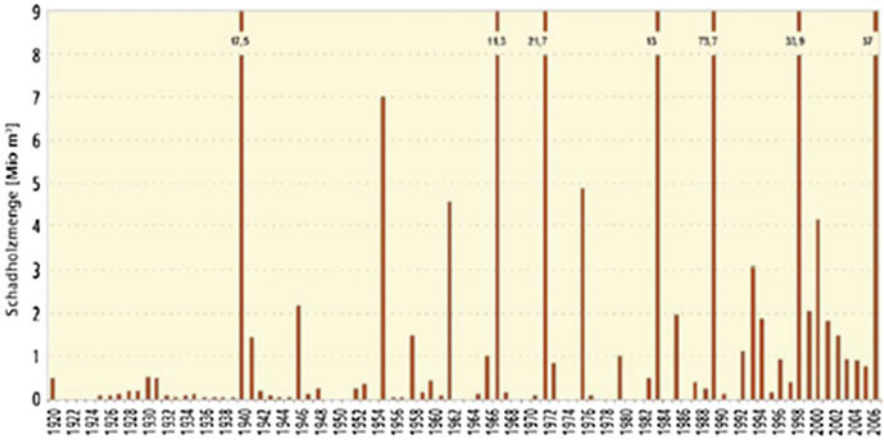

Fig. 24.7 Storm calamities since 1920 in Germany (Majunke et.al. 2008)

as before. Another advantage is the high level of wood production. Nearly 60 % of the annual demand of wood is produced domestic in a small country with one of the highest population density. But that's already all. Because from the forestry planning view, the perspective of the highly acclaimed forest sustainability is only one for pure timber mass production.

From the middle of the nineteenth century, forest planning was more and more improved. At the end, it fixed the annual usage rate per hectare, the so-called allowable yield cut. The plan is divided in intermediate cutting (thinning material) and final cutting (stem wood) and differentiated according to tree species shares, which dictates the annual total mass. This is the steady state of forestry planning in Europe. But at least every production ends with clear-cut and reboot of the following forest always started on the bare surface, with its poor ecological characteristics of a free field and the typical following problems of every planted forest – everybody knows. But nevertheless, all kinds of management plans base on easy-to-control age-class forestry; it was the only source of idea and this remained so until today. And this is also the situation worldwide in all forest sciences and universities, and it seems, if nothing really happened, that the future of the global forests is either destruction or – on the best chance – transformation to age-class forest.

The question is what about the biosphere?

24.3 Forest Production Under the Rule of Biosphere and Consistency

Most of all political strategies you can read daily qualify sustainability either as sufficiency or efficiency. But both do not help at the end. Sufficiency is good to rethink the own way of life. But life is impossible without any resource consumption, and

you will not reach a situation that does not require any resources. The same is true of efficiency. You can reduce energy consumption and remarkably use of material, but never refrain entirely from both. To use less and less material for house, table, and chairs and no use for locomotion and activities, for food and health, etc. is hard to imagine. Ultimately soon 12 billion of people consume just as much energy and material as we do today – inclusive sufficiency and efficiency. And the consumption of today is already too much: more than twice the global capacity! And there is no rest for future generations already today with only seven billion people on Earth! Therefore, social sciences give us a magic word: consistency! That is the magic trick of the biosphere to use and to produce inside the system without any damage and without using up completely all resources. We should look and find the rules of the biosphere and comply with them – that is the challenge!

24.3.1 The Rules of Syntropy

This question is that one of syntropy – just the contrast of entropy. Entropy is the physical fact that all energy divides in any closed system in direction of equal energy distribution, the level of general energy devaluation that would be standstill also of life. But fortunately the Earth is not a closed system but opened to sun energy, the prime energy input of life par excellence. And the biosphere is able to use it in a way biologist call autotrophy. That is the production of organic substances (= biomass) by the primary producers (= green plants) out of water and mineral substances. The process is named assimilation and one of its most important products is timber.

As Lovelock guessed, this performance is largely responsible for the composition of our atmosphere and allows life on our globe as we know. The process had begun when primitive life in form of bacteria populated the Earth and the gas composition of the atmosphere for higher life improved. As a result, sufficiently high oxygen content as a low carbon dioxide and methane content depend on it. We ourselves are therefore indirectly products of syntropy and depending on the autotrophy of biosphere. However, only 29 % of the total surface of the Earth is land mass, in turn, of which only about 60 % have sufficient water disposal to enable autotrophic production. These about 17 % of the total surface of Earth are the part we call Green Earth (Fig. 24.8). Ninety-nine percent of all biomass on Earth is produced on this small green part of the surface. At least only 8–9 % of the globe is possible to create forests, which in reality are the high-performance machines of all biomass production (Fig. 24.10). But actual 13–16 million hectares are destroyed yearly, and nobody knows or counts those forests which are devastated by bad forestry year by year.

There are almost exclusively the forest area and the seas, which determine the capacity of biosphere by syntropy (Fig. 24.9). The global forest stockpile is more than 90 % of the total biomass and produces nearly 50 % of the annual growth. You can see out of economic point of view the global forests as capital stock in the biosphere economy, which keeps the globe from collapsing (= insolvency). Their high

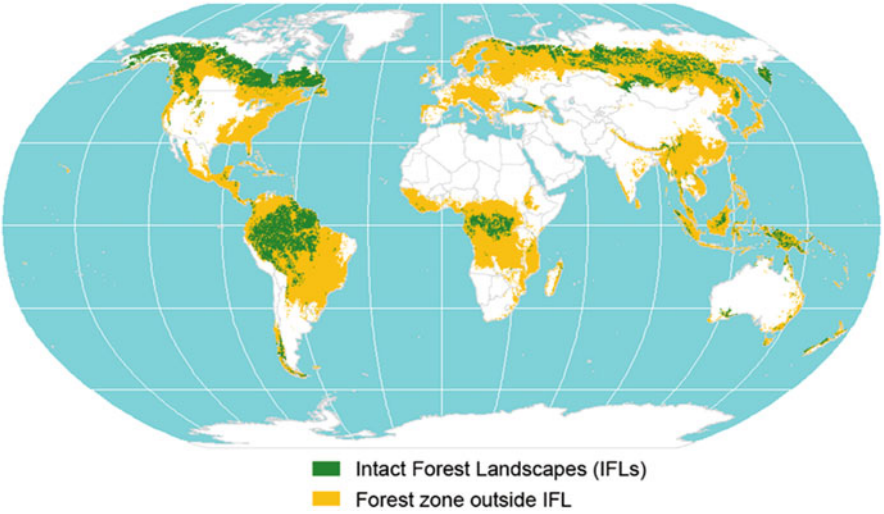

Fig. 24.8 Actual forest area on earth (World Resource Institute and Greenpeace)

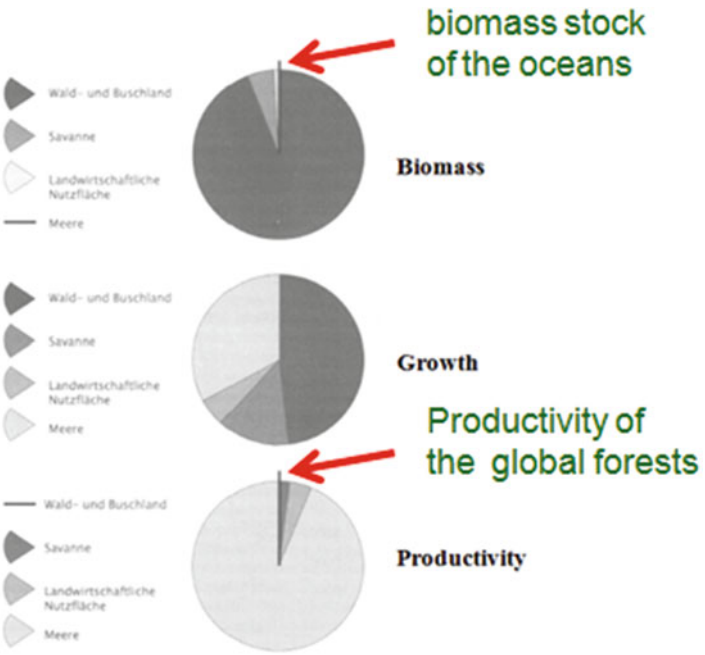

Fig. 24.9 Stock biomass, growth, and productivity of biosphere (W. Bode by G. Piel 1992)

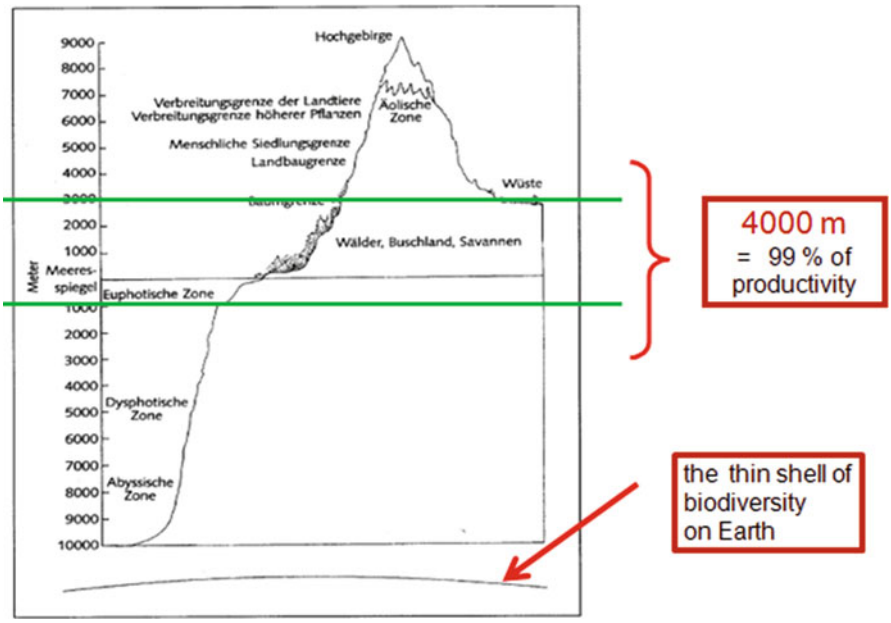

Fig. 24.10 A vertical section through biosphere (W. Bode by G. Piel)

production rate (~ the interests of the stock) is considerably limited compared to the oceans, but they can be used sustainably without destruction the capital stock.

Compared with the forests, the biomass stocks of oceans are negligible; however, they have in relation to the forests an almost gigantic productivity (~ a really banknote press) they generate from these low inventories. In other words, we should step up our produce durable wood products (e.g., our houses) and our daily food from the seas. Our way to do so is to assimilate to the biosphere. Judge for yourself whether we do that sustainably with previous methods. All we can say as an intermediate result is that the sustainability of age-class forestry is not sufficient for this purpose.

24.3.2 The Rules of Biosphere

Undeniably, the biosphere is sustainable in the broadest sense, even continually improving by evolution. It is a remarkable efficiency with which it delivers its services. As shown, it does so only on a small horizontal fraction of the global surface and then only in a very thin shell, in vertical dimension only 0.3 % of the diameter of the globe (see the section of a circle with a diameter of 1 m in relation to the Earth, Fig. 24.10: the thin circular arc below). There are only 4,000 m height differences which run 99 % of all biomass productions and also store the stock. It is

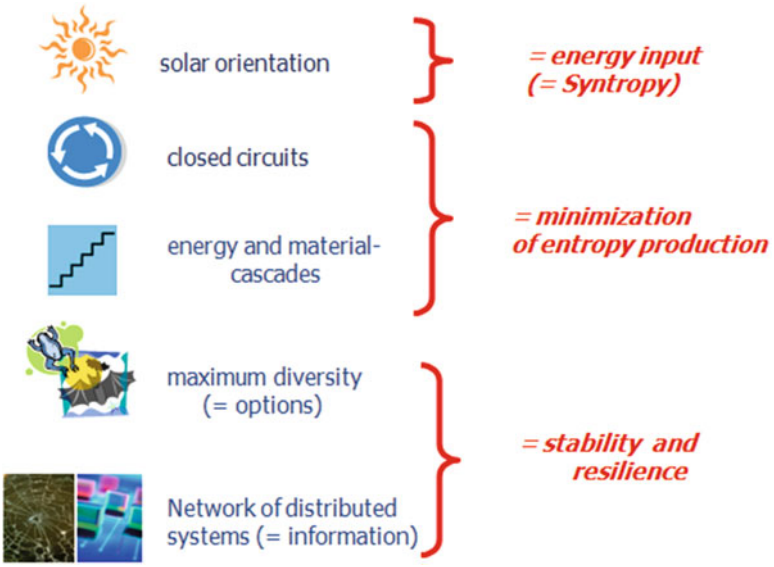

Fig. 24.11 The mechanism of biosphere (Bode 2013)

exactly the vertical and horizontal habitat of the globe, which is also identical to the habitat of human culture. Should we not know which mechanisms the biosphere has developed to do this?

There are not more than five principles which enable the biosphere to this syntropic productivity (Fig. 24.11). And Lovelock was right that these principles are not only the motor of biological syntropy but its self further optimize by that what biologists call evolution:

1. The base of this process is the use and storage of sunlight by the way of assimilation of green plants (= autotrophy). All production processes are optimally aligned to the sunlight out. It is the principle of maximizing the energy input (= syntropy).
2. Wherever possible the growth and degradation processes are going on in circuits. The best example of this is the autumn leaves fall of the trees in the temperate zone and the rapid decomposition by soil organisms. The remineralized nutrients are already available for the plants in the following summer.
3. All operations that cannot be organized in closed circuits are processed in cascades. That is, a waste product of the first production stage is the input of raw material of the second and so on. Until the very end, a very small residue is left, which is deposited without damage. Principles No. 2 and 3 are the way to minimize entropy with tendency toward zero.
4. Each life niche that opens is as soon as possible occupied by existing organisms. This requires a wide variety, which in turn drive the evolution by mutation to improve and optimize the utilization of all life niches. So the biosphere produced

the relatively highest species diversity that is possible under the concrete given conditions of life.

5. Finally, the biosphere links all life processes to ensure the maximum possible information that provides all the best processes for each reaction in case of failure. It is the genetic diversity within species and as high as possible variety of habitats (biotopes), which accomplish this tremendous power and remain in the waiting state interference to give the right answer to any damage. Principles No. 4 and 5 are the trick of biosphere to organize stability and resilience. Resilience is the provision that all interference cannot be prevented and why it is so, to keep the damage as low as possible and to have good starting conditions for the repair. It is a technique of Yin/Yang in the biosphere.

Anyone who has already dealt with the beauty and diversity of natural forests knows that these principles are clearly just in the global forests. Forests are the prime example of the biosphere and how it works. It would be surprising if facing a 300-year-old forest science in such countries as Germany, no one would have asked the question how you could produce wood in accordance with these principles of nature. There were some foresters, against the backdrop of increasingly frequent calamities since the mid-nineteenth century, asked what they should do differently. But every time, they were ridiculed by the majority of their colleagues. Until very recently, it has harmed the career when somebody pleaded a silviculture with nature and not against. Just now from the point of view of climate change, these conditions are slowly changing.

24.4 Permanent Forestry: Forestry of the Future

A German forestry professor who asked this question was a mycologist named Alfred Möller, who had previously explored for years by order of the Emperor the tropical forests of the Amazon. In his revolutionary writing ("The idea of permanent-forestry," 1923), he criticized the manifest error of age-class forestry and called for the complete turning from clear-cutting. He looked at the forest in its entirety as a tree and the wood to be harvested only as its fruit. That means, the forests should be regenerated and used according to the rules of natural continuity, by natural seeding, without clear-cut, harvested only by selective cut and only on basis of mixed forest stands. These ideas are now nearly 100 years old but the most of the forests are still managed as age-class forests. This fact is surprising because the successes of the few private permanent forests in Germany are highly visible, rich, natural, stabile, and even today the most profitable in Europe, and this has been arranged first by nature.

24.4.1 The Actual Concept of Permanent Forestry

A modern definition of permanent forestry of today includes six strict rules (respectively rules of abstinence), so as not to interfere with nature:

1. Never clear-cutting! A clear-cut is always present when the diameter of tree-free area is larger than the adjacent existing height of neighbor stands (bioclimatic definition).
2. Absolute priority of the natural seeding from mature mother trees! Only to enrich previous, lost tree species should be planted in addition (mixed forest principle).
3. Selective cut exclusively with soft (gentle) techniques (cable) or muscle strength (horse and man) according to the motto: Always the bad has to fall first! The better one has to continue to produce (stock maintenance).
4. Consistent protection of the soil! The ground may only be used by logging machines on specified drivelines (min. 30 m distance) or by soft techniques.
5. No biocides and no chemical fertilizers!
6. Consistent approach to nature conservation within the management system and habitat accompanying deadwood strategy (5–10 % of big stems may not be used and remain as habitat wood on the root forever).

In Germany, a permanent forest is achieved only by transformation of age-class forests. Currently this is done to less than 10 % of the forest area, and the silvicultural approach is shown graphically in Fig. 24.12. Indeed, since about 100 years, a few large private forest owners in the hand of noble families followed the rules of Möller, and these are now the most profitable and nature's richest forest companies in Europe. If you ask, why do not follow more forest owners this meaningful and fruitful example, so it is partly due to the slowness of forestry sciences to leave their idea of birth and other sided at the very forest ownership structure in Germany. More than 50 % of the forests belong to the countries and communities. Do not

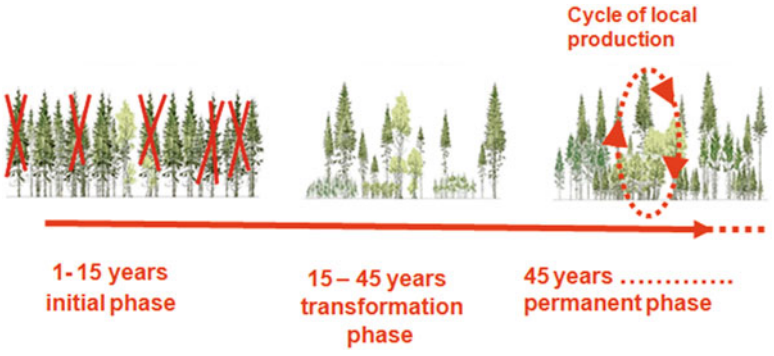

Fig. 24.12 Transformation of an age-class forest into permanent forest without clear-cut (W. Bode 2010)

mind if they make deficits, because they cover them by compulsory levies of citizens through taxes.

Recently, about 45 years after the beginning of transformation, harvesting is only by rotation in place, i.e., without damaging the forest structure. The structure should exist forever! Therefore, it is named permanent forest. It guarantees Möller's required burden of continuity and allows all forest-bound organisms to differentiate itself and to mature in high diversity. The trees are harvested not by age, but according to technical maturity and at the time of their best prices.

24.4.2 The Conformity of Permanent Forest Economy and Biosphere

After these 45 years, the transformed forests lose their visible horizontal organization through different forest stand types. All types flow more or less clearly at one uniform mixed forest type together gradually with more and more mixed tree species. A vertical and morphological structure secures the highest of rain, low transpiration, a differentiated vertical light profile with the highest utilization of sunlight, different life niches, and, not least, a high stability and resilience.

Its vertical structure above is reflected in the tiered root system in the ground. Therefore the different big, old mother trees do not compete for the same nutrient horizons but roots in different depths. After the harvest, the roots of the younger trees grow into recent root canals of the harvested mothers and thus open up the deeper horizons. The vertical structure ensures optimum physical and chemical soil conditions that are prerequisite to promote soil organisms and thus again trigger positive feedback. But where are the disadvantages of this wonderful system?

- The disadvantages are very manageable: In the early initial phase for 5–8 years, more thinning wood and less stem wood are harvested. This can reduce the returns a little and increase the costs. At the latest after 12–14 years the result (= operating profit) achieved the previous level. Then the permanent forest produces better and thicker stem wood than the age-class forestry.
- Another main problem is the hunting in Germany. The unnaturally high density of roe deer and red deer makes the natural seed grow in almost anywhere impossible. It must be hunted sharp and the conflict is successfully passed with the hunters.
- There is also the fact that it does not longer need the forest science of today which reduces all problems to few isolated aspects always with the goal of making forests more easily usable for technology. Forest sciences in EU try to solve problems with reductionism and technocratic consolations. Instead, we need a system of forest research, looking at the forest in its entirety and investigating the effects of disorder which produce conventional management everyday. Instead, we need a forest science biologically intensifying the production power of the forest and not wasting more capital and fuel.

- Not least, the forestry will need to take a big step backward, namely, back to the best technique used centuries ago: the muscle strength of forest workers and working horses. A few decades ago, manual labor in the forests was almost completely replaced by big machinery, causing severe damages to the soil. These are a heavy burden that must be withdrawn soon. It happened just at that time when the "Waldsterben" in Germany began and first changes in climate were felt. The foresters did not consider this signal of their own problem child as a call to themselves but as a warning to society to combat emissions and to let them make at rest. At the same time, they accelerated their efforts to replace forest workers by energy-guzzling machines.

But biosphere requires a gentle technique for the forests. Like for all economic systems, it is a must: forestry needs energy balance for its products and its management systems (Fig. 24.13). The energy and capital expenditure of permanent forestry is overall absolutely very small but only a little bit more with view to harvesting. For this, the owner pays a little more effort wage for its workers and the use of soft techniques. Therefore, he does not earn soil damages. At the same time, he saves a lot of costs for forest protection, less calamities, no planting, less thinning, no chemicals, etc. The cultural system of the permanent forest fits perfectly into the

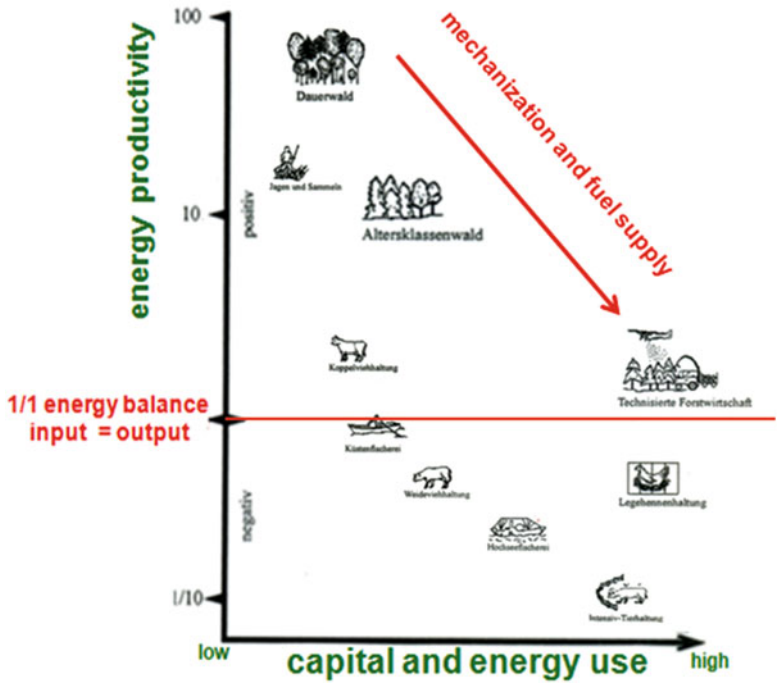

Fig. 24.13 Energy productivity of different types of land use (W. Bode 2013)

mechanisms of the biosphere and, in spite of high productivity, offers approximately 80–85 % of all wood bounded species with adequate living niches. Permanent forestry is an assimilation strategy, i.e., as cultivated forest consistent to the biosphere and a cultural strategy for syntropy on Earth.

24.5 Conclusion

Compared with all other sectors of economy forestry can best fit into the processes of the biosphere and imitate them. Its energy productivity (Fig. 24.13) reveals whether forestry has correctly understood the biosphere. But unfortunately Fig. 24.13 shows that the world forestry is running on the way, just in the opposite direction. We should learn from biosphere and from the power of syntropy now – or we have to pay in the future. Permanent forestry is in fact a realization of the biblical order to subdue the Earth in a responsible way and to obtain it permanently for future generations.

References

Bode, W. u. Heinrich, Ch., in: Naturschutzbund Deutschland (Hrsg.), Das NABU-Waldkonzept, Bonn 1995.

Bode, W. by G. Piel, in: Bode, W. (Hrsg.), Naturnahe Waldwirtschaft, Holm 1997.

Bode, W. (2010). Das NRW-Bürgerwaldkonzept im Auftrag des Naturschutzbundes Deutschland NRW, Düsseldorf 2010. https://nrw.nabu.de/imperia/md/content/nrw/stellungnahmen/das_nrw_buergerwaldkonzept.pdf

Bode, W. (2013). In W. Bode (Hrsg.), *Naturnahe Waldwirtschaft*, Holm 1997.

BWI, Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (Hrsg.). (2005). Bundeswaldinventur II, Berlin.

FAO. (2010). aus: WWF (Hrsg.), Die Wälder der Welt – ein Zustandsbericht. http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF_Waldzustandsbericht.pdf

Lovelock, J. E. (1979). *Gaia – A new look at life on earth*. Oxford: Oxford University Press.

Majunke, C., et al. (2008). Sturmschäden in Deutschlands Wäldern von 1920–2007, AFZ-Der Wald 2008, S.7.

Möller, A. (1991). Der Dauerwaldgedanke – Sein Sinn und seine Bedeutung. In W. Bode (Hrsg.), kommentierter Reprint, Oberteuringen.

Sperber, G. (2008). In Bundesamt für Naturschutz (Hrsg.), Naturerbe Buchenwälder – Situationsanalyse und Handlungserfordernisse, BfN Skripten, Bad Godesberg 2008.

World Resource Institute and Greenpeace, in: Wikipedia, http://en.wikipedia.org/wiki/Intact_forest_landscape

Chapter 25
The Case of Biwako Quasi-National Park: An Analysis of Sustainability and Development

Naoko Katano and John XXV Paragas Lambino

Abstract In this paper, we analyze a facet in the transformation of the anthropo-environmental relationships that occurred during Japan's modernization by investigating the establishment of natural parks through the case of the Biwako Quasi-National Park in Shiga Prefecture. The paper aims to clarify the processes that attempt to sustain the reproduction of labor power through the natural park system. These processes are (1) the earmarking land with outstanding scenery for leisure and (2) the allocation of time for leisure.

Keywords Natural parks • Local development • Sustainability

25.1 Introduction

Nature conservation for the sustainable use of resources has always been a primary concern for human beings since ancient times. Even so, this has remained a controversial issue that involves many questions. What has to be conserved? To what goals should "sustainability" be pursued? How should human beings intervene in nature in order to maintain a sustainable ecosystem? It is difficult to come up with a clear answer to any of these questions.

With regard to nature, the authors propose that it is not about the conflict between "protection" and "development." For one, we think that there is a need to abandon the assumption that there exists "nature" that is untainted by human beings since human beings are never separate from and are always part of nature. In this paper, "nature" means both "external nature," i.e., the human environment including living

N. Katano (✉)
Architects Regional Planners & Associates, Kyoto, Japan
e-mail: katano-naoko@hotmail.co.jp

J.X.P. Lambino
Kyoto University Graduate School of Economics, Kyoto, Japan
e-mail: johxn.lambino@econ.kyoto-u.ac.jp; lambinoxxv@hotmail.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_25

and nonliving environment, and "internal nature," i.e., the human being as a biological organism. Since we see human beings being part of nature, we are reframing the discussion from the dichotomy between protection and development toward the social structure that is bringing about a transformation in how "nature" is being used.

So far, most of the researches on natural parks in Japan have focused on a number of well-known national parks. The arguments have tended to focus on the conflict between protection on the one hand and development on the other. Meanwhile, we rather think there should be more structure-based analyses about natural parks while treating their establishments as a social phenomenon within the dynamics of capitalism.

In this paper, we analyze a facet in the transformation of the anthropo-environmental relationships during Japan's modernization by investigating the establishment of natural parks through the case of the Biwako Quasi-National Park in Shiga Prefecture.

By considering the case of Japanese National Parks System that would include Quasi-National Parks, the paper aims to clarify the processes that attempt to sustain the reproduction of labor power through the natural park system. These processes involve the following. First, land with outstanding scenery is assigned for leisure. Second, time is allocated for leisure. The first one indicates the fragmentation of external nature through spatial categorization and separation. On the other hand, the second one indicates the fragmentation of internal nature through temporal categorization and separation.

The commodification of external nature—i.e., the natural environment—has taken place to expand the control of lands, including the natural resources in them, to expand profit. Cultivation of higher-yielding crops has been continuously pursued in agricultural lands. At the same time, massive conversion of agricultural lands toward nonagricultural use has also been carried out in pursuit of higher profit rates. In contrast, the commodification of internal nature as labor power has continued to proceed in terms of expanding control over human beings.

As a consequence, there is a dramatic increase in the consumption of natural resources and in the discovery and use of new resources. Berque (2011) argued that the identification and recognition of landscapes and vistas were accompanied by their commodification and monetization.

25.2 Leisure and Scenery for the People

We would like to clarify how the identification of landscapes as superior and the assignment of time to enjoy them—i.e., through leisure—have proceeded from a global historical viewpoint. The most significant phenomenon is the regulation of time for labor that came with industrial revolution. In the beginning of the nineteenth century, work time and non-work time had not yet been clearly separated and distinct from one another. However, as a result of incorporating workers into the capitalist mode of production, work became considered as the highest priority over

all others. During this time, "work time" and "leisure time" became distinctly separate. These were attempts within the capitalist mode of production to deploy resources most efficiently.

A reduction in work hours was followed by the growth of leisure-related industries that aimed to provide rationalized leisure to the laboring class. National indoctrination facilitated the regulation of non-work time (Sato 1990).

Modern alpinism and the subsequent boom in outdoors activities exemplify this phenomenon. Beginning in the eighteenth century, praising nature such as the Alps became popular, and in the second half of the nineteenth century, alpinism became popular among the upper classes in Europe. Outstanding mountains—e.g., Mont Blanc and Matterhorn—were admired for their beauty as sanctuaries in nature. Alpine clubs in Switzerland and France made mountaineering maps, laid down the paths to the summit, and standardized techniques for mountaineering. Consequently, mountaineering ceased from being dominated solely by ambitious alpinists. Practical techniques and knowledge about the mountains and mountaineering were imparted to members who wanted to go to the sites. Corbin (2010, pp. 126–129) has pointed out that the schedule and itinerary made by the members were convenient for tourists who want to go around in a day and discover fine landscapes. Rapidly, mountaineering became popular as leisure for the public, and at the same time, tourism emerged as a promising industry in the rural regions.

"Rural landscapes" and "mountainous areas" among others were recognized as destinations for leisure. They were developed such that they became places for people to spend time that was qualitatively different from their "everyday lives". Leisure or the time spent in these places became a "national lifestyle norm." The time for leisure was differentiated from the time for work.

Non-working hours were standardized and incorporated into a system such that people would consume them efficiently for maximum satisfaction. In this societal structure, people were encouraged to travel to the beaches or to the mountains. This generated both the systemic demand for and supply of leisure time that is necessary for leisure-related industries.

In other words, leisure was developed on two wheels: the production aspect, i.e., to reproduce labor power efficiently, and the consumption aspect, i.e., to generate the amount of consumption that has to be equal to the amount of production of consumer goods. To realize these, the establishment of time and space for leisure was a major issue in public welfare. As a consequence of this process, natural parks became more accepted by the society.

Along with the popularization of leisure was the emergence of the prominent movement to conserve nature. For example, the British philosopher John Ruskin argued for the preservation of spaces for contemplation and regeneration to be open and accessible for citizens. His idea led to the National Trust Movement. In the United States, as a result of the passionate efforts by nature activists, the national park system was established for the leisure of the people (Sato 1990, pp. 58, 72). Both of these movements aimed to conserve nature and rural landscapes for public use. This means that these ideas assume that numerous people—in other words members

of the labor class—have enough time to enjoy viewing outstanding landscapes and other activities in these places that are separated from their ordinary lives.

25.3 Birth of Japanese National Parks

The Japanese National Park Law was established in 1931. Under this law, 15 national parks—including three parks in Taiwan—had been designated as such by the end of World War II. It aimed to conserve nature by establishing the natural park system. The establishment had the following objectives: (1) to improve national welfare and promote consumption, (2) to advance leisure-related industries and to expand the business operations of tourism-related companies (e.g., railroad companies), and (3) to unify different nations to facilitate their colonial administration under the Japanese empire.

After the industrial revolution in Japan, a massive labor class appeared. The labor class contributed to the democratic movement and to the improvements in labor problems during the Taisho era. As the length of the work time decreased, proper ways to spend leisure time became the focus of the government-led social welfare policy. The government employed a leisure policy through the education of the people. Indeed, one of the purposes of the 1931 National Park Law was in the same direction (Murakushi 2005, 2011).

Dr. Tamura, who contributed in establishing the Japanese national park system after studying the national parks in the United States, focused on the leisure of the labor class and their education. He defined necessary features of national parks as: (1) having excellent natural landscapes, (2) having the ability to prioritize labor and for the laborers to enjoy their non-working time in nature, and (3) open to the public for leisure (Tamura 1937, 1938).

In addition to these, economic incentive was also important in establishing the national park system. From 1921 to 1930, the Japanese Imperial Diet received 168 proposals for particular areas to be designated into national parks from various parts of the country (Seta 2009). During the same period, companies under tourism-related industries such as railroad companies were developing rural regions with hot springs or with famous mountains. They aimed to attract international tourists as a preparation with the hopes of holding international expositions and the Olympic Games. But due to war preparations toward World War II, the government budget was limited for national parks, and little investment was made on infrastructure.

On the other hand, as Japan's modern landscape emerged, outstanding nature sites were used to nurture Japanese nationalism. Shigetaka Shiga, who made the notable achievement of introducing modern alpinism to Japan, emphasized the beauty of Japanese landscapes in his most important work *Nihonfukeiron* (*On Japanese Landscape* in the English language). He praised Japanese landscapes while using western aesthetics and claimed their superiority over other Asian and Western ones. In his arguments, he tried to promote the concept of a unified national

boundary to support the creation of an integrated identity of the peoples under Japanese administration.

The latter half of the 1930s saw the rapid strengthening of the connection between national parks and nationalist ideology. In 1938, the administration of national parks was transferred to the Ministry of Health from the Ministry of Education. This meant that the administration was incorporated into the *kosei kenmin undo*—i.e., the national scale welfare movement—to promote people's health as part of the war preparations. National parks were used for these activities. There were also many cases that emphasized that the national parks being the locations of the legendary stories about the Japanese imperial family. The landscapes were used to propagate the legitimacy of the emperor and the authenticity of the Japanese nation.

The authors would point out two implications from the history of the national parks system in Japan. First, the national park system was created by the national government as spaces to be separated from daily lives. Second, whether its purpose was to enhance nationalist ideology or to attract tourists, the government tried to harness new resources from nature and to provide opportunities for companies to generate profit from them efficiently. After the end of World War II, national parks fell under the control of the General Headquarters of the occupation (GHQ). The GHQ was initially intent in applying American-style national park system to Japan with the purposes of Japanese demilitarization and democratization. The designation of the Ise-Shima National Park was the perfect opportunity to show their authority all over the country. This is because it includes the Ise Shrine, which is an essential and important shrine in Shinto and Emperor worship. Moreover, instead of *kosei kenmin undo*, exercises and recreations were delinked from military objectives. The GHQ demanded the Japanese government to prioritize the conservation of nature and landscapes because they wanted stronger management of national parks.

However, the United States switched its strategy in the Far East because of the Korean War and the inadequate effectiveness of its dollar spending policy. The United States saw that it was necessary for Japan to function as a "seawall against communism" by being economically independent and by accepting foreign investments (Okada 1989). On the other hand, the major objective of natural parks was transformed toward the promotion of public use. They were different from the American standard of prioritizing natural landscapes, since in the case of Japan, access from the urban area was considered more important. New parks were designated all over the country, and the total area was increased so that people from different urban areas would have equal opportunities in visiting a natural park. Based on national land planning, high industrial agglomeration proceeded in limited regions. In less-developed regions, the development of tourism-related industries was one way to improve the regional gaps in living standards. The number of natural parks rapidly increased (Fig. 25.1). At the same time, for the public to access the natural parks, it also became necessary for them to have the resources to do so.

To complement the supply side, consumption was encouraged at the same time. In 1962, as "Reduction of Hours of Work Recommendation" was adopted by the ILO, labor movements in Japan became more active to reduce the working hours.

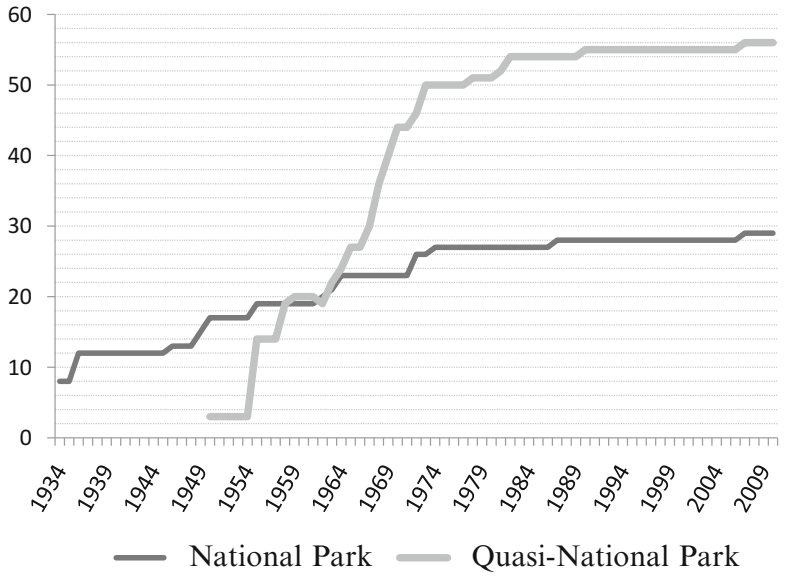

Fig. 25.1 Total number of national parks and quasi-national parks in Japan (Source: National Park Association of Japan 2011)

Around the same time, the Japanese government started promoting "social tourism" as a national welfare policy (Economic Planning Agency 1964). This included the construction of *kokumin kyuka mura* or villages for people's recreation in national parks and quasi-national parks from 1961. These villages offered accommodations at prices that would enable people from the labor class to go on vacations. The investment for these accounted for 18 % of the total expenditure for nature park facilities (1961–2003) (Kaji 2009). In this period, most Japanese people started to think that they belonged to the "the middle class." Their consumption preferences were being homogenized and standardized to fit the images of the middle class lifestyle. The broad standardization of lifestyle was successful within the Japanese populace. All Japanese believed that they belonged to the middle class as expressed in the Japanese term of *ichiokusochuryu* meaning "100 million in the middle class." This started during the era of high economic growth in the 1960s and stabilized in the 1970s. The 1960s saw how middle class consciousness promoted consumption without real contraction in the income gap. Along with this, the expenditure for leisure increased gradually. Leisure consumption became a part of the national lifestyle. The bottleneck in consumption was overcome.

At the same time, Japan through various policies experienced extensive conversion of land use and significant transformation in the industrial structure. Farmlands and forests were converted to roads and industrial lands. Ultimately, because of this, the country became highly dependent on other countries for food, timber, and fuel.

25.4 Biwako Quasi-National Park

The authors would like to take the specific case of how the transformation in the use of natural resources was advanced in Biwako. Since the olden times, Biwako has been continuously admired for its beautiful landscape. Its designation as a quasi-national park however had a different meaning compared to its significance for the beautiful landscape. For one, the designation was seen as a way to promote greater use for leisure. Another one was that the designation was seen as a way to encourage investments in areas connected to the leisure industry in Biwako's less-developed regions in the north and the west.

Biwako is the largest freshwater lake in Japan and a popular destination for leisure for the people from the Keihanshin metropolitan region—i.e., Kyoto, Osaka, and Kobe. In 1950, the lake and the surrounding mountainous areas were designated as a quasi-national park (Fig. 25.2). Biwako Quasi-National Park is a very popular destination such that it receives the third largest number of visitors among the 30 national parks and 56 quasi-national parks in Japan.

Since the 1930s, Biwako has been targeted for comprehensive and integrated development with the aims of securing water resources for industrial use and of

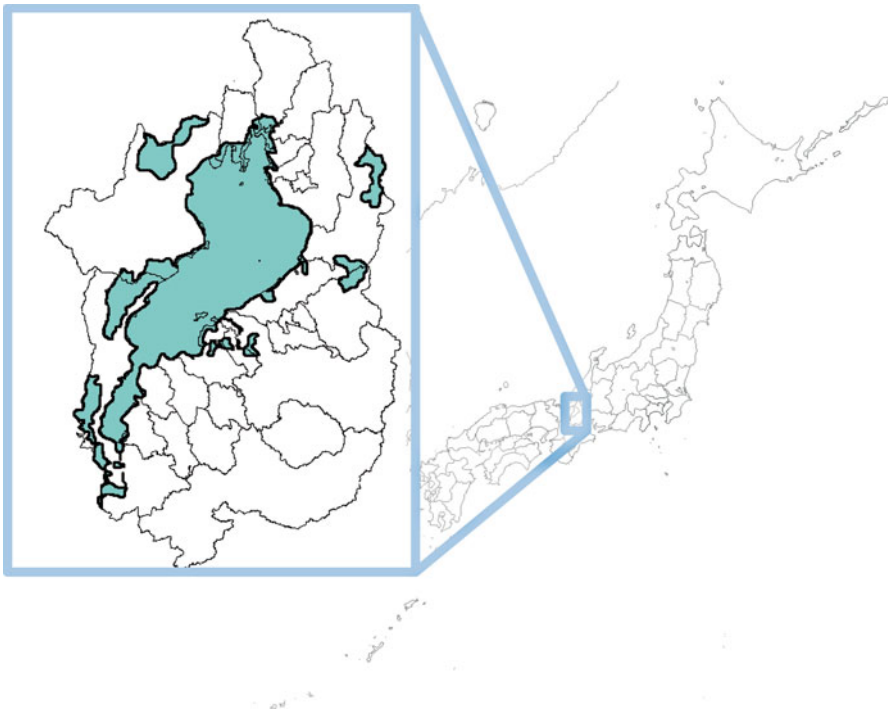

Fig. 25.2 The location of Biwako Quasi-National Park in Shiga Prefecture (Source: Shiga Prefecture website: *Fureai* map)

improving flood control. One of the projects that caused considerable impact to the natural environment was land reclamation from the lagoons that surrounded the mother lake and in which freshwater fishing and reed production thrived. These wetlands were continuously reclaimed since the 1940s due to the drive toward increasing agricultural production.

Ozawa (2011, pp. 50, 85) made an analysis of the landscape planning of the Biwako Quasi-National Park from the viewpoint of landscape architects. He emphasized the value of lagoons around Biwako as a resource for tourism. When Biwako was about to be designated as a quasi-national park, he pointed out the conflict between "agriculture and reclamation" on the one hand and "tourism and conservation" on the other hand. He concluded that areas that meet one of the following conditions could be included in the quasi-national park: (1) outstanding vista of the shore and (2) mountains suitable for skiing.

However, the designation of Biwako as a quasi-national park was based on the plans intended to make the park as a *dorokoen* based on parkways developed in the United States. In fact, it was Dr. Tamura along with other landscape architects who introduced *dorokoen* before World War II. He and the others attempted to apply the *dorokoen* model to Biwako when they nominated it as a possible national park (Sekiguchi 1937).

Moreover, based on the tourist development plan of Shiga Prefecture, there were plans to connect tourist attractions along the lake's shore with the driveway. It was supposed to make driving itself as a new leisure activity. The authors think that this idea was also reflected in the natural park management. The features as a *dorokoen* obviously appeared in the modification of the park boundary and regulation in 1960. Along with magnificent sceneries such as the lake island called Chikubujima, the lake's shore and adjacent lands along the parkway were also designated as special areas to promote conservation and public use (Shiga Prefecture 1949, 1954, 1960, 1961).

Following these policies, the Japanese central government, along with the prefectural government and municipal governments in Shiga, invested in social capital in the area such as in building paved roads and in establishing villages for people's recreation.

At the same time, railroad companies took initiatives in promoting its designation as a national park. They were hoping that this would help their businesses as a result of better infrastructure. Naturally, prefectural governments cooperated with them to attract company investments to develop new resources.

What is clear was that national park regulations were not able to preserve and protect the lagoons. Instead, the construction of paved roads to improve access was prioritized to encourage more people to come and to enjoy the park. Out of 40 lagoons, 16 lagoons with an area of 2,521 ha were reclaimed by the 1960s. Twenty-seven percent of the lake's shore was covered with artificial structures such as concrete. The haul of fish decreased from 10,000 tons per year in 1955 to 1,560 tons in 2009 (Shiga Prefecture 2012).

The government tried to compensate the communities for the loss of lagoon resources by investing in infrastructure and by resettling the people to the reclaimed farmlands. However, in the end, the government's compensation program could not

recompense for the harm caused by the fracture of the day-to-day and unceasing connection of the people to the lake, by the decrease in fishing resources, and by water pollution (Kada 2003).

25.5 Gonza in Nishinoko Lagoon

There are recent attempts to create a better relationship with Biwako. Activities in Gonza, which is an inner lake island in Nishinoko lagoon, are representative of these attempts. Gonza is a 2.5 ha island with farmlands. Many years ago, there were seven more islands in the lagoon. All of them but Gonza disappeared due to reclamation. Gonza is located 500 m from the shore. Farmers have to use boats to carry farming instruments and harvested rice. The farmlands are very inferior from the viewpoint of efficiency in terms of quantity. The island was almost a forgotten place before. This changed when it received public attention as a consequence of its designation as a cultural landscape by the central government and by Nishinoko lagoon's designation as a Ramsar site (wetland of international importance).

Motivated with these honors, the local people established an NPO in 2008. They decided to protect the cultural landscape by growing rice that was developed in Shiga Prefecture for the production of *sake*. They have been concerned with the ecosystem of wetlands, so they have allotted lands for reed production and nurtured freshwater creatures. As they try to develop alternative ways for Japanese agriculture to survive, they have opened their activities to the public. They invite people to participate in events usually held in weekends such as in rice transplanting in early summer and rice harvesting in autumn (Gonza: suigo wo mamorisodateru kai website 2013).

Not only are the farmers revitalizing traditional agriculture, they are also trying to develop an approach to agriculture that incorporates leisure activities with the ultimate aim of reconstructing a closer relationship between the lake and the people and among the people.

From the authors' perspective, they are attempting to remove the distinct borders between conservation and human living. Their activities are not classified solely as labor, but they would also have to include consumption, education, and activities that reproduce a harmonious environment. Their activities transcend the categorization of activities designed for modern human beings only as laborers.

This outstanding attempt in Gonza is not directly associated with natural park regulations. But this type of activities driven by the local community is especially important since the natural park system is expected to be reformed and be placed under a local environmental governance system with the aim of revitalizing the local regions and encouraging people to realize the sustainability of their localities.

25.6 Conclusion

The authors think that the concept of "conservation" as defined in the natural park system has pushed forward the fragmentation of external nature by spatial definition and categorization through the designation of beautiful landscapes as national parks. It has also pushed forward the fragmentation of internal nature by temporal categorization and separation in creating a clear distinction between work time and leisure time. We think that the movement in Gonza is opposite to spatial and temporal fragmentation and may give us a clue on how to build a sustainable relationship with nature.

The history embedded in the establishment of natural parks in Japan reveals that the expansion of the leisure industry required the assignment of a commodity value to the natural resources and the formulation of policies that secure leisure time. In other words, what this entailed was that nature and time have to be standardized and homogenized for regulation toward the most efficient and rational way. This efficiency had been a factor in the transformation not only of lifestyles and food cultures but also of nature.

Right now, protected areas including natural parks cover 12 % of all the total land area on earth. In Japan, 14 % of the lands are designated as natural parks. For sustainable development of these areas, it is necessary that conservation of nature is not isolated from the lives of visitors and people in surrounding regions.

Acknowledgment This paper is based on the master thesis of Naoko Katano at the Kyoto University Graduate School of Economics. She would like to show her gratitude to her former academic supervisors Prof. Okada and Prof. Hisano. Finally, she would like to appreciate her present company ARPAK, a Kyoto-based independent consultancy company specialized in supporting regional sustainable development, in encouraging her to develop her research.

References

Berque, A. (2011). *Hukeitoiu chi* (N. Kioka, Trans.). Kyoto: Sekaishisosha.

Corbin, A. (2010). *Reja no tanjo* (New ed.). (K. Watanabe, Trans.). Tokyo: Hujiwarashoten.

Economic Planning Agency. (Eds.), (1964). *Kokumin sekatsu hakusho*. Tokyo: National Printing Bureau.

Gonza: suigo wo mamorisodateru kai website, http://gonza.jp/. Accessed 17 Aug 2013.

Kada, Y. (2003). Public works project and environment protection. Environment economic policy academic meeting, Tokyo.

Kaji, T. (2009). *Study about the significance of the holiday camp formation and the effect to the park use in the natural park*. Tokyo: Tokyo Environment Engineering Department School Press.

Murakushi, N. (2005). *Kokuritsu koen no kenkyu*. Tokyo: Hosei University Press.

Murakushi, N. (2011). *Shizenhogo to sengonihon no kokuritsukoen*. Tokyo: Jichosha.

National Park Association of Japan. (2011). *Shizenkoen no tebiki*. Tokyo: National Park Association of Japan.

Okada, T. (1989). *Nihonshihonshugi to nosonkaihatu*. Kyoto: Horitsubunkasha.

Ozawa, S. (2011). *Biwako kokuteikoen ni kansuru Kenkyu*. Ph.D dissertation paper of, University of Shiga Prefecture, Hikone.
Sato, M. (1990). *Rizoto retto*. Tokyo: Iwanamishoten.
Sekiguchi, E. (1937). *Shigakenkanko ni taisuru shorai no hosaku, Kankono ohmi, 1*. Otsu: Biwako Visitors Bureau.
Seta, S. (2009). *Saiseisuru kokuritukoen*. Tokyo: Shimizukobundoshobo.
Shiga Prefecture. (1949). *Kanko doro, tetsudo, wanko seibikeikakusho*. Otsu: Shiga Prefecture.
Shiga Prefecture. (1954). *Honken kankoujigyo shinko no kihonhosaku*. Otsu: Shiga Prefecture.
Shiga Prefecture. (1960). *Biwako kokutei koen kuikihenko oyobi koenkihonkeikaku*. Otsu: Shiga Prefecture.
Shiga Prefecture. (1961). *Shiga Prefecture kanko kaihatsu kihon keikaku kosoan*. Otsu: Shiga Prefecture. (Uzo Nishiyama Memorial Library ID70478).
Shiga Prefecture. (2012). *Lake Biwa comprehensive preservation and improvement project: mother lake 21 plan*. Otsu: Shiga Prefecture.
Shiga Prefecture website: Fureai map, http://www.pref.shiga.jp/d/shizenkankyo/furusato/map/index.html. Accessed 4 Dec 2012.
Tamura, T. (1937). *Kankoshigen no riyo to kanko keikaku, Kankono ohmi, 1*. Otsu: Biwako Visitors Bureau.
Tamura, T. (1938). Kokueitsu koen no sankento. *Journal of the Japanese Institute of Landscape Architecture, 6*(2), 81–85, Tokyo.

Chapter 26
Influence of Differences Between Western and Eastern Philosophy Thoughts on Ethics of Genetic-Modified Foods and Crops

Xingze Wu, Ming Wang, Shukun Tang, and Ang Li

Abstract Ethics judgments on one product are closely related to social culture. Western civilization creates abundant philosophy thoughts and greatly influences modern science development; on the other hand, China and other eastern countries have more than 5,000 years of history and create abundant philosophy thoughts in a different pattern. Genetic-modified (GM) foods and crops are always the controversial products from their birth. What and how affect the judgments of people toward GM foods and crops intrigue interests of many researchers. In this paper, we select three ethical questions of GM foods and crops and intend to compare western philosophy thoughts with eastern philosophy thoughts in four different visions to discuss how these differences influence the three ethical questions.

Keywords Genetic-modified foods • Culture comparing • Ethics • Western culture • Eastern culture

X. Wu (✉)
School of International Relations and Public Affairs, Fudan University,
Room 401, Building 23, No.102, Guonian Road, Yangpu District,
Shanghai, Shanghai 200433, China
e-mail: staresque@126.com

M. Wang
School of Management, Hunan University of Science
and Technology, TaoYuan Road, Xiangtan,
Hunan Province 411201, China
e-mail: wmwithyou2008@126.com

S. Tang • A. Li
School of Humanities & Social Science, University of Science and Technology of China,
No.96, JinZhai Road, Hefei, Anhui Province 230026, China
e-mail: sktang@ustc.edu.cn; liang30073@163.com

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_26

26.1 Introduction

People's ethics judgments toward one controversial product are intimately related to their culture backgrounds. Transgenic technology is inserting the genes separated and modified artificially into the other organism and finally enabling the organism with the new characteristics of the genes inserted. Genetic-modified foods and crops (GM foods and crops) gave rise to intensive and extensive controversies in society from their birth. We intend to explore how the differences of western and eastern philosophy thoughts influence people's ethics judgments toward GM foods and crops.

Culture is the product of society and the fruit of the lives of people from thousands of years. Western culture represented by ancient Greece and eastern culture represented by China and India are the origins of western and eastern culture of modern society, respectively. Differences of western and eastern culture greatly influence people's judgments toward products, thus influencing ethics judgments toward GM foods and crops as well.

In this paper, we select three representative ethics issues of GM foods and crops and discuss the influences of four pairs of western and eastern philosophy thoughts toward these issues. Among all ethics issues of GM foods and crops, three types of the most important issues are health ethics issues of GM foods, environmental ethics issues of GM crops, and science and technology research behavior ethics issues of transgenic technology. We select three ethics questions to represent the three types of the issues mentioned above. (1) Health ethics question: is GM golden rice with vitamin A beneficial to human's health? (2) Environmental ethics question: are GM herbicide-resistant corps harmful to environment? (3) Research behavior ethics question: can scientists prove the safety of GM foods by examining their ingredients? We choose the third question because the popular principle adopted to judge the safety of GM foods is the principle of substantial equivalence, which declares that if the ingredients of GM foods are the same or similar with the corresponding traditional foods, the GM foods examined can be proved to be safe. Though the principle of substantial equivalence is the general principle in examining safety of GM foods in international society, many scholars question its rationality (Zeng 2004).

26.2 Four Pairs of Western and Eastern Philosophy Thoughts

26.2.1 "Logical Positivism" Compared with "Intuition Thinking and Animism"

Logical positivism believes that the correct results come from admitted experiments, inferences with logical tools, and amendment by probability. Logical positivism denies the role of sensible experiences in forming conclusion, believing that the

objective world can be recognized by quantification and methodology of science is the only correct way to research human's behaviors.

Logical positivism is formed in the 1930s–1950s. However, the original idea of logical positivism stems from ancient Greece and impacts on western society for thousands of years. Ancient Greek philosopher Parmenides said, "There are two ways: one is eternal and correct to lead to truth, that is, the way of logic; another is the way of fickle phenomena, that is, the way of habits and sensible experiences. We must realize all the risks of the latter way" (Xu 2004).

Aristoteles built the rules of thinking—formal logic. The resplendent achievements of ancient Greece attribute a lot to astronomy, mathematics, and logic.

Therefore, people with the thought of logical positivism may come to the following proposition and inference:

Proposition 1: To judge the correction of something, we must rely on scientific experiments and strict logical inferences.

Inference 1: If harm of something cannot be found via scientific experiments and strict logical inferences, we can prove it safe.

On the other hand, in China, intuition thinking is very important in Chinese culture.

Intuition thinking is an illogical thinking that emphasizes researchers to master the truths relying on their self-experience and intuitive judgments. For example, TCM (traditional Chinese medicine) emphasizes to diagnose and treat diseases by observing, smelling, asking, and pulse-taking. Chinese paintings focus on expressing mental aura and artistic conception. The masterpiece of "Lao-tse quiet bible" mentions, "Tao, cannot be acquired by teaching. Keep quiet, you will experience Tao" (Zhang 2012). In Buddhism culture, there is a famous story saying that Sakyamuni picked one flower to express the meaning of Zen.

Therefore, people with intuition thinking may believe the following proposition:

Proposition 2: Intuition thinking of researchers is vital to judge the correction of things.

In Chinese culture, animism is another important philosophy thought. The basic idea of animism is everything is alive and with its own will. People should respect everything. For example, Chinese people pay attention to feng shui. They believe that the soil is alive. If we need to build houses, we should communicate with nature via divining an ancient witchcraft. TCM (traditional Chinese medicine) believes that herbs have seven types of emotions like enjoying, fearing, hating, etc. (Wu 2008). Buddhism believes that everything has Buddha nature.

Thus, people with animism may form the following proposition and inferences:

Proposition 3: Everything is alive and has its own will.

Inference 2: Everything has its principle of growth and does not hope to be changed at will.

Inference 3: If something is changed by force, it will revenge on humans.

Inference 4: The degree of change by force determines the degree of revenge.

26.2.2 "Subject-Object Dichotomy" Compared with "Harmony between the Heaven and Human"

The thought of subject-object dichotomy supports that nature and man are dichotomous and opposite, which is the characteristic of western culture. In the eyes of western people, there are many dichotomous phenomena: subject and object, nature and man, sensibility and reason, phenomenon and essence, etc. Ancient Greek philosophers were eager to find the identity of philosophy and looked for the differences of nature and man. Marxism believes that nature is the operational object of human's labor and activities. Human is the subject that is conscious, purposeful, and able to improve self and nature via social practice. People with thought of subject-object dichotomy may come to the following proposition and inferences:

Proposition 4: Nature and man are dichotomously opposite.
Inference 5: To satisfy man's need, we must conquer and sacrifice nature.
Inference 6: To satisfy man's need, man should transform nature at will.

On the other hand, "Harmony between the Heaven and Human" influences Chinese people's mind for thousands of years. The thought of "Harmony between the Heaven and Human" indicates that the structures and movement rhythms of heaven and earth accord with those of the human body. The general principle of the relation of heaven-earth-human is that heaven, earth and human rely on each other. If the three agree with each other, the result will be beneficial to human beings, or else, harmful to human beings. Nature and human are integrated, identical, and with the same benefits. People should revere and thank nature, behave under the principle of nature, and should not transform nature for their own luxurious sake.

As the masterpiece of TCM—*The Yellow Emperor's Canon of Internal Medicine*—says, "Heaven is round and earth is square, and man's head is round and foots are square; heaven has sun and moon, and man has two eyes; earth has nine states, and man has nine holes on body; heaven has wind and rain, and man has happiness and anger…Earth has 12 rivers, and man has 12 meridians… etc." Moreover, Chinese culture believes that the law of nature accords with that of human. The masterpiece of *The Yellow Emperor's Canon of Internal Medicine* indicates that the circle of movement of qi and blood of human body directly connect with the circle of movement of the sun. Moreover, another TCM masterpiece of *The Yellow Emperor's Canon of External Medicine* says, "Menses is the sea, in tune with the moon and tide."

Proposition 5: Interests of nature and human are identical.
Proposition 6: Structures and law of nature accord with those of human.
Proposition 7: Changes of nature and changes of human will influence each other.
Inference 7: Human should live under the law of nature and should not change nature at will.

26.2.3 "Philosophy of Competition" Compared with "Philosophy of Mean"

Western society with well-developed commerce breeds the philosophy of competition. She always values "interest" and "power" and motivates people to compete for their own sake. There are lots of stories reflecting philosophy of competition in Greek mythologies. Philosophy of competition makes western arts full of paintings and sculptures that adore power and strong men or women with strong and handsome muscles. Gravity becomes the main characteristic of western arts. The most important sports games—Olympic Games—in the world, with the motto "Citius, Altius, Fortius," originate from ancient Greece. Emergence of capitalism and popularity of commerce reinforce the impact of philosophy of competition.

With philosophy of competition, western people may believe that people should change and conquer nature for their own sake. Thus, they may come to the following proposition and inference:

Proposition 8: We must win our interests through competition.
Inference 8: People should change and conquer nature for their own sake.

On the other hand, philosophy of mean is the core thought in Chinese traditional culture. Philosophy of mean emphasizes that man's thinking and behaviors should be mean and temperate and man's desires should be within limits.

The Chinese philosophy masterpiece—*The Doctrine of the Mean*—defines philosophy of mean as a status that individual's emotions, such as happiness, anger, sadness, etc., should not be showed up, and once showed up, they should be confined. Philosophy of mean believes that the status of mean will put everything into their correct position and develop well with others. Another Chinese masterpiece—*The Book of Rites*—says, "Saints master way of mean."

Proposition 9: Human's action should be temperate, not extreme, unbiased and accord with everything in the universe.

26.2.4 "Thought of Subdivision Analysis" Compared with "Thought of Holographic Integration"

The thought of subdivision analysis is the mainstream thought of modern western science and technology. Phenomenon is variable, illusory, and determined by essence, while essence is eternal, true, and pure. If we intend to reveal essences through phenomena, we must subdivide the entirety into units and analyze these units with logic.

The thought of subdivision analysis influences western society for a long time. The famous anatomist of ancient Greece—Alcmaeon (530–470 years BC)—wrote the first anatomist book according to the results of anatomizing animal body.

Fig. 26.1 Face diagnosis

Roman Galen (130–201 years AD) built the theories of medical science that ruled European medical science for thousands of years. Biology, based on cell theory, built a series of branch discipline—biology, molecular biology, genetics, cytopathology, virology, etc. Physics has the similar situation. French scientific historian Cuvier wrote in the book of *History of Natural Science* that the true science should be under divisions of labors and branches.

Based on thought of subdivision analysis, we can come to the following proposition and inference.

Proposition 10: Units determine the function of the object. We should divide object into units and research the roles and functions of those units to master the essence of object.

Inference 9: Parts and entirety are not holographically unified. Modifying parts of object cannot influence essentially on the other parts or the whole of that object.

On the other hand, the thought of Holographic Integration greatly influences Chinese people for thousands of years. The thought of Holographic Integration means part and entirety are integrated. Part reflects information of entirety and other parts in the same entirety. Modifying part means modifying the entirety. The thought of Holographic Integration emphasizes understanding parts should relate to the entirety.

Chinese traditional culture embodies the thought of Holographic Integration. Traditional Chinese medicine (TCM) describes a diagnosis named face diagnosis, believing that face can reflect all information of the whole body as Fig. 26.1 shows. The top of face reflects information of head; the section between eyebrow and nose reflects information of lung and heart; the bottom of nose reflects information of spleen and stomach; the bottom of face reflects information of legs, feet, etc.

The famous Buddhist priest Fa Zang in Tang dynasty wrote, "All hairs in lion's eyes, ears, joints contain numerous golden lions; Lions in all hairs enter one larger hair at the same time, layer upon layer, like the beads in nets of God. This is called the state of Indra's Net."

According to the thought of Holographic Integration, we may come to the following proposition and inferences:

Proposition 11: Parts and entirety are holographically integrated.
Inference 10: We cannot discuss the roles or functions of units by separating them from the entirety.
Inference 11: A tiny modification of the parts will influence the entirety and other parts in the same entirety.
Inference 12: The more change of the part, the more change of the entirety and other parts in the same entirety.

26.3 Influences of Four Pairs of Western and Eastern Philosophy Thoughts on GM Foods and Crops Ethics

26.3.1 "Logical Positivism" Compared with "Intuition Thinking and Animism"

As to the ethics of GM foods and crops, the people who hold logical positivism may support the following propositions and inferences:

Proposition 12: The only way to judge the ethics of GM foods and crops is via conducting strict scientific experiments and following logical inferences.
Inference 13: If strict scientific experiments and logical inferences cannot prove GM foods and crops are harmful, we can conclude that GM foods and crops are truly safe to human beings.

Therefore, as to the three ethics questions mentioned above, the people who hold logical positivism may come to the following conclusions: (1) If strict scientific experiments and logical inferences cannot prove GM golden rice is harmful, we can conclude that GM golden rice is actually healthy to human being. (2) If strict scientific experiments and logical inferences cannot prove transgenic herbicide-resistant crops are harmful to environments, we can conclude that GM golden rice is actually not harmful to human being.(3) If strict scientific experiments and logical inferences can prove the safety of chemical ingredients of GM foods, we can conclude that the whole foods are safe.

On the other hand, people who hold intuition thinking and animism may come to the following conclusions:

Proposition 13: Every crop has its own will as human beings.
Inference 14: Crops have their own growth principle and do not wish to be transformed.

Inference 15: Crops will revenge on human beings if they are being forcedly genetically modified.

Inference 16: The more differences between the genes modified and the original genes, the stronger the crops revenge on human beings.

Inference 17: Spirituality of organism is stronger than that of chemical ingredients.

Therefore, as to the three ethics questions mentioned above, the people with intuition thinking and animism may come to the following conclusions:(1) Because vitamin A is forcedly transferred into rice, this action violate the will of rice, the GM golden rice with vitamin A would be harmful to human beings' health. And the more differences between the genes transferred and the original genes, the worse the GM golden rice to human beings' health. (2) Herbicide-resistant genes are forcedly transferred into the crops, and evidently this action violates the wills of the crops; thus the crops will revenge on human beings and be harmful to the environments eventually. (3) Spirituality of organism is stronger than that of chemical ingredients; thus safety of chemical ingredients cannot represent safety of the whole organism.

26.3.2 "Subject-Object Dichotomy" Compared with "Harmony between the Heaven and Human"

As to the ethics of GM foods and crops, the people who hold the thought of "subject-object dichotomy" may support the following propositions and inferences:

Proposition 14: Crops and man are dichotomously opposite.

Inference 18: In order to satisfy the needs of man, man should conquer and transform crops at will.

Therefore, as to the first and second ethics questions mentioned above, the people who hold logical positivism may come to the following conclusions:(1) Rice and man are dichotomously opposite. The only value of rice is just for satisfying human's need; thus the action of transferring genes with vitamin A into rice must be beneficial to human being and finally fits ethics. (2) For the same reasons, the action of transferring genes resisting herbs into crops satisfies human's needs; thus this action must be beneficial to environments and human beings and finally fits ethics.

On the other hand, the people who hold the thought of "Harmony between the Heaven and Human" may support the following proposition and inference:

Proposition 15: The benefits of crops and man are identical and influence each other.

Inference 19: Man can just transform crops with the law of nature and should not transform crops at will.

Therefore, as to the first and second ethics questions mentioned above, the people who hold the thought of "Harmony between the Heaven and Human" may come to

the following conclusions:(1) Transferring genes with vitamin A into rice severely violates the law of nature and greatly changes the original structures of rice, and because the benefits of rice and man are unified, the action violates the benefits of rice and benefits of man as well. (2) For the same reason, the people who hold the thought of "Harmony between the Heaven and Human" may believe that crops with herbicide-resistant genes violate the law of nature; thus it may also be harmful to environments.

26.3.3 "Philosophy of Competition" Compared with "Philosophy of Mean"

According to the philosophy of competition, we may come to the following proposition:

Proposition 16: Man should compete with nature and conquer crops to satisfy man's needs.

As to the first and second ethics questions on GM foods and crops, people holding the philosophy of competition may believe that adding vitamin A into rice and herbicide-resistant genes into crops must be beneficial to human beings.

However, people with the philosophy of mean may come to the following proposition:

Proposition 17: Man's behavior should be temperate, moderate, and unbiased and be in accordance with the crops and environments.

GM crops different from traditional crops are produced by man via breaking species boundaries and forcedly transferring genes which do not follow the natural growth process of crops. Therefore, people with the philosophy of mean would believe that this action is extreme, stressing too much on satisfying man's own sake and breaking the balance of nature. As to the first and second GM foods and crops ethics questions, people with the philosophy of mean would believe that those actions do not fit ethics, and thus GM golden rice with vitamin A would be harmful to human's health, and crops with herbicide-resistant genes would be harmful to environments.

26.3.4 "Thought of Subdivision Analysis" Compared with "Thought of Holographic Integration"

Based on this "thought of subdivision analysis," researchers are prone to believe that the behavior of modifying living creatures' genes just impacts on the genes modified and does not impact on other parts or the whole of the living creatures.

And the genes transferred are safe and can satisfy man's needs; thus the whole GM foods must be safe. As to the GM food and crop issues, people with the "thought of subdivision analysis" may come to the following propositions:

Proposition 18: Modifying genes do not exert substantial influence on the living creatures.

Proposition 19: Modifying genes do not exert substantial influence on other parts of the living creatures.

Proposition 20: The safety of chemical ingredients of GM foods can represent the safety of the whole GM foods.

Therefore, based on the three propositions mentioned above, people with the "thought of subdivision analysis" may believe that adding vitamin A genes into rice and herbicide-resistant genes into crops fits ethics. The principle of substantial equivalence fits ethics as well.

On the other hand, people with the "thought of Holographic Integration" are prone to believe that the behavior of modifying living creatures' genes is equal to changing the whole creatures and thus violates ethics. Thus, people with the "thought of Holographic Integration" may come to the following conclusions:

Proposition 21: Modifying genes will exert substantial influence on the living creatures.

Proposition 22: Modifying genes will exert substantial influence on other parts of the living creatures.

Proposition 23: The safety of chemical ingredients of GM foods cannot represent the safety of the whole GM foods.

As to the three ethics questions mentioned in the beginning of this paper, people with the "thought of Holographic Integration" may believe that though vitamin A of GM golden rice is more than that of common rice, this action totally changes the attributes of rice; thus it does not fit ethics. For the same reasons, transgenic herbicide-resistant crops do not fit ethics. They may also deny the principle of substantial equivalence, because nucleic acid and protein examined are separated from the GM foods, not as part of the foods anymore. According to the "thought of Holographic Integration," safety of chemical ingredients cannot represent the safety of the whole foods (Fig. 26.2).

Western thoughts (Support GM foods)	Eastern thoughts (Reject GM foods)
Logical positivism	Intuition thinking and Animism
Subject-object dichotomy	Harmony between the Heaven and Human
Philosophy of competition	Philosophy of mean
Thought of subdivision analysis	Thought of Holographic Integration

Fig. 26.2 Influences of the four pairs of philosophy thoughts on GM foods and crops

26.4 Conclusions and Discussions

In this paper we discuss the influences of four pairs of opposite western and eastern philosophy thoughts toward the ethics issues of GM foods and crops. The four pairs of western and eastern philosophy thoughts are opposite; thus the western and eastern cultures are opposite to each other and greatly impact on the people's value of the relations of man and nature, which finally influence the attitudes to GM foods and crops. People with the thoughts of "logical positivism," "subject-object dichotomy," "philosophy of competition," and "thought of subdivision analysis," which represent the western philosophy thoughts, may support GM foods and crops as ethical products. Inversely, people with the thoughts of "intuition thinking and animism," "Harmony between the Heaven and Human," "philosophy of mean," and "thought of Holographic Integration," which represent the eastern philosophy thoughts, may reject GM foods and crops as unethical products.

However, we must realize that the western and eastern philosophy thoughts discussed in this paper are the traditional thoughts originating from ancient Greece and China or other ancient eastern countries like India. Though these thoughts are the mainstream ideas that influence western and eastern people for thousand years, they cannot cover all individuals in the modern world. In modern society, numerous western people, such as Americans, European people, etc., are learning Chinese and eastern culture, while eastern people are learning western culture and thoughts in the past several hundred years. Moreover, cultures are not invariable. Different cultures communicate with each other and influence each other, especially in the modern society with powerful Internet. Both western and eastern cultures are essential to our life. They should learn from each other and develop themselves in the modern society.

As to the ethics issues of GM foods and crops, we should firstly pay attention to the influence of philosophy thoughts on people's attitudes toward ethics issues of GM foods and crops. Secondly, we should soberly treat the roles of philosophy thoughts to the developments of GM foods and crops and promote communication of western and eastern culture, for the sake of leading transgenic technology to the ethical direction that agrees to human's fundamental long-run interests.

References

Wu Changguo. (2008). *General meaning of herbs properties* [M] (p. 2). Peking: China Press of Traditional Chinese Medicine.

Xu Xingyan. (2004). *ZHONGXI WENHUA BIJIAO* [M]. Peking: Peking University Press.

Zeng Beiwei. (2004). *Safety of transgenic organism* [M]. Peking: Chemical Industry Press.

Zhang Junfang. (2012).*Yun Ji Qi Jian* [M] (Vol. 17). Peking: Zhonghua Book Company.

Chapter 27
Arthropod Pest Management in Sustainable Agricultural Systems

Hwang Shaw-Yhi

Abstract Insect pests have been considered to cause substantial annual losses in global crop production. Chemical pesticides have been the primary solution for controlling such insect pests in conventional agricultural practice. However, the overuse of chemicals has caused long-term and irreversible destruction to the environment. Therefore, seeking alternatives and safe agricultural practices has become vital to attaining sustainability. To achieve sustainability, the approaches to pest control must be reconstructed. According to Wyss et al. (Org Res, 33–36, 2005), a conceptual model can be developed for arthropod pest management in sustainable agricultural systems. This model involves using preventative measures followed by direct and curative measures if necessary. The process can be split into four phases. First, in the core phase, initial action is taken to reduce the chances of pest infestation and damage. The second and third phase strategies for pest management are to control pest insects by using natural means. The fourth phase strategy is to apply approved insecticides (biological or synthetic) to control pests. In summary, the proposed arthropod management practice stresses a spectrum of approaches ranging from those that operate in a purely preventative manner to curative methods that are typically considered a last resort.

Keywords Sustainable agriculture • Insect pest • Management

27.1 Introduction

Agriculture involves domesticating plants and animals and has been central to human life for thousands of years; humans continue to rely on agriculture for food and survival. Dr. Norman Borlaug mentioned that "civilization as it is known today could not have evolved, nor can it survive, without an adequate food supply." The world population is increasing and crops continue to be the primary source of food as global demand increases. To feed the global population, 1 billion metric tons of additional

H. Shaw-Yhi (✉)
Department of Entomology, National Chung Hsing University, Taichung, Taiwan 402, China
e-mail: oleander@dragon.nchu.edu.tw

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_27

grain is estimated to be required by 2025. Cultivated land occupies approximately 37 % of the worldwide land area and may have already reached saturation. Therefore, the primary approach to increasing grain production may be improving the crop yield of existing productive land. One approach to enhancing crop productivity is to adapt the use of *biotechnology. Various inventions in* farming *technology* have rapidly advanced as a result of high yields and low costs. In addition to adapting technology, reducing grain loss because of pests is an urgent subject.

In addition to poor farming practices, various pests can damage crops. The estimated potential crop loss caused by insect pests has recently increased and may reach approximately 13 % of the total production (Schoonhoven et al. 2005). Insects are responsible for two primary types of damage to growing crops: (1) Insects that feed directly on leaves or burrow in stems, fruit, and roots injure plants. Hundreds of pest species of this type may exist in either larval or adult stages, including orthopterans, homopterans, heteropterans, coleopterans, lepidopterans, and dipterans. (2) Insects can cause indirect damage by transmitting diseases that may cause little or no harm but introduce a bacterial, viral, or fungal infection into crops. This indirect damage may severely affect crop production, generating viral diseases in sugar beets and potatoes that are carried from plant to plant. Therefore, finding ways to control insect pests and increase grain production has been a major endeavor.

After industrialization, conventional farming became the primary farming practice; it relies on chemical inputs, using a highly mechanized approach. Chemical pesticides have been heavily applied for pest control. The most frequently applied pesticides are insecticides (to kill insects), herbicides (to kill weeds), rodenticides (to kill rodents), and fungicides (to control microbes). Literature has indicated that over 1 billion tons of pesticides are used in the United States every year (The latest US Environmental Protection Agency information, 2007). An estimated 5.2 billion pounds of pesticides are used annually throughout the world. Chemical pesticides can easily eliminate and control various agricultural pests, but produce side effects, such as damage to crops and livestock, and reduce farm productivity. Recent evidence has indicated that crop yields may remain stable, but chemical pesticides could pollute ecosystems, increase the cost of fertilizers, reduce soil fertility, and cause an imbalance in host-parasite and predator-parasite relationships, jeopardizing the agricultural industry. Thus, scientists have focused on using biotechnological developments to increase crop yields without using extensive pesticides. In addition, serious concerns have been raised regarding human safety and the biological effects of chemical pesticide use. Pesticides have been linked to numerous human health problems such as neurological and endocrine system disorders, birth defects, cancer, and other diseases. Thus, sustainable agriculture has recently developed to ensure that agroecosystems are stabilized and that sustained crop yields are secured on a long-term basis.

The word “sustainability” denotes constant effort or ability to strive and prevent from diminishing. The idea of sustainable agriculture originated from the US Farm Bill (1990) and is described as an integrated production system by which agricultural application could eventually fulfill the requirements of human food production, sustain natural resources, and enhance the environment, enhancing

the agricultural economy. Therefore, sustainable agriculture requires successfully managing resources for agriculture to satisfy human needs, retaining or enhancing the environmental quality, and conserving natural resources and the environment (http://www.tutorvista.com/content/biology/biology-i/sustainable-agriculture/sustainable-agricultureindex.php). Sustainable agriculture is dedicated to the concept of self-sustainability, where the agroecosystems may function on their own in a sustainable manner, facilitating nutrient supply and crop protection to stabilize crop yields. Sustainable agriculture practices may involve processes such as organic farming, biological and natural pest control, soil and water conservation, and careful use of synthetic chemicals. These sustainable practices can ensure pollution-free food production and continued agriculture, minimizing ecosystem damage. Sustainable agriculture should satisfy current human needs without affecting the needs of future generations; sustainable practices promote health and benefit the environment, economy, and society. To adhere to this sustainability principle, approaches to pest control must be reconstructed.

According to Wyss et al. (2005), a conceptual model can be developed for arthropod pest management in sustainable agricultural systems. This model involves using preventative measures followed by direct and curative measures if necessary. This study elaborates on the principle raised by Zehnder et al. (2007) and discusses possible approaches to pest control for sustainable agriculture systems.

27.2 Arthropod Pest Management in Sustainable Agriculture Systems

The pest management process can be divided into four phases (Zehnder et al. 2007). First, in the core phase, initial action is taken to reduce the chances of pest infestation and damage. Therefore, this phase comprises cultural practices compatible with natural processes such as crop rotation, soil management, host plant resistance, and farm and field location. These cultural practices might be the oldest and most efficient practices that farmers used for pest suppression before the invention of modern pesticides. Although individual cultural practice strategies may not produce promising results, combining these practices could be regarded as the foundation of sustainable agriculture; when this foundation is stable, additional practices could have a synergistic effect.

After establishing an effective foundation, a subsequent strategy for pest management includes controlling pest insects by using natural processes to sustain the environment and prevent land pollution. This strategy involves controlling pests by using natural enemies and through the trophic relationships. The second phase of pest control concerns vegetative management, increasing how natural enemies affect pest populations. After the fundamental structure (first phase) is constructed, the strategy of the second phase involves adapting ecological engineering approaches, such as biological conservation control, intercropping, and trap cropping, to build an ecologically friendly environment for the natural enemies of pests;

thus, biodiversity is increased in the agricultural production system. To allow these natural enemies to function, they must be provided with a suitable environment to survive and reproduce. Therefore, promising results could be naturally achieved assuming that sufficient natural enemies are present. To achieve favorable results from the natural enemies, chemical pesticides must not be applied at this stage. Relevant literature has indicated that the natural enemies of pests are typically more susceptible to insecticides than the pests are. Therefore, spraying pesticides could seriously disrupt the effects of natural enemies and must be reserved as a final solution. Allowing natural enemies feed on their hosts is an excellent approach to regulate pests. However, the life stages of natural enemies make them fall behind the hosts. The natural enemy population typically increases as the pest population increases; therefore, crops could be damaged before the natural enemies affect the pest population. Thus, in the third phase, the idea of using natural enemies for pest control is adapted to achieve immediate effects. Because natural enemies require time to develop and cannot catch up with the population increase of the pests, the third phase strategy involves the inundative and inoculative release of biological control agents. Therefore, if sufficient natural enemies are lacking at the required time in a natural situation, we could artificially mass-produce such enemies and release them into the field to control pests for a brief or extended period. The primary natural enemies used for biological control include predators, microbes, and parasitoids. Among the control agents, the final two agents are specific to pests and are considered excellent candidates for use in controlled releases. Using biological control agents for pest control has a long history and several agents have yielded convincing results. When using natural enemies for agricultural sustainability, restrictions may apply; however, selecting appropriate natural enemies to mass-produce for pest control remains the most effective solution. In addition to natural enemies, insect sex pheromones can be used at this stage for mating disruption and mass trapping. Insect sex pheromones are semichemicals secreted by insects and have the specific function of attracting other insects of the same species. After properly applying the sex pheromone for mating disruption and mass trapping, insect pest populations significantly reduced.

Despite these strategies, pests can overcome barriers and approach a level of economic damage; thus, the fourth phase must be entered. At this time, the pest population may be considerably high, such that natural enemies or other applications cannot regulate the pests and an efficient approach to reducing the pest population is immediately required. Because the objective is clear and no other options are available, the primary strategy is to apply approved insecticides (biological or synthetic) to control the pests. Synthetic insecticides typically achieve rapid and promising control, and biological insecticides may achieve favorable results in specific environments. Applying these insecticides should be reserved as a final option for the control of pests after all methods used in the preceding phases have failed. In addition, the insecticides used must be approved and applied during the no-harvest period. Safety for the environment and consumers is the basic consideration when deciding to use chemicals. Because synthetic insecticides are effective and simple to apply, they are readily used by farmers; thus, tolerating minor damage and reserving synthetic insecticides as a final option is difficult.

27.3 Conclusion

The practice of arthropod management highlights the spectrum of approaches ranging from those that are purely precautionary to restorative methods that are generally considered final alternatives. Although the strategies in each phase are independent, they are fundamentally related and must be integrated. Therefore, knowledge of integrating various methods from the phases is crucial. This integration may already appear in the literature, but such integration must be learned through organized lectures and real farming practices. Recently, numerous governments acknowledged the importance of educating farmers. "Farm academy" programs were organized in several locations, providing farmers opportunities to learn about newly developed technology and sustainability. Access to sufficient and safe food is a fundamental human right, and facilitating a food-secure world for future generations may be the primary responsibility of the current generation. These responsibilities imply that sustainability must be promoted; this goal yields substantial ethical implications and requires enormous effort, practice, and discussion to achieve. Addressing the enormity of this effort is both the reason for and purpose of this conference.

Acknowledgments The author wishes to thank Dr. Kiattisak Duangmal and Dr. Annop Kunavongkrit from the OCARE, Chulalongkorn University, for their efforts organizing this conference, kind invitation, and services provided.

References

Schoonhoven, L. M., van Loon, J. J. A., & Dicke, M. (2005). *Insect-plant biology*. Oxford: Oxford University Press.

Wyss, E., Luka, H., Pfiffner, L., Schlatter, C., Uehlinger, G., Daniel. C. (May 2005). Approaches to pest management in organic agriculture: a case study in European apple orchards. *Organic Research,* 33–36.

Zehnder, G., Gurr, G. M., Kuhne, S., Wade, M. R., Wratten, S. D., & Wyss, E. (2007). Arthropod pest management in organic crops. *Annual Review of Entomology, 52*, 57–80.

Chapter 28
Japanese Consumers' Altruistic Attitude and Food Choice: Two Years After Fukushima Accident

Hiromi Hosono, Mami Iwabuchi, Yuko Kumagai, and Tsutomu Sekizaki

Abstract Since the TEPCO first Fukushima nuclear power plant explosion, Japanese food contamination with radioactive substances has widely been spread. This research is an attempt to understand how Japanese perceive the risk of radioactive substances in food and their attitude and knowledge on radioactive substance control measures as well as their intention to support the disaster-affected areas. We've implemented three times web-based surveys in October 2011, March 2012, and January 2013. Results showed mixed feelings, both willing to support the radiation-affected area and willing to avoid the risk of radioactive substances. Among the respondents who were satisfied with the radiation risk management, willingness to pay for foods from affected areas and knowledge level were higher, and their risk perception level was lower. The donating behavior to support the disaster-affected areas also was related to willingness to pay.

Keywords Consumer attitude • Radioactive cesium • Donation • Willingness to pay • Beef

28.1 Introduction

Two years has passed since the Great East Japan Earthquake, following the tsunami and the accident at TEPCO's first Fukushima nuclear power plant. The disaster caused huge damage to the social life in Eastern Japan. Soon after the accident in the nuclear power plant, public anxiety on food and environmental contamination

H. Hosono (✉) • M. Iwabuchi • Y. Kumagai • T. Sekizaki
Graduate School of Agricultural and Life Sciences, The University of Tokyo,
1-1-1, Yayoi, Bunkyo, Tokyo 113-8657, Japan
e-mail: ahiromix@mail.ecc.u-tokyo.ac.jp; mi_lin91@yahoo.co.jp;
2791388998@mail.ecc.u-tokyo.ac.jp; asekizak@mail.ecc.u-tokyo.ac.jp

S. Hongladarom (ed.), *Food Security and Food Safety for the Twenty-first Century*, DOI 10.1007/978-981-287-417-7_28

with radioactive substances has widely spread. The Japanese Ministry of Health, Labour and Welfare (MHLW) adopted a provisional regulation level for radioactive substances in foods on March 17, 2011, which was revised upward on April 2012 as the regulation, and a maximum permissible dose of radioactive substances was set to each food category, in which the value for radioactive cesium in general food products was designated at 100 Bq/kg or less.

In order not to distribute the foods contaminated above the maximum permissible level of radioactive cesium, intensive radiation inspection of food produced in Eastern Japan also has been implemented along with the decontamination activities. Recently, radioactive cesium is detected only from limited categories of foods such as mushrooms, wild vegetables, and marine products. More than 99.9 % of foods inspected showed an N.D. level of radioactive cesium contamination. However, the market price of food produced in Fukushima area has not yet recovered even if they are inspected to assure safety.

A number of consumer surveys to investigate the attitude and anxiety on radioactive cesium contamination in food have been implemented since the disaster. According to the annual survey implemented by the Food Safety Commission, consumer anxiety on radiation contamination in food was highest among 12 food-related hazards in 2011 but become lower in 2012. Other consumer surveys also revealed the similar propensity that the perceived risk of radioactive cesium in food produced in Japan became lower as time passed. Though the risk perception or anxiety on food contamination of radioactive cesium became lower, however, the revealed willingness to purchase or willingness to pay for foods produced in the disaster-affected areas has not yet been recovered.

In this article, we'll report the Japanese consumer attitude, knowledge, risk perception, and food-purchasing behavior as well as recovery-supporting intention to the disaster-affected areas.

28.2 Materials and Methods

We conducted web-based consumer surveys in Oct.–Nov. 2011 ($N=4{,}363$), March 2012 ($N=5{,}028$), and Jan. 2013 ($N=6{,}357$) to investigate the risk perception, attitude, and knowledge on radioactive substances and its management measures taken in Japan focusing on beef. After the third survey, a web-based donating experiment was offered to the 1,881 participants selected from the third survey responses. In this experiment, participants got 100–10,000 JPY as the result of the ultimatum game. Then, using the money they've got, they were asked whether to donate or not. Ten charitable subjects such as enhancement of food radiocesium monitoring, compensation for farmers, subsidization for recovery from tsunami-affected areas, research on radiation risk, development of new energy resources, etc., were selected as options.

The first to third surveys covered the following subjects: (1) perceived risk level of seven beef-related hazards, (2) knowledge on food safety risks focusing on

radiocesium and its risk management, (3) attitude toward food safety and radiation risk management, (4) intention to support recovery from the disaster, (5) intention to purchase food produced in East Japan and Fukushima prefecture, (6) and demographic characteristics such as age, sex, residential area, and household members. The demographic characteristics of the respondents are shown in Table 28.1. In the following section, we mainly focus on the third survey and the donating experiment referring to or comparing the first and second surveys.

28.3 Results

28.3.1 Risk Perception

Perceived risk levels of the hazards originating in beef, such as enterohemorrhagic *E. coli*, *Salmonella* sp., *Campylobacter* spp., bovine spongiform encephalopathy, antibiotic residue, radioactive substances, and animal cloning, were rated from no risk (0) to very high risk (5). Considering cases having no idea about hazards or no ability to assume risk, the option of "have no idea" was included. As a result, about 40 % (35 %) of women (men) didn't rate the risk of *Campylobacter* spp. in the third survey. Women were more apt to assume higher risk in all hazards compared to men. And the rate of choosing the "don't know" option was higher among women.

Similar to the related researches, the results of the three surveys indicated that Japanese perception of risk on radiation contamination in beef became lower in average as time passed (Fig. 28.1). Perceived radiation risk among women was second highest in the second and third surveys, while it was fourth in the third survey among men. Enterohemorrhagic *E. coli* were regarded as consistently the highest risk throughout the three surveys.

28.3.2 Attitude and Trust

Attitude toward food produced in the disaster-affected areas was assessed in the third survey. We described several statements, and the respondents were asked to answer "agree," "somewhat agree," "somewhat disagree," and "disagree." The rate of those who (somewhat) agree to each statement is shown in Fig. 28.2. The result shows that 80.1 % agree to reconstruct the agricultural farm land affected by the disaster rapidly; however, 67.5 % thought that the land around the nuclear power plant accident site should not be utilized for food production. About 50 % of responses agree to purchase food produced in Tohoku/Kanto or Fukushima area to support the recovery from disaster, and 58 % of respondents thought that they can support recovery from the disaster by purchasing food produced in the affected areas. However, over 40 % of respondents disagree to use agricultural products from Fukushima for school lunches (Fig. 28.3).

Table 28.1 Overview of respondents

		First survey		Second survey		Third survey (+ donation game)			
Investigation period		Oct.–Nov. 2011		Mar. 2012		Jan. 2013		Mar. 2013	
Research company		Nikkei Research Inc.				Nippon Research Center, Ltd.			
		Number of respondents	%	Number of respondents	%	Number of respondents	%	Number of respondents	%
Total		4,363	100.0	5,028	100.0	6,357	100.0	1,881	100.0
Gender	Male	2,165	49.6	2,641	52.5	3,385	53.2	962	51.1
	Female	2,198	50.4	2,387	47.5	2,972	46.8	919	48.9
Age	20–29	882	20.2	873	17.4	936	14.7	344	18.3
	30–39	839	19.2	1,014	20.2	1,485	23.4	410	21.8
	40–49	864	19.8	1,078	21.4	1,550	24.4	412	21.9
	50–59	861	19.7	1,047	20.8	1,428	22.5	384	20.4
	60–69	917	21.0	1,016	20.2	958	15.1	331	17.6
Residential area	Hokkaido	70	1.6	95	1.9	191	3.0	124	6.6
	Tohoku	433	9.9	582	11.6	775	12.2	203	10.8
	Kanto	1,462	33.5	1,255	25.0	1,278	20.1	236	12.5
	Hokuriku	281	6.4	382	7.6	480	7.6	182	9.7
	Chubu	347	8.0	516	10.3	796	12.5	276	14.7
	Kinki	500	11.5	624	12.4	923	14.5	227	12.1
	Chugoku	367	8.4	479	9.5	621	9.8	233	12.4
	Shikoku	292	6.7	383	7.6	405	6.4	192	10.2
	Kyushu	526	12.1	629	12.5	778	12.2	177	9.4
	Okinawa	85	1.9	83	1.7	95	1.5	31	1.6

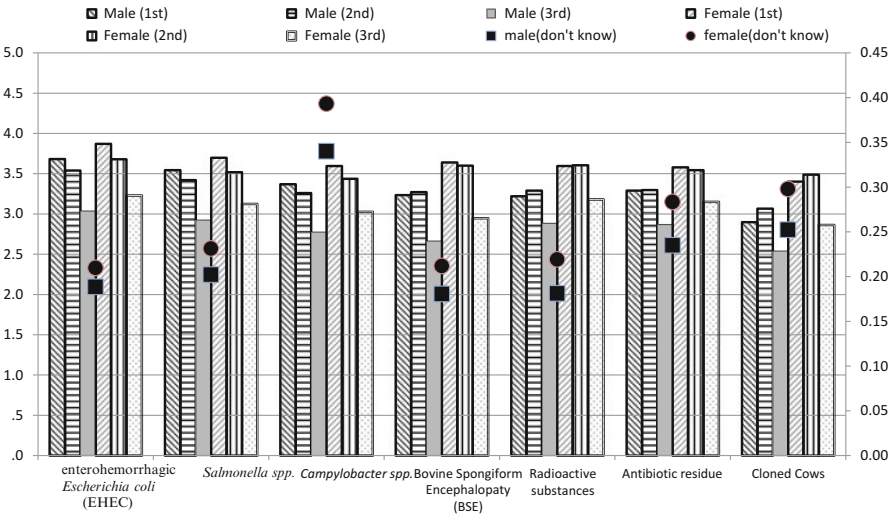

Fig. 28.1 Risk perception (*left axis*) and the rate of choosing the "don't know" option (*right axis*)

Trust on the radiation risk management body including the central government, local government, food companies, and retailers was low. Less than 30 % of respondents trust the central government including those who "somewhat agree." Among the above four stakeholders, trust on food companies was highest, but the rate was only 35.1 % in the third survey. Compared to the second survey, trust on all four stakeholders became higher. About 50 % of respondents considered that the stricter the standard value of radioactive substances in foods, the better in order to increase safety. And 41.6 % of respondents agreed to the statement that "I am less concerned with radioactive substances in foods because contamination level is low in risk."

28.3.3 Knowledge on Radiation Risk and Risk Management Measures Taken After the Accident

In order to understand what is known and what is not known to the people about radiation risk, we showed nine sentences on radiation risk and its management measures. Respondents were asked to answer if the sentences are "true," "not true," or "I don't know." The correct answer rate is shown in Fig. 28.4. The results show that about 40 % of respondents correctly answered the meaning of Bq and Sv. About 20–25 % of respondents know about radiation exposure from the natural environment in peacetime and the currently applied standard value of radiocesium from food. The correct answer rate on radiocesium management and the relation between adverse health effect and exposure dose was under 20 %. Only 7.5 % (8.2 %) of respondents know about the current standard value of radiocesium contamination in beef (milk).

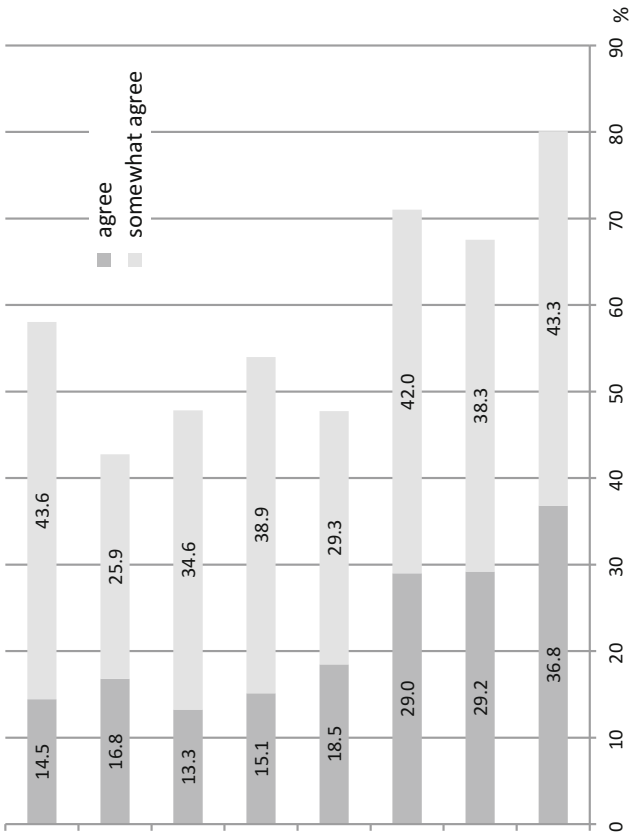

Fig. 28.2 Attitudes toward food from disaster-affected areas

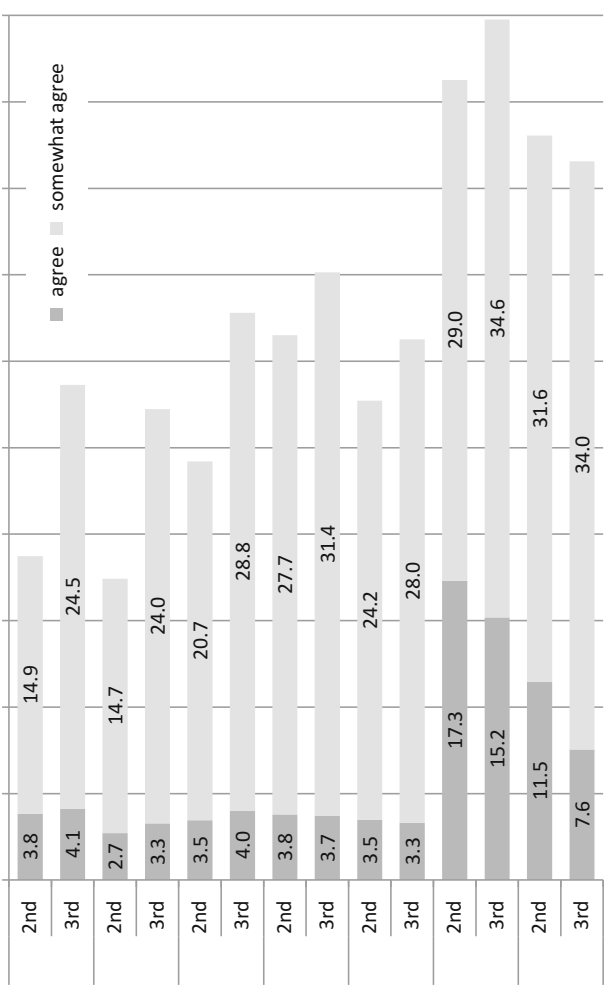

Fig. 28.3 Trust on the radiation risk management body

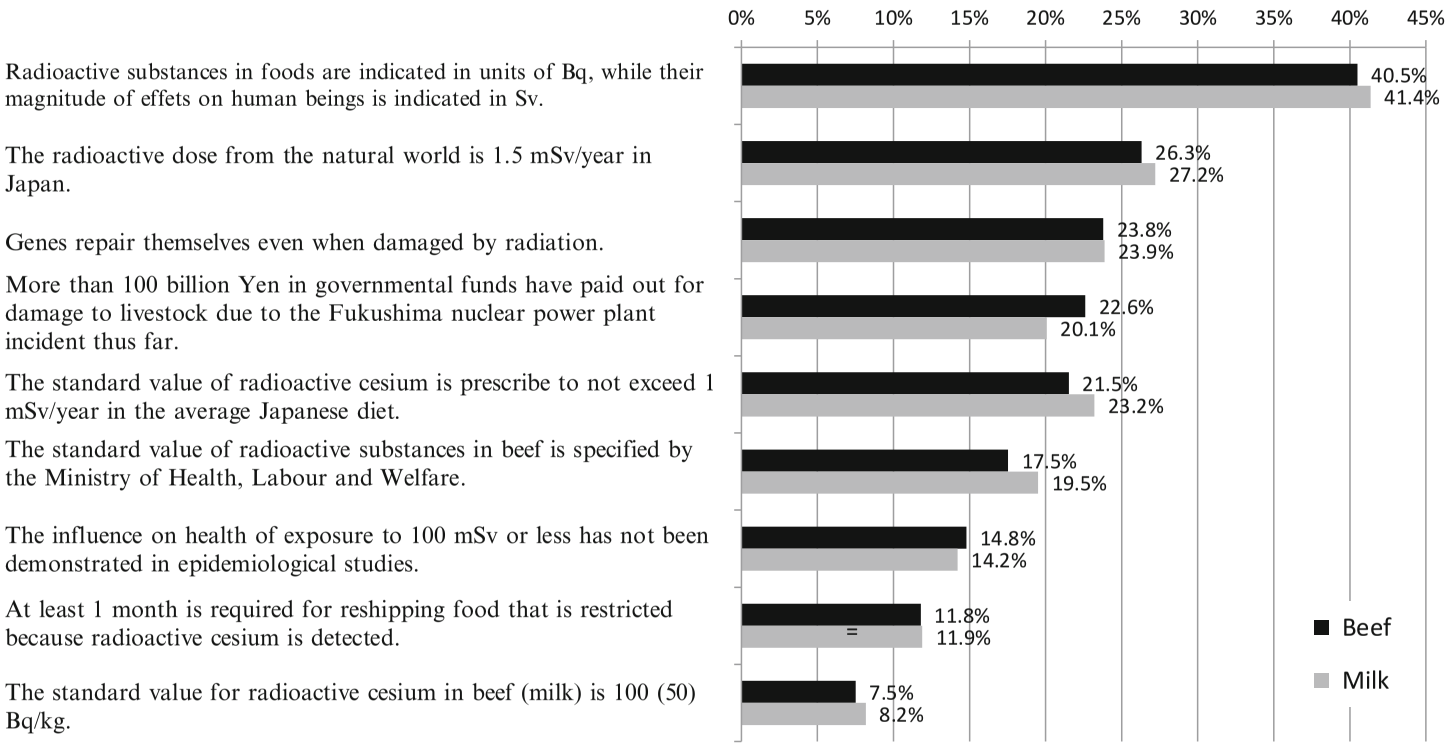

Fig. 28.4 The correct answer rate of radiation risk and risk management

Figure 28.5 shows the relationship between the correct answer rate, risk perception, and satisfaction level for radiation risk management. Less than 3 % of respondents answered "strongly satisfied" with the radiation risk management, and their knowledge level was significantly higher than the others. And as satisfaction levels rise, their risk perception on radiocesium in foods was decreased. Those who have never thought about if he/she is satisfied on radiation risk management revealed lower risk perception, and their knowledge levels also were lowest.

28.3.4 Willingness to Pay for Foods from Disaster-Affected Areas

The respondents who were asked to state the maximum price they want to pay for food from disaster-affected areas compared to non-affected areas answered 100 %. The prepared choice option was 0–200 % with 10 % increments. The changes of WTP distribution in the three surveys are shown in Fig. 28.6 separately, that is, if the food from the affected area was inspected to be with radiocesium contamination under the provisional regulation value (standard value in the third survey) or if radiocesium contamination was not detected. Though radiocesium was not detected, about 40 % of respondents revealed their willingness to pay below 100 %, and the rate was 70 % if it is under the regulation level. When we compared the first and second surveys, implemented 6 months and 1 year after the disaster, this rate was slightly decreased; however, it increased again in the second and third surveys. The rate of respondents who don't want to buy food and answered 0 % was increased to 22.5 % if the contamination level was below the regulation level and 15.0 % if radiocesium was not detected.

Knowledge level and WTP were compared between the respondents' satisfaction levels of risk management measures taken in Japan (Fig. 28.7).

28.3.5 Donating Behavior for Disaster-Affected Areas

Web-based donation experiments were implemented in the third survey participants. Age group, sex, residential area, and WTP were considered in selecting the participants. A total of 1,881 respondents were selected. In this experiment, participants received 300–1,300 JPY as a result of two-player ultimate game, and then we asked their intention to draw a lottery or not using the money they've got in the first ultimate game. If they refused to participate, they can get the money they've got at this stage. As a result, 1,669 participants drew lottery to get 100–10,000 JPY. A donation experiment was implemented in those 1,669 participants. The overview of the result of the donation behavior is shown in Table 28.2.

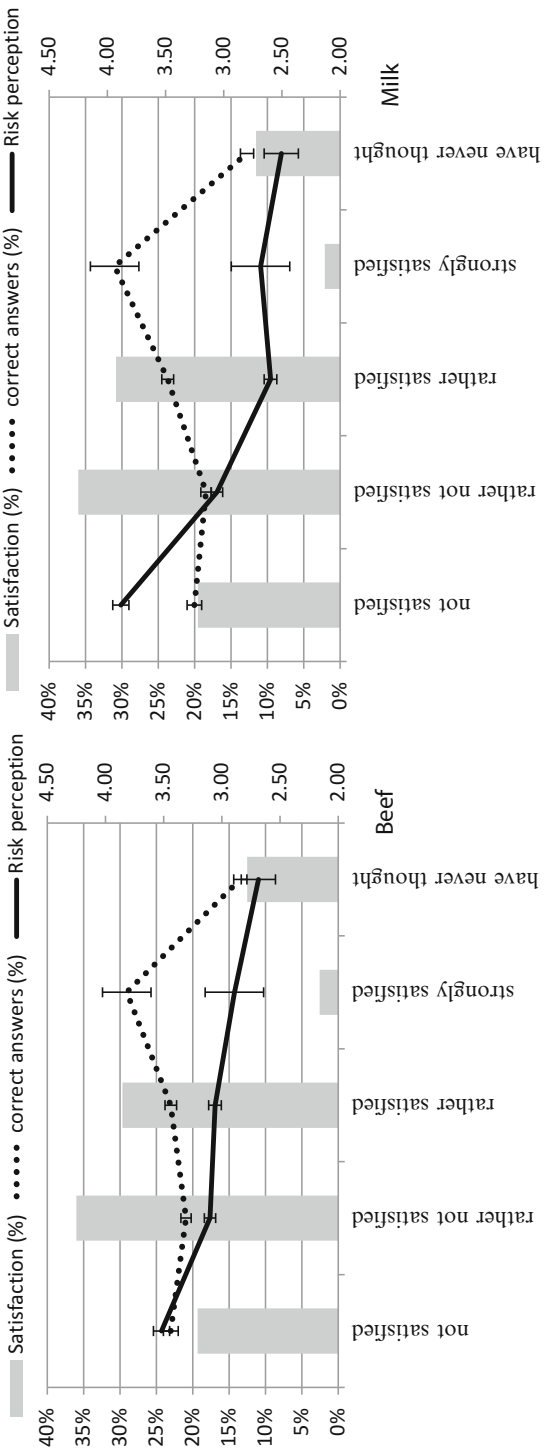

Fig. 28.5 Relationship between knowledge, risk perception, and satisfaction level of risk management

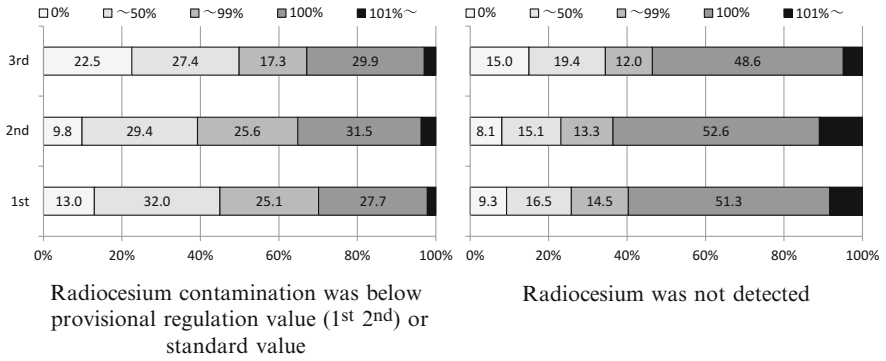

Fig. 28.6 WTP for foods produced in the disaster-affected areas

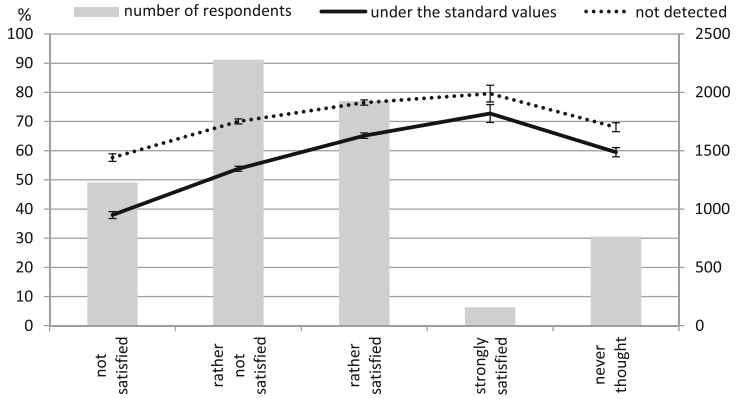

Fig. 28.7 Relationship between WTP and satisfaction level of risk management

The donated amount varied from 1 to 10,000 JPY, and 1,273 participants (76.3 %) donated more than 1 JPY. In average, 50 % of the money they've received was donated. Women donate significantly more than men ($p=0.014$), and the donation rate increases in the older groups ($p=0.000$). Though the regional difference of the donating rate was not significant, the participants living in Hokkaido and Tohoku donated 55 % and 54 %, respectively, while the participants living in Kansai area donated 44 % in average.

A lot of contributions were collected after the Great East Japan Earthquake to support affected people and utilized for recovery activities. In this research, we asked for what kind of activity they want to donate. The result is shown in Table 28.3. The greatest amount, more than 200,000 JPY (32.3 %), was contributed to the recovery of tsunami-affected areas, followed by health monitoring of radiation-exposed children (74,000 JPY, 11.6 %), compensation for farmers in Fukushima (70,000 JPY, 11.0 %), and development of new energy resources (66,000 JPY, 10.4 %). Monitoring of radiation in foods in each category was around 25,000 JPY,

Table 28.2 Overview of donating behavior

	Participants	Received money (JPY)	Donated money (JPY)	Donation rate (JPY) (%)
Male	842	823.4	348.6	47
Female	827	818.6	416.2	52
Twenties	320	783.8	224.2	32
Thirties	361	864.0	338.1	43
Forties	359	771.3	375.2	53
Fifties	336	825.0	442.0	57
Sixties	293	865.2	548.3	64
Hokkaido	109	957.8	490.5	55
Tohoku	178	842.1	448.9	54
Kanto	212	795.8	345.2	47
Hokuriku	159	775.5	372.5	50
Chubu	247	758.7	327.7	47
Kansai	200	858.0	323.1	44
Chugoku	210	800.0	388.5	49
Shikoku	171	902.3	425.0	52
Kyushu	183	779.8	394.0	52
Average	1,669 (total)	821.0	382.1	50

Table 28.3 Desired activities for donation

Activities	Total amount
Recovery of tsunami-affected areas	¥206,275
Health monitoring for radiation-exposed children	¥74,196
Compensation for farmers in Fukushima	¥69,902
Research on development of new energy	¥66,300
Research on decontamination of radioactive substances	¥58,928
Research on health effects of radiation exposure	¥58,277
Compensation for farmers outside Fukushima	¥30,195
Radiation monitoring of marine products	¥25,891
Radiation monitoring of animal products	¥24,962
Other food radiation monitoring	¥22,753
Total amount of donation	¥637,679
Total amount respondents received	¥732,621
Total	¥1,370,300

and marine products were most favored to strengthen monitoring. When the three categories of foods were aggregated, the total amount became 73,000 JPY (11.5 %).

Participants living in Hokkaido selected health monitoring of children 2.8 times more than the national average, and Tohoku participants (especially Minagi prefecture residents) selected compensation for farmers 1.5 (3.0) times more than the national average.

We have asked the intention to donate and to participate in voluntary activity in the third survey. As a result, 52 % of respondents answered that they want to donate when disaster occurs, and 15 % of respondents showed their intention to participate in voluntary activities. Actually, 73.5 % of respondents answered that they've donated after the Great East Japan Earthquake and 4.5 % joined the voluntary activities. Those who've donated after the earthquake donated more (54 % of received money) in this experiment than those who didn't donate after the earthquake (38 % of received money). However, the gap in the donating rate in this experiment was not significantly different between those who joined voluntary activities (52 %) or not (49 %).

The relationship between the donating rate in this experiment and WTP for foods from disaster-affected areas in the third survey is shown in Table 28.4. Over 100 % of revealed WTP participants donated more in this experiment; both the foods are inspected to be under standard value case ($p=0.012$) and not detected case ($p=0.001$). Donation rates were not significantly different between less than 99 % of WTP groups.

28.4 Discussion and Conclusion

Consumers are carrying an additional burden of collecting information to understand the effects of radioactive substances on health and selecting food. Japanese had not cared before about such effects among multiple risks concerning food. Some residents said they "want to be able to buy local food without considering radioactive risk sooner (the same as before the 2011 earthquake)" in an investigation targeting citizens in Fukushima prefecture. This remark suggested that they felt

Table 28.4 Donating behavior and WTP for foods from affected areas

	Under standard value		Not detected	
WTP	Donation rate (%)	No. of respondents	Donation rate (%)	No. of respondents
0 %	47	357	43	232
1–50 %	48	489	46	327
51–99 %	47	306	45	211
100 %	54	467	53	811
101–200 %	59	50	54	88

"secure" with a safe food supply through the food system by that time and that this "secure" feeling was eliminated because of the Fukushima incident.

It is difficult to regain "secure" feelings given that trust in efforts made by stakeholders in the food system is low, as shown in research results. It will take time to remove radioactive substances emitted due to the Fukushima incident, and the original state before the incident will not be immediately restored. Against this background, time and effort are required for collecting information on understanding risk and management methods for radioactive substances and the current contamination situation. On the other hand, it is relatively easy to obtain alternative food or to select production areas indicated on labels in Japan. In this situation, efforts (cost) to understand the risk of radioactive substances and to select food from specific areas are likely to exceed reduced benefits (cost) due to a lack of availability of food from specific areas in the short term. Decision-making thus makes sense to avoid risk by selecting food from areas as far away from the incident site as possible.

Japanese should cope with the issue of contamination by radioactive substances in the years to come. In order to reduce the cost of information collection and processing by the public concerning the risk of radioactive substances, communication content and methods should be studied by the various entities involved in order to investigate citizen interests and factors in anxiety. Anxiety would not be fully dispelled, and a secure feeling such as that felt before the Fukushima incident will not be obtained even if knowledge is increased. In fact, nine out of 39 of those who responded correctly to all questions related to radiation knowledge in the present research answered that they were "not satisfied" regarding radioactive substance management in food and still rated risk at 5, very high.

An overall trend in research results shows, however, that recognition of the health effects of radioactive substances, the relationship between the radiation dosage in normal situations and the current standard value, contamination of food, and management such as inspection and shipment restrictions is linked to the risk perception (lower) of radioactive substances and satisfaction levels (higher) regarding radioactive substance management. We assume that it would be preferable for Japanese consumers in the long view if they could gain a secured feeling by acquiring the knowledge of radiation risk even if it requires efforts. Otherwise, they face an amount of anxiety at every purchase of foods or can't enjoy the food culture or special local products produced in the affected area.

Moreover, the reconstruction of agricultural production in Tohoku area, an important food supply base for the metropolitan area, is crucial when considering about the future stability of food supply in Japan. To promote the reconstruction, consumer support is a vital element. The food risk we're facing is not only caused by radioactive substances. In order to enjoy a healthy diet life, we should consider other food safety risks, availability of food (food security), and, more widely, ecosystem, natural resources, and local infrastructure. Developing a social or educational system for the consumers to acquire a comprehensive vision would be a huge challenge to be addressed.

Acknowledgments This research was implemented under the projects "safety of animal products in relation to radioactive substance," funded by the Japan Racing Association, and "risk communication in dairy sector," funded by the Japan Dairy Association.

References

Kurihara, S., Maruyama, A., & Luloff, A. E. (2012). Analysis of consumer behavior in the Tokyo Metropolitan area after the Great East Japan earthquake. *Journal of Food System Research, 18*(4), 415–426.

The Food Safety Commission. (2012). *Consumer survey on food safety concerns*. http://www.fsc.go.jp/monitor/index.html (in Japanese). Accessed 6 Apr 2013.

The Ministry of Health, Labour and Welfare of Japan (n.d.). *Information on the Great East Japan earthquake*. http://www.mhlw.go.jp/english/topics/2011eq/index.html. Accessed 6 Apr 6 2013.

Tokyo Metropolitan Central Wholesale Market (n.d.). *Information on the transaction*. http://www.shijou.metro.tokyo.jp/torihiki/index.html (in Japanese). Accessed 6 Apr 2013.

Ujiie, K. (2012). Consumer's evaluation on radioactive contamination of agricultural products in Japan – Decomposition of WTA into a part due to radioactive contamination and a part due to area of origin. *Journal of Food System Research, 19*(2), 142–155 (in Japanese).