

The Soy Paradox:
The Western Nutrition
Transition Revisited, 1950–2010

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Abstract: The article addresses Western dietary change from the mid-twentieth century through the lens of soy. The soybean, originating from the Far East, has often been neglected in accounts of the Western Nutrition Transition. In fact, soyfoods are regarded as an alternative to the nutritional mainstream in the West and are often considered an icon of vegetarian counterculture. Aside from this recognised position in Western dietary culture, this article argues that soy simultaneously played a contradictory (though hidden) role. Through time-series and cross-section analyses of country-level data, a more differentiated account of Western dietary change emerges. Consequently, soybean cake and oil were substantial factors in 'meatification' and 'oilification', which were the main trends of the transition. Metaphorically speaking, soy played a paradoxical role as both antagonist and protagonist in the drama of Western dietary change.

Keywords: soybean, margarine, meat, Western Nutrition Transition, Europe, North America

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The Soy Paradox

The Western Nutrition Transition Revisited, 1950–2010

Introduction

Regardless of whether we refer to the post-1945 development of world society as ‘modernisation’ or as ‘globalisation’ (Beck 1999), the Western Nutrition Transition (WNT) is a crucial, but often neglected subject in discussions of these megatrends. The concept was coined by Barry M. Popkin (1993), who categorised the *longue durée* of human nutrition into five overlapping stages: first, the age of collecting food, which includes a varied diet of wild plants and low-fat animals; second, the age of famine, which rests on a less varied and cereal-based diet; third, the age of receding famine, which involves a cereal-based diet with added vegetables, fruits and animal protein; fourth, the age of degenerative diseases, which prefers a low-fibre diet rich in fats, sugar and processed food; and fifth, the age of behavioural change, which includes a low-fat and unprocessed diet with increased vegetables, fruits and carbohydrates. Though each shift from one stage to the next is a transition in itself, most scholars associate the WNT with the move from the third to the fourth stage (Caballero and Popkin 2002). The timescale of the WNT differs by world regions: it took off in the USA already in the 1930s and 1940s, spread to Europe in the 1950s and 1960s and captured several countries in Latin America and Asia from the 1970s onwards. As a consequence, the Western diet emerged on a global scale: “Modern societies seem to be converging on a pattern of diet high in saturated fat, sugar, and refined foods and low in fiber—often termed the Western diet” (Popkin 1993, 138).

In order to contextualize the WNT in a world-historical sense, I refer to the concept of the global food regime, which combines world-systems analysis and regulation theory with regard to agriculture and food (McMichael 2013). This structuralist and political-economic concept can be extended with regard to practical and socioecological aspects by actor-network theory, which focuses on hybrids of society and nature (Latour 2007). This notion of the global food regime comprises three interrelated elements: first, value extraction and accumulation along transnational commodity chains by powerful

and market-dominating actors (agrochemical industry, trading firms, supermarkets, etc.); second, the social and environmental relations of food production, distribution and consumption (labour relations, nutrient cycles, food waste, etc.); and third, intentional and functional regulation of commodity chains by formal and informal institutions (nation states, transnational companies, social movements, etc.) The literature distinguishes three global food regimes since the onset of globalization: the UK-centred or ‘extensive’ food regime (1870s–1920s), built upon food flows from farming families in overseas settler colonies to working-class households in industrialised Europe; the US-centred or ‘intensive’ food regime (1940s–1970s), fuelled by the deposition of US surplus feeding stuffs in Western Europe and Japan as well as US surplus grains in the Third World; and the WTO-centred or ‘flexible’ food regime (from the 1990s), shaped by new major exporters (e.g. Brazil) and importers (e.g. China) in the global food market. Transitions from one regime to another are often driven by political and economic crises (McMichael 2013). The WNT gained a foothold in Western middle-classes in the first regime, unfolded in the welfare societies of the industrialised world (Europe, North America and Japan) in the second regime and spread to the middle-classes of emerging countries (Brazil, China, Philippines etc.) in the third regime (Smil 2002).

While modernist and globalist accounts of the WNT suggest that liberation from the pre-industrial Malthusian trap of endemic famine was a success (Federico 2005), more critical assessments draw attention to the ambivalent effects of this liberation on society and the environment. On the one hand, literature on nutrition focuses on the adverse impacts of obesity on human health, namely the spread of nutrition-related non-communicable diseases such as cardiovascular disease, diabetes and certain types of cancer (Cordain et al. 2005). On the other hand, socio-ecological accounts highlight the environmental impacts of ‘meatification’ (Weis 2013)—the change from a plant-based to an animal-based diet—in relation to its inefficient use of natural resources. On average, six kilograms of plant protein is required to yield one kilogram

of meat protein (Pimentel and Pimentel 2003). Thus, the centrality of the WNT for accounts of modernisation and globalisation can hardly be overestimated.

This article addresses the WNT since the mid-twentieth century in relation to soy. The soybean has often been neglected in accounts of dietary change. For instance, a search of Levenstein's (2003) food history of the USA in the twentieth century reveals that the keyword 'soy' is entirely absent. Most scholars recognise soyfoods as an alternative to the nutritional mainstream and highlight the soybean as an icon of the vegetarian counterculture (Belasco 2012). The anthology *The World of Soy* (Du Bois et al. 2008) provides a comprehensive account of the use of soy in human nutrition from a long-term and global perspective. Though the role of soy in Western vegetarian counterculture is well known, recent research has argued that it simultaneously played a contradictory (though more covert) role (Roth 2013; Prodöhl 2013, 2016; Langthaler 2015). Based on time-series and cross-section analyses of country-level data, this article draws a more differentiated account of dietary change in Europe and North America. Soybean cake and oil played a large part in the rising intake of meat and vegetable oils in the course of the WNT, and metaphorically speaking, soy played a paradoxical role as both an antagonist and protagonist in the drama of Western dietary change. The metaphors 'antagonist' and 'protagonist' refer to soy's dual role as a countercultural icon (whole soybean) and as an ingredient of the Western diet (soybean oil and cake).

I will outline my argument of the 'soy paradox' in three steps: firstly, soy will be portrayed as a versatile actor connected to complex networks; secondly, the emergence of the Western diet will be reviewed by time-series and cross-section analyses of country-level data; and thirdly, soy's paradoxical role in the WNT will be highlighted. In doing so, this article provides a nuanced account of past dietary changes, which pose a big challenge for world-society and the environment in the future (Smil 2002).

Soy as a Versatile Actor

The soybean, *Glycine max*, is a cultigen that apparently does not exist outside of human cultivation. Possible origins of the soybean are depicted in many legends, although it is known that the trial-and-error process of soybean domestication did not fully succeed until the eleventh century BC, in the northeast of China. Through migration and trade, the soybean spread to other parts of East, Southeast and South Asia in the following centuries, and became a commonly-used ingredient in regional food cultures. In the twentieth century, the bulk of soybean cultivation shifted to the Americas. The US soy expansion took off in the 1930s, followed by another expansion in South America (Brazil, Argentina and Paraguay) from the 1970s onwards. Through this transfer

from East to West in the twentieth century, soy was converted from a food crop into a cash crop with a multitude of commercial uses (Du Bois and Mintz 2003; Sorosiak 2000).

The soybean plant, as a living organism, has specific characteristics which both enable and limit its interaction with other species, including humans. The plant's maturation is highly sensitive to day length. This phenomenon, which is known as photoperiodicity, as well as soy's vulnerability to frost, means that each location may require a different variety of soy for optimal growth. However, under the right conditions, any given variety of soy is a reliable crop, which can grow in moderate, subtropical and tropical climates and can tolerate poorer soils. The symbiosis between the soy plant and *Rhizobium* bacteria on its roots causes the bean's high protein content, and the bacteria itself plays a role in the renewal of soil fertility by tying up nitrogen. During the growth phase, the slowly-maturing plant competes with weeds for sunlight, water and nutrients, and thus depends on alliances with its cultivators. Asian-style, labour-intensive farming with mechanical weed control through hoeing has given way to Western-style capital-intensive farming, with the growing use of large-scale machinery, agrochemicals and herbicide-resistant transgenic seeds. The harvested bean consists of 25 to 45 per cent protein and 15 to 20 per cent fats, depending on the variety and farming conditions. In addition, the soybean is high in amino acids and vitamins. In comparison to other vegetal crops, it is strikingly nutritionally complete as a human food (Du Bois and Mintz 2003; Sorosiak 2000).

Due to its richness in protein and oil, soy is a multi-purpose crop. Therefore, soy-related commodity chains are widely spread (van Gelder and Dros 2002). The bean has been traditionally used for a variety of food-stuffs in its non-fermented (tofu, soy milk, okara, etc.) and fermented forms (soy paste, soy sauce, natto, etc.), as practiced in East Asian food cultures for centuries. In the modern era, the processing of soy has shifted to bean crushing, in order to extract the oil with chemical solvents (which takes place primarily at large-scale extraction plants, mostly run by transnational companies) or screw presses (more frequently used at smaller extraction plants). The oils are then refined, bleached and deodorised to be used for food (margarine, mayonnaise, cooking oil, etc.) or for industrial purposes. The residual cake is mainly used as protein-rich animal feed by the livestock industry (Huang 2008; Du Bois and Mintz 2003; Sorosiak 2000; Clay 2004, 173–202).

As noted earlier, soy is a versatile crop. It resists any singular definition, instead oscillating between a pulse, due to its high protein content, and an oilseed, due to its high oil content. The question of which definition is most appropriate is not solely determined by the biological features of the crop, but also depends on how it is

Table 1: Total food supply per capita in Europe and North America 1961 and 2011

Categories of foodstuffs	1961		2011		Difference	
	kcal	per cent	kcal	per cent	kcal	per cent
Cereals	1,080	36.0	936	27.1	-143	-8.9
Starchy roots	183	6.1	136	3.9	-47	-2.1
Sugar and sweeteners	363	12.1	440	12.8	77	0.7
Vegetable oils	210	7.0	514	14.9	304	7.9
Vegetables	55	1.8	79	2.3	24	0.4
Fruits	72	2.4	107	3.1	35	0.7
Alcoholic beverages	139	4.6	168	4.9	29	0.2
Meat	255	8.5	372	10.8	117	2.3
Animal fats	199	6.6	148	4.3	-51	-2.3
Eggs	43	1.4	51	1.5	8	0.0
Milk	291	9.7	324	9.4	33	-0.3
Fish and seafood	25	0.8	43	1.3	18	0.4
Other foodstuffs	84	2.8	132	3.8	47	1.0
Vegetal products	2,177	72.6	2,506	72.6	328	0.0
Animal products	822	27.4	945	27.4	123	0.0
Total	2,999	100.0	3,451	100.0	451	0.0

Other foodstuffs: pulses, treenuts, oilcrops, stimulants, spices, offals and miscellaneous. Source: FAO 2016 (own calculation).

used by society as a more or less commodified resource (Langthaler 2015). In this context, soy can be conceived of as both a structured and structuring actor, neither a dependent object nor an autonomous subject (Giddens 1984). This notion by no means denies the differences between human and nonhuman beings, as animals and plants lack certain features of humanity. However, in a non-anthropocentric sense, soy can gain considerable agency if it is understood as a node of hybrid (that is, both natural and social) actor-networks (Latour 2007). As this article will show, soy impacts in many ways on related entities, both human and nonhuman, by widening or narrowing their rooms for manoeuvre (Knappett 2008).

Pathways of Dietary Change

To reconstruct dietary change in Europe and North America at a national level, three sources of data are available, each with its own strengths and weaknesses (de Boer et al. 2006). These are as follows: firstly, the national food consumption surveys that were undertaken for some countries (Sweden, United Kingdom, Netherlands, etc.), but not in all; secondly, the quinquennial national household budget surveys conducted by Eurostat (2016), which do not include food consumed outside the home; and thirdly, the annual food balance sheets by the United Nations Food and Agriculture Organization (FAO),

which cover all Western countries and extra-household consumption (FAO 2016). Despite the FAO dataset's strengths in comparison with the other data sources, it also has a drawback: since the data measure per capita supply at retail level and consequently ignore waste, they provide no exact indicators of actual food intakes (Smil 2002). However, because no better published data exist with a similar temporal and spatial scope, the FAO food balance sheets are employed in this study to compare national patterns of food consumption.

Since its establishment in 1947, the FAO has been publishing annual country-level data on food supply in its yearbook *The State of Food and Agriculture* and—for the period from 1961 onwards—in its online database *Faostat*. Although the data gathered by different national governments must be treated with caution (as with every statistical representation of reality), they enable both time-series and cross-section analyses.

A comparison of the FAO food balance sheets for 1961 and 2011 reveals the main direction of the WNT. Food supply per capita in Europe and North America not only grew in calorific value—from 2,999 to 3,451 kcal—but also changed in composition. The most notable changes include a decrease in the supply of cereals, animal fats and starchy roots, and an increase in the supply of vegetable oils and meat. Despite these massive changes, the proportions of vegetable and animal products have stayed constant over the past fifty years (see Table 1).

Table 2: Total food supply per capita in Greece 1961 and 2011

Categories of foodstuffs	1961		2011		Difference	
	kcal	per cent	kcal	per cent	kcal	per cent
Cereals	1,327	47.0	961	28.0	-366	-19.0
Starchy roots	59	2.1	120	3.5	61	1.4
Sugar and sweeteners	148	5.2	259	7.5	111	2.3
Vegetable oils	423	15.0	637	18.6	214	3.6
Vegetables	68	2.4	139	4.0	71	1.6
Fruits	200	7.1	148	4.3	-52	-2.8
Alcoholic beverages	80	2.8	101	2.9	21	0.1
Meat	93	3.3	314	9.1	221	5.9
Animal fats	36	1.3	56	1.6	20	0.4
Eggs	22	0.8	35	1.0	13	0.2
Milk	185	6.5	413	12.0	228	5.5
Fish and seafood	31	1.1	33	1.0	2	-0.1
Other foodstuffs	152	5.4	217	6.3	65	0.9
Vegetal products	2,450	86.7	2,574	75.0	124	-11.7
Animal products	375	13.3	859	25.0	484	11.7
Total	2,825	100.0	3,433	100.0	608	0.0

Other foodstuffs: pulses, treenuts, oilcrops, stimulants, spices, offals and miscellaneous. Source: FAO 2016 (own calculation).

However, the average Western consumer characterised by these numbers represents only a crude approximation of actual eating and drinking habits. We also cannot ignore the remarkable variation among countries, demonstrated by the contrasting cases of Greece and Ireland. Though the per capita intake grew in both countries between 1961 and 2011, the growth in calorific value was stronger in Greece than in Ireland. As a consequence, the gap in total food supply between the Greek below-average level and the Irish above-average level diminished. Even more striking are the changes in the composition of these national diets. In the 1960s, the Greeks still adhered to their Mediterranean diet (Montanari 1994, 6), rich in cereals, vegetable oils, fruits, fish and seafood. In contrast, the Irish diet was characterised by high intakes of sweeteners, milk, animal fats and starchy roots. In the following decades, both national patterns of food consumption converged. The Greek population had a massively reduced intake of cereals and fruits while raising the supply of milk, meat, vegetable oils and sweeteners. Simultaneously, the Irish reduced their intake of animal fats, milk, starchy roots and sweeteners while raising their supply of vegetable oils and alcoholic beverages. Consequently, the initially divergent proportions of vegetable and animal products in both countries converged to meet the average of the Western world (see Tables 2 and 3).

The comparison of the cases of Greece and Ireland suggests the emergence of the Western diet with its em-

phasis on meat, sweeteners and saturated fats as a common pattern in the second half of the twentieth century (Popkin 1993; Cordain et al. 2005). An assessment of this suggestion is provided by a combined time-series and cross-section comparison at a national level, covering twenty-four European and North American countries: Austria (A), Belgium-Luxembourg (B-L), Bulgaria (BG), Canada (CDN), former Czechoslovakia (CZ-SK), Denmark (DK), France (F), Finland (FIN), West and East Germany (D), Great Britain (GB), Greece (GR), Hungary (H), Ireland (IRL), Italy (I), Norway (N), the Netherlands (NL), Poland (PL), Portugal (P), Romania (RO), Spain (E), Sweden (S), Switzerland (CH), the United States of America (USA) and former Yugoslavia (YU). Each of these countries is represented by at least four time-points, which were calculated as multi-annual means (1961/65, 1976/80, 1991/95 and 2006/10). Depending on the availability of data, a fifth time-point (1948/53) was added for most countries (FAO 1966, 2016).

In order to uncover time- and space-specific patterns of food consumption, a Principal Components Analysis (PCA) is applied in three steps (Dunteman 1989): firstly, PCA reduces the set of thirteen variables (i.e. categories of foodstuffs) into a smaller set of uncorrelated components (i.e. dimensions of a multi-dimensional space) that represent most of the information found in the initial dataset. Secondly, PCA positions the 115 cases (i.e. nineteen countries at five time-points and five countries

Table 3: Total food supply per capita in Ireland 1961 and 2011

Categories of foodstuffs	1961		2011		Difference	
	kcal	per cent	kcal	per cent	kcal	per cent
Cereals	1,067	31.7	1,062	29.6	-5	-2.1
Starchy roots	256	7.6	150	4.2	-106	-3.4
Sugar and sweeteners	520	15.5	419	11.7	-101	-3.8
Vegetable oils	75	2.2	396	11.0	321	8.8
Vegetables	27	0.8	86	2.4	59	1.6
Fruits	57	1.7	118	3.3	61	1.6
Alcoholic beverages	107	3.2	292	8.1	185	5.0
Meat	286	8.5	365	10.2	79	1.7
Animal fats	360	10.7	162	4.5	-198	-6.2
Eggs	54	1.6	35	1.0	-19	-0.6
Milk	470	14.0	328	9.1	-142	-4.8
Fish and seafood	10	0.3	35	1.0	25	0.7
Other foodstuffs	75	2.2	143	4.0	68	1.8
Vegetal products	2,150	63.9	2,645	73.7	495	9.7
Animal products	1,214	36.1	946	26.3	-268	-9.7
Total	3,364	100.0	3,591	100.0	227	0.0

Other foodstuffs: pulses, treenuts, oilcrops, stimulants, spices, offals and miscellaneous. Source: FAO 2016 (own calculation).

at four time-points) in the multi-dimensional space according to the values of their variables (i.e. the national diets at certain time-points). Thirdly, by connecting the four or five positions of the respective countries, national pathways in the WNT, from the mid-twentieth century onwards, begin to emerge. Positions close together indicate similar dietary patterns, whereas positions further apart indicate different dietary patterns.

Let us now interpret the results of the first step of the analysis. According to the positive or negative correlations ('loadings') within the categories of foodstuffs, each of the uncorrelated dimensions can be identified as a separate strand of the WNT (see Figure 1). As the first and second dimensions together account for more than half of the variance (55 per cent), the other dimensions can be disregarded. The horizontal and most important dimension, D1, distinguishes the countries with high supplies of cereals and pulses from countries with high supplies of sweeteners, meat, milk, eggs and stimulants (coffee, tea, cacao, etc.). From left to right, D1 indicates the tendency towards meatification: the transition to a diet based on meat and other animal foodstuffs (Weis 2013). The vertical and second most important dimension, D2, distinguishes countries with high supplies of starchy roots (e.g. potatoes) from countries with high supplies of vegetable oils, fruits, tree nuts, vegetables and oil crops. From bottom to top, D2 indicates a tendency which I propose to label 'oilification', the transition to a

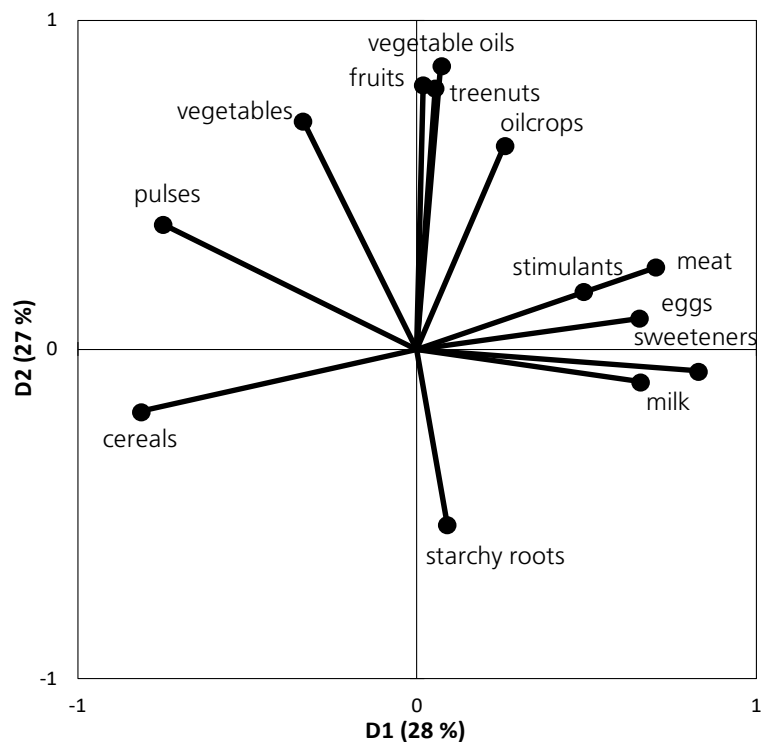
diet rich in vegetable oils and oil-bearing plants. Thus, meatification and oilification emerge as main components of the WNT since the mid-twentieth century.

In the second stage of analysis, countries are positioned in a two-dimensional cloud, according to the (dis-) similarities of their diets. The positions of the countries in 1948/53, 1961/65, 1976/80, 1991/95 and 2006/10 indicate a decade-long trend from the lower-left to the upper-right corner. This coincides with the lines of meatification and oilification (the basic trends of the WNT). However, we must not suggest that this collective movement was universal, as individual cases reveal the multiplicity of national pathways in the field of dietary change.

This variability is highlighted in the third step of analysis. By connecting the positions of the respective countries, for example Greece and Ireland, national pathways emerge in the cloud (see Figure 2). As already discussed, Greece and Ireland had adopted contrasting diets in the mid-twentieth century: the former was rich in cereals, vegetable oils, fruits, fish and seafood; the latter was characterised by high intakes of sweeteners, milk, animal fats and starchy roots. Consequently, the Greek and Irish pathways unfolded in opposite corners of the two-dimensional space: while Greece predominantly moved towards meatification, Ireland moved towards oilification, thus demonstrating the two main trends of the WNT.

The unevenness of national pathways indicates that there is no such thing as a uniform Western diet; thus

Figure 1: Correlations between categories of foodstuffs and dimensions. Only correlation coefficients of 0.50 or more have been included. Source: FAO 1966, 2016 (own calculation: PCA, rotated, 13 variables, 96 active and 19 passive cases).



we should instead use this term in the plural rather than the singular. A multiplicity of trajectories, which converge and correlate with geographical locations, emerged from the mid-twentieth century onwards. The Eastern European countries (BG, PL, RO and YU) initially stood out due to their high supplies of cereals and potatoes, but from the 1960s onwards, they approximated the Western average. The diets of the Southern European countries (E, GR, I and P) in the 1950s were rich in pulses and cereals, but in the following decades, vegetable oils and vegetables came to the fore. The Northern European countries (DK, FIN, N and S), Northwest European countries (B-L, F, GB, IRL and NL) and Central European countries (A, CH, CZ-SK, D and H) had a balanced diet, many of them with above-average supplies of potatoes. However, in the late-twentieth century, they moved towards either meatification or oilification. The North American countries (CAN and USA) already had high supplies of animal products, combined with sweeteners and stimulants, in the 1950s. In the following decades, vegetable oils, vegetables and fruits gained traction.

The surprising resemblance between our PCA-based map (after a counter-clockwise quarter-turn) and the geographical maps of Europe and North America suggests regional pathways of dietary change. The divide between the Roman and Greek versus the Germanic and Celtic cultures reaches back to ancient times. Due to the agricultural cultivation of wheat, grapes and olives in the south of Europe, “there developed a diet, which we may call ‘Mediterranean’, characterized by a dominant vegetable component—bread, wine, oil and greens—complemented by a little meat and especially cheese.” In the

northern cultures, “hunting and fishing, the gathering of wild fruits and the free pasturing of livestock in the woods (especially swine, but also horses and cows) was central to their way of life. Meat, rather than bread or polenta, was the most important element of their diet” (Montanari 1994, 6). Some authors argue that also religion had an impact on culinary preferences. According to current household budget surveys, consumers in Catholic areas seem to be “more inclined to appreciate meat as a pleasure and an expression of the family’s social position” than their Protestant counterparts (de Boer et al. 2006: 272). The income gap between northern and southern countries—due to the uneven distribution of industrialisation in nineteenth- and twentieth-century Europe—also shaped the culinary landscape. While poor households relied on inferior goods such as bread and potatoes, affluent buyers preferred superior goods such as meat and dairy products (Teuteberg and Flan-drin 1996).

Since the late nineteenth century, the development paths outlined above were partly weakened and partly reinforced in the contexts of global food regimes. After initial steps in the UK-centred food regime, meatification and oilification—the main trends of the WNT—unfolded in the US-centred food regime in the decades after the Second World War. Rising incomes due to the acceleration of economic growth and the expansion of the welfare state in the *Trentes Glorieuses* (1945–1975) enabled households to purchase more exclusive foodstuffs, with meat as an icon of (male) middle-class lifestyles. The crisis of the 1970s and the subsequent transition to the WTO-centred or ‘flexible’ food regime, accompanied by

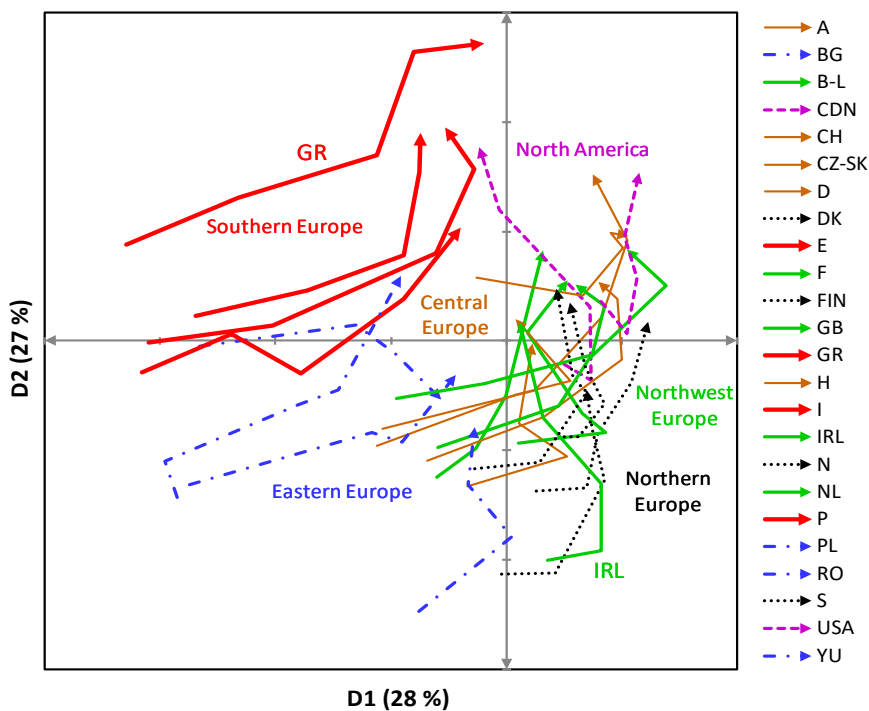


Figure 2: National Pathways of the WNT, 1948/53–2006/10. The cases for 1948/53 were set passive (i.e. they do not actively contribute to the PCA) due to inconsistencies and lack of data. Source: FAO 1966, 2016 (own calculation: PCA, rotated, 13 variables, 96 active and 19 passive cases).

market fluctuations and lean government, led to a bifurcation of Western foodways: besides the mainstream of industrialised agro-food chains—which span long distances between production and consumption (‘food from nowhere’)—niches for organic and regional food (‘food from somewhere’) emerged in the affluent societies (Hobsbawm 1996; McMichael 2013).

Soy’s Dual Role

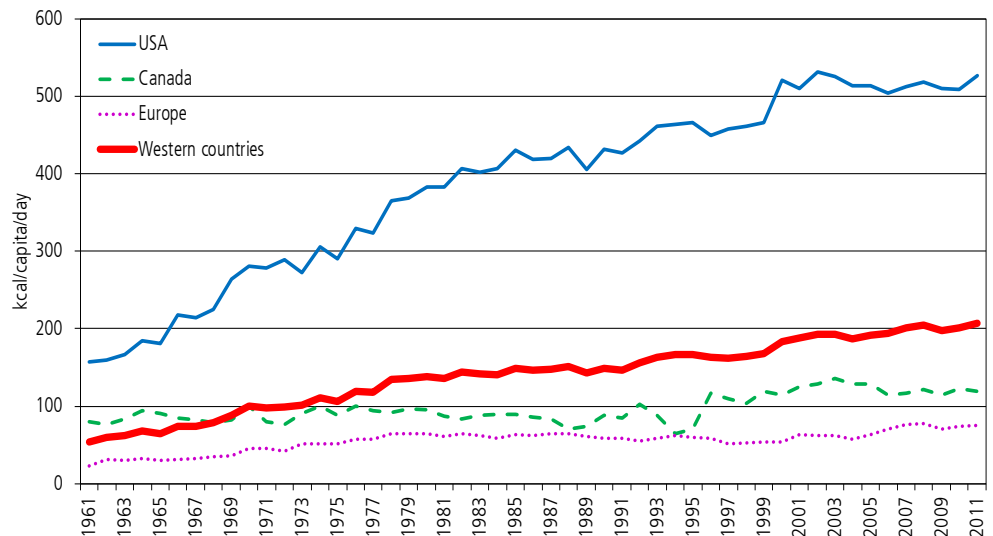
Foodstuffs made from whole soybeans in their non-fermented or fermented forms had already entered Western food cultures by the mid-twentieth century. This is most evident in the case of the USA. By the 1950s, three cultural streams had brought soy into the consciousness of US consumers. These came from Asian-American communities of immigrants, who preserved and adapted their culinary traditions as part of their ethnic identity; from Seventh Day Adventists, who substituted vegetarian alternatives for the mainstream meat-based diet due to their commitment to vitalism; and also from the technical improvement of soyfoods, which was intended to match Western culinary preferences. However, the effects of these three factors were limited compared to the mainstream Western dietary change driven by meatification and oilification (Roth 2013, 1–21).

In the 1960s and 1970s, a fourth stream emerged from the burgeoning counterculture that rejected the commodification, bureaucratisation and rationalisation of daily life. The followers of this countermovement against Western civilisation drew on all the previous cultural aspects of soyfoods in their own culinary culture. The in-

troduction to ‘authentic’ Asian-style meals provided an alternative to the Western diet, Adventist vegetarianism dovetailed with Buddhist ideals, and last but not least, cheap and improved soyfoods further facilitated the culinary shift to ‘hippie food’, thereby paving the way for further commodification. Through this countercultural movement, soyfoods in general and tofu in particular became culinary icons. ‘Soytopia’ (the countercultural obsession with soy as an alternative to Westernisation) was represented in popular works covering a broad spectrum: from the dystopia of an overpopulated world, relegated to soy-based meat imitations (e.g. Harry Harrison’s 1966 book *Make Room! Make Room!* and its 1973 film adaptation *Soylent Green*), to the utopia of a materially and spiritually sound future, based on high-protein meatless cooking (e.g. Frances Moore Lappé’s 1971 book *Diet for a Small Planet*). In short, soy became an antagonist of the Western diet (Roth 2013, 425–493).

Beyond the US hippie culture, broader social movements that were sceptical of the Western route to modernity also began to address food issues. The environmentalist strand of alternative discourses attested that the Western diet was exploiting the planet’s natural resources (causing deforestation, soil erosion, global warming, etc.). Therefore, meat-reduced or meatless diets—with soy as the main source of vegetable protein—were promoted on the premise that this would sustainably feed the world, especially the fast-growing countries in the Global South. The medical community highlighted the beneficial effects of soyfoods on human health, especially with regard to heart disease, osteoporosis and certain cancers. The spiritualist community oriented towards

Figure 3: Per capita supply of soybean oil in Europe and North America, 1961–2011. Source: FAO 2016 (own calculation).



Asian worldviews regarded soyfoods to be healthful, invigorating and cleansing (Belasco 2012; Mintz 2008).

In the discursive and social contexts of this emerging counterculture, soy was conceived of as a sustainable, healthy and ethical food. Since then, a myriad of cookbooks have promoted whole soybeans as a key ingredient in vegetarian and low-meat diets. However, the food industry soon incorporated this alternative trend into business-driven commodity chains by marketing soy-based substitutes of meat and dairy products. By 2006, three quarters of soyfoods purchased in the USA were sold in mainstream supermarkets (Du Bois 2008, 219–222). Despite rising consumption in some Western countries in the last few decades—with a maximum of 16 kcal per capita in Austria in 2009—the contribution of soyfoods to total calorific value is still negligible. Currently, tofu, soy milk and other soyfoods occupy only a small—though growing—niche in Western food cultures (Mintz et al. 2008).

Soy's role in dietary change was not restricted to the prevalence of soyfoods, however. Soybean oil and cake became main ingredients in Western diets, whether directly or indirectly. Soy's richness in oil and protein enabled its two-way commodification over the course of the WNT. Among all vegetable oils used for food purposes in Europe and North America, soybean oil came out on top, with per-capita frequencies rising from 54 to 207 kcal or from 26 to 40 per cent of total oil consumption between 1961 and 2011 (see Figure 3). However, these averages demonstrate soybean oil's exceptional position in the USA: per capita supply rose from 157 to 527 kcal or from 57 to 75 per cent of total oil consumption between 1961 and 2011. In Canada and Europe, soybean oil was less important. Here, other vegetable oils (sunflower, rapeseed, and olive oils, etc.) prevailed. Only in some North and Northwest European countries—Norway (209 kcal),

the Netherlands (165 kcal), Denmark (119 kcal), Germany (116 kcal) and Sweden (102 kcal)—did the average annual supply from 1961 to 2011 exceeded 100 kcal. Thus, the USA stands out as a special case among Western food cultures in its preference for soybean oil.

Soybean oil entered the American diet during the Second World War. Prior to the war, the USA had imported around 10 per cent of its food supplies of vegetable oils and fats from the Pacific region, mainly copra from the Philippines and palm hearts or kernels from the Dutch East Indies and British Malaya. After the outbreak of war with Japan in 1941, these supply chains were largely interrupted due to military operations. Though a loss of 10 per cent does not seem high, these particular oils and fats contained an extraordinarily high amount of glycerine, which was urgently needed for military purposes (explosives, gunpowder, protective paint, etc.). Thus, the US government decided to resolve the shortage of oils and fats by strongly regulating the commodity chain. Tropical oils and fats were used in the most efficient ways possible, consumers were urged to save waste oils and fats for recycling and farmers were encouraged by price supports to plant more oilseeds such as soybeans, peanuts and flax. Since the production offensive proved to be extremely successful, domestic oilseeds replaced tropical high-glycerine crops in food processing to a large extent, especially in the manufacturing of shortening and margarine, but also mayonnaise and salad dressings (Prodöhl 2016, 33–40; Roth 2013, 280–347).

The wartime years were not a short-term interlude, but a watershed for the infiltration of soybean oil, as well as other new products, into US diets with long-term effects (Collingham 2012, 476–501). Political lobbying, corporate strategies and technological improvements strengthened the commodity chain between the soybean field and the dining table under the US-centred

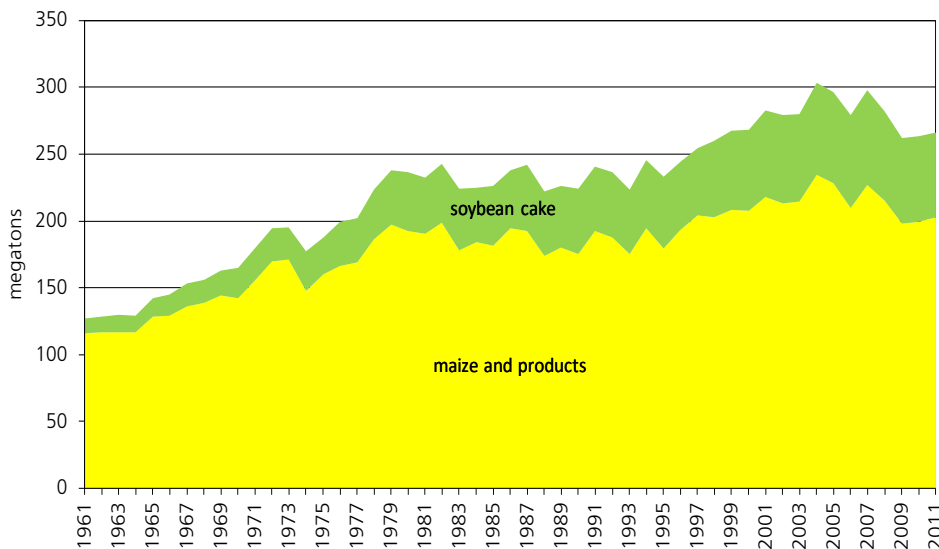


Figure 4: Maize and soybean cake as animal feed in Europe and North America, 1961–2011. Source: FAO 2016 (own calculation).

food regime. Margarine was the lynchpin of the soy commodity chain, as it was a guaranteed high-value use of soybean oil. In 1949, a powerful alliance of soybean and cotton farming interests in Congress successfully enforced the repeal of federal taxation of yellow coloured margarine ('oleomargarine'), going against the longstanding protests of the dairy farming lobby. Ten years later, US margarine production surpassed butter, and another ten years later, its production was double that of butter (Roth 2013, 349–371). Besides foodstuffs, soybean oil was also used for industrial purposes, for example as a lubricant for machines and as raw material for a broad range of products (soap, ink, glue, etc.). Henry Ford's obsessive efforts to develop soy-based parts for automobile manufacturing in the 1930s were emblematic of the 'chemurgy' movement, which strived to incorporate agrarian products into industrial supply chains (Prodöhl 2013, 476–481). As the industrial sector began to substitute synthetic oils for vegetable ones, the soy industry reinforced its attempts to channel excess oil into food processing. However, the strange flavour of soybean oil for Western tastes was a serious hindrance to this commodification strategy. Cooperative research between government, universities and industry brought ever-greater improvements to the oil's flavour and shelf life with new technologies. As a result, soybean oil was used in ever larger quantities for margarine, shortening and cooking or salad oil. Western retailers often labelled it simply as 'vegetable oil', thereby obscuring its historical origins in the Far East (Du Bois 2008, 214–219; Péhaut 1999, 462).

Soy's role as a protagonist of meatification is less obvious than in the case of oilification, but was nevertheless substantial. As a by-product of the extraction of oil from the soybean, soybean cake as animal feed was incorporated in the commodity chain of meat-based diets. The

expansion of the livestock-feeding complex in North America and Europe in the post-war era was driven not only by a growing demand for meat on the downstream side, but also by a growing supply of animal feed on the upstream side. The massive expansion of soybean production in and after the Second World War and the channelling of the oil into the food industry resulted in excess amounts of soybean cake, which were to be channelled into the livestock industry. While the use of oil as an agro-food commodity was mainly demand-driven, the commodification of cake was mainly supply-driven. Industrialised feeding of cattle, pigs and poultry mainly relied on maize as a source of carbohydrates and soybean cake as a source of protein (Weis 2013). Though maize prevailed in absolute and relative terms, the share of soybean cake constantly rose from 10.8 to 63.3 megatons, or from 8 to 24 per cent of total supply of feeding stuffs, between 1961 and 2011 (see Figure 4). Concerning the cake's importance as animal feed in these five decades, European countries (7 to 29 per cent) overtook North America (9 to 20 per cent).

The growing use of soybean cake as animal feed emerged under the US-centred food regime after the Second World War. As it became the world's leading soybean producer, the USA not only flooded the expanding domestic market, but also looked for foreign markets to export their state-subsidised surpluses. On the other side of the Atlantic, Western European countries heavily depended on imports of feed for their growing livestock herds. This problem was resolved in two steps: initially in the framework of the European Recovery Program, and secondly in the Dillon Round of the General Agreement on Tariffs and Trade, which exempted US exports of feed crops to the European Economic Community from import duties. Consequently, the USA became the main supplier of soy-based animal feed for their allies

in Western Europe and Japan. After the neoliberal restructuring of the global food regime in the 1980s and 1990s, soy-based commodity chains were deepened and widened. In the de- and re-regulated framework of the World Trade Organization (WTO), Brazil and other South American countries successfully challenged the US dominance in the European and East Asian export markets for soybeans and soybean cake (Winders 2012, 129–158; McMichael 2013, 21–40; Friedmann 2002).

Conclusion

This article has shed new light on the WNT from two angles. Firstly, the conventional wisdom of the uniformity of the so-called Western diet has been challenged by a discussion of the multitude of national pathways of dietary change. Second, soy's paradoxical role in the WNT—especially evident in the case of the USA—has been highlighted. On the one hand, the soybean as a whole emerged in the 1960s and 1970s as an icon of the vegetarian counterculture to the Western diet, but did not reach far beyond this niche. On the other hand, the soybean in its crushed form became a mostly hidden, but widely used, ingredient in the main trends of the WNT, in the form of protein-rich cake for meatification, and oil for oilification. In this way, a crop deeply embedded in food cultures in the Far East for millennia was westernised in just a few decades: “Soybeans were perceived not primarily as human food but rather as an industrial crop that could best be exploited by breaking it down into its components, more like an inedible oilseed, such as cotton, than like a food containing oil, such as maize or peanuts” (Mintz et al. 2008, 4). Consequently, soy as a commodity that was incorporated into state-regulated and corporate-controlled agro-food chains was not centre stage in Western debates on food. However, its derivatives—soybean oil and cake—were nearly omnipresent in post-war mass consumer society in a wide range of foods that were in high demand: in cubes of yellow coloured margarine, in cans labelled as vegetable oil, in meals with meat from industrially-fed animals and so on. By acting as countercultural icon as well as ingredient of the nutritional mainstream, soy figures as both an antagonist and protagonist in the WNT.

Although the WNT has been discussed here as a phenomenon of the past, it also is highly relevant for the future, given that the worldwide diffusion of the Western diet could gain disastrous social and environmental effects in both the Global North and the Global South (Weis 2013). According to Popkin (1993), the WNT transition to the ‘age of degenerative diseases’ (the third to the fourth stage) might be succeeded by the transition to the ‘age of behavioural change’ (the fourth to the fifth stage). While the former involves meatification and oilification, the latter leads to a ‘rational diet’: that is, reducing ex-

cessive meat intakes in the Global North and capping them in the Global South (Smil 2013, 177–215). Soy's role in such a society- and environment-friendly nutritional transition cannot be predicted, but given its versatility in the past WNT, its future seems quite promising.

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