Chapter 24
Conceivable Strategies for Sustainable Well-being

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Contents

Abstract The final chapter of this volume explores how – at this moment in time – strategies can be developed in the Netherlands to achieve sustainable well-being. In addition to key problems like the non-circularity of supply chains and the vast increase in volumes of mass flows since 1960 (cf. Chap. 22) the Netherlands is also struggling with a 'welfare paradox,' i.e. high levels of welfare accompanied by widespread alienation and cynicism. The development of a circular economy and the achievement of sustainable levels of mass-flows are the key goals. Three strategies to achieve these goals are described: regeneration, restoration, and dematerialisation. For all four cases described in Chap. 23 it is shown how each of the three strategies contributes to more circularity and more manageable mass flows. In a final section it is argued that the transition toward a circular economy harbours promises about resolving both some patent defects of the market system as well as

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a potential resolution of the "welfare paradox" by aiming at an economy that is integrated into society and that fosters markets and social institutions that include, rather than exclude, ordinary citizens.

Keywords Circular economy · Mass flows · Welfare paradox · Regeneration · Restoration · De-materialisation · Markets · Grain · Meat · Gravel · Plastics · Electricity

24.1 Introduction

The previous two chapters have provided a backdrop against which to develop strategies for sustainable well-being: here and now, at the end of the second decade of the twenty-first century. Chapter 22 recapitulated how, by 1960, the problems of well-being that had plagued Dutch society from the mid-nineteenth century (poverty, poor housing, poor health) had largely been resolved – accompanied by a vast expansion of resource and energy flows and associated damage to natural capital in the Netherlands and elsewhere. It also showed how, ironically, 50 years later Dutch society sees itself confronted with a welfare paradox: while the country's level of welfare is spectacularly high, certainly by international standards, there is widespread public discontent and pessimism about the future.

In the previous chapter, we analysed three exemplary value chains (grain-for-meat; gravel-for-housing; plastics-for-everyday life) and showed how two key problems emerged from evolving practices of production and consumption and their structural and spatial embedding: the non-circularity of chains and the vast increase in the volume of mass flows since around 1960. A fourth case, electricity-for-households, explored increasing energy intensity, showing how domestic electricity consumption, the efficiency of electricity generation and primary energy use and emissions evolved over time.

In this chapter we will, first, proactively evaluate, for each of the cases, basic strategies to address these key problems and then, second, discuss the relationship between these strategies and society's potential for coping with the welfare paradox. In the remainder of this introductory section, we introduce the analytical framework for the first task: elaborating three basic strategies and assessing their plausibility. This will provide a basis for the work of the next section where we will answer, for each case, three questions:

1. How, for this case, could the three strategies be elaborated?
2. How plausible is each strategy, and what could be done to promote them?
3. How (much) do these strategies and associated changes contribute to resolving the welfare paradox?

We conclude the chapter with a reflection on the mix of routes Dutch society could take towards 2050, and the ways in which and conditions under which that might contribute to dealing with the welfare paradox described in Chap. 22.

24.1.1 Basic Strategies for Resource Use

Two of our three basic strategies are related to notions that, at the time of this writing, are comprised in the notion of a circular economy. If, as the Ellen MacArthur Foundation puts it "[a] *circular economy* seeks to rebuild capital, whether this is financial, manufactured, human, social or natural" in order to ensure "flows of goods and services," then a circular economy is obviously one potential solution for the basic challenge outlined in Chap. 22, of sustaining well-being, broadly defined. It particularly takes issue with the non-linear character of supply chains, due to which key resources are wasted. To be sure, as of now few resources are actually close to global depletion. Yet in the long run, wastage is not tenable and a few resources are already suffering local depletion; in even more cases around 2050 increasing scarcity may produce political-economic and geopolitical ramifications. These were in fact the motives for the Dutch government to declare in 2016, that the Dutch economy should be circular by 2050.[1]

What exactly *is* a circular economy? Its authoritative propagator, the Ellen MacArthur Foundation characterises it as a catch-phrase for a variety of approaches: Cradle to Cradle, Performance Economy, Biomimicry, Industrial Ecology, Natural Capitalism, Blue Economy and Regenerative Design.[2] More explicitly, a circular economy is '*an economy that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles… In a true circular economy, consumption happens only in effective biocycles; elsewh. ere use replaces consumption. Resources are generated in the biocycle or recovered and restored in the technical cycle.*'[3] Thus, there are two broad modes of circularity: regeneration of resources (the 'biological cycle') and restoration of materials and products ('technical cycle'). Ideally, resource consumption is limited to biocycles that are fully regenerative, with solar (and hence wind) energy as the sole external inputs; in all other cases resources are used rather than consumed. The proper collection of (what in a linear case would be called) waste, so as to re-introduce it into the chain, is part and parcel of both modes. All this may be summarised in three main principles.[4]

1. Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows.
2. Optimise resource yields by circulating products, components and materials at the highest utility at all times in both technical and biological cycles.

[1] Grondstoffenvoorzieningszekerheid, *Tweede Kamer* 32852 no. 33; Ministerie van Infrastructuur en Milieu (2016). Rijksbrede Programma Circulair Economie. «Nederland circulair in 2050»

[2] Ellen MacArthur Foundation. *Towards a Circular Economy: Economic and business rationale for an accelerated transition* (2013), pp. 26–27.

[3] https://www.ellenmacarthurfoundation.org/circular-economy/overview/ (consulted May, 2017).

[4] Ellen MacArthur Foundation. *Towards a Circular Economy: Business rationale for an accelerated transition.* (web publication, 2015), pp. 5–8.

3. Foster system effectiveness by revealing and designing out negative externalities, including damage to other systems (food production, forests) and externalities such as land use, and air, water and noise pollution.

In the Foundation's framework, one basic strategy is *regeneration*, pertaining to the production of renewable materials in the biological cycle. While these materials may be consumed, the natural capital needed for production (nutrients) may, in principle, be largely regenerated in the biological cycle. *Restoration* strategies focus on the technical cycle. Materials, parts or derivatives from products used are fed back into the technical cycle. In operationalising restoration as a second basic strategy, it helps to distinguish among three modalities. We can distinguish among recycling (processing materials so as to retrieve the original functionality) down-cycling (processing for lower functionality) and upcycling (processing for higher functionality).

The third overall strategy is de-materialisation. Here we follow the approach taken by Potting et al.[5] We thus avoid bracketing consumption practices or treating them simply as different modes of appropriating products emerging 'from the supply side.' Rather, we consider consumption practices as relatively autonomous, both as parts of the problem and as an element of potential solutions.[6] Iconic examples are wearing a sweater to maintain bodily warmth at a lower room temperature and building a larder in homes to replace electric refrigerators[7] or vegetarianism as a way to make more efficient use of plant protein.[8]

Refuse	Make product superfluous, by discarding its function or by fulfilling that function with a radically different artefact
Rethink	Intensify product use (e,g, through sharing it, or through multifunctional use)
Reduce	Manufacture the product more efficiently, using less resources and materials; or design it for less resource- and material-intensive use

With regard to our fourth case, finally, the three basic strategies are more efficient appliances, more limited electrification and renewable electricity production.

[5] Potting, J., M. Hekkert, E. Worrell & A. Hanemaaijer (2016): Circulaire economie: Innovatie meten in de keten, Den Haag: Planbureau voor de Leefomgeving PBL.

[6] Elisabeth Shove, Frank Trentmann, Richard Wilk. *Time, consumption and everyday life. Practice, materiality and Culture.* (Oxford, 2007); Elisabeth Shove, Matthew Watson, Martin Hand, Jack Ingram. *The Design of Everyday Life.* (Oxford, 2009).; Elisabeth Shove, Gordon Walker. 'CAUTION! Transitions ahead: politics, practice, and sustainable transition management' in *Environment and Planning A,* 39,4: 763–770.; Hui, A. Shove, E. and Schatzki, T., *The Nexus of Practices: Connections, constellations, practitioners*, (London, 2016); Gert Spaargaren, Peter Oosterveer 'Citizen-consumers as agents of change in globalizing modernity: the case of sustainable consumption'. *Sustainability* vol. 2 no. 7 (2010), p. 1887–1908.; Gert Spaargaren, Peter Oosterveer, Anne Loeber (Eds.), *Food practices in transition: changing food consumption, retail and production in the age of reflexive modernity*, (New York, 2012) p. 1–31.

[7] Elisabeth Shove, Frank Trentmann, Richard Wilk. *Time, consumption and everyday life. Practice, materiality and Culture;* Hui, A. Shove, E. and Schatzki, T., *The Nexus of Practices: Connections, constellations, practitioners*.

[8] Spaargaren et al. *Food practices in transition*. (New York, 2012).

24.1.2 Assessing Strategies

Absent a crystal ball, any pro-active analysis of the merits and limits of these strategies requires a theory of change. In Chap. 1, we outlined the claim of transition theory that innovations will normally follow the patterns implicit in a regime: a web of incumbent practices oriented to resolving dominant social problems aligned to a particular normative orientation, and the spatial and institutional structures in which they are embedded. If dominant (perceptions of) societal problems shift, there will be pressure to change practices and their embedding. Such changes may be induced by new problem definitions and novel, often experimental, practices that address these, but also by more or less exogenous 'landscape' trends pressing on the regime.

Thus, in discussing the possibilities and opportunities for the different strategies, we will focus on the historically emerged institutional and spatial embedding of contemporary supply chains, as well as on the long-term trends that are likely to shape the further evolution of the practices and structures of production, innovation, policy-making, and consumption that constitute them.

24.2 Grain-for-Meat

The grain-for-meat case is an occasion to explore a transition in a transnational, biotic chain. In fact, two nested biotic chains may be distinguished: meat production with grain serving as a resource; and grain production with water, nutrients and arable land as resources. Thus, in an ideal-typical circular chain, natural capital would be maintained through a closed nutrient cycle between the meat production and grain production chain, and through the regeneration of soil quality (first circular principle), while minimising externalities for other eco-systems (third principle). However, the present situation is rather remote from this ideal. First, grain production is hardly regenerative and it is rife with negative externalities. Second, due to the transnational nature of the chain, nutrients are exported from countries where grain is produced, only to be, third, largely wasted during meat production and consumption – yielding, fourth, local pollution (acidification of the soil; eutrophication of surface waters) and, finally, extracting significant flows of nutrients from global stocks. The latter is especially problematic for phosphates. While the degree of depletion of mineral phosphate resources is a contested issue, the political-economic and geo-political ramifications may still be significant.

The consequences of this non-circularity are exacerbated by the vast volume of flows. As we have seen (Chap. 23), non-circularity emerged historically after nineteenth century agricultural practices sought to resolve domestic problems of food quality, availability and affordability, as well as to cull benefits from international trade. These practices were structurally and spatially embedded in a robust incumbent chain that was characterized in Chap. 23 as an analytical-chemical web, interconnecting practices from different sectors on different continents through main ports and other trade infrastructures, as well as to supportive institutional arrangements for governance and innovation. In the Netherlands, more specifically, animal and crop production became structurally differentiated, with animal production taking the lead. These same factors promoted the vast expansion of the chain, which was oriented as much to export as to domestic consumption. After about 1960, meat consumption both in the Netherlands and in export countries also boomed due to increased welfare and the emergence of mass consumption.

We will now take one specific example, soy-for-pig-breeding, and assess possible strategies for making such a massive, transnational, non-circular chain more sustainable. In doing so, we will consider the nature of the incumbent regime, as well as address long-term trends that may (be mobilized to) change it: e.g. liberalisation of global food trade and increasing recognition of food (resource) security in a post-Cold War, post-colonial multi-polar world – the latter trend lending additional salience to two other crucial trends: climate change and water scarcity.

24.2.1 Towards More Regenerative Grain Production

Two basic strategies may be distinguished to make grain production more regenerative: more sustainable production of soy elsewhere, and increased production of cattle fodder in The Netherlands. In either case, restoring phosphates in the Netherlands is an essential complement.

Land use is a significant externality of soy-for-pigs production: the largest share of land dedicated to meat consumption in Europe is used for fodder production.[9] Soy production in Latin America frequently competes with food production for the domestic population and impacts on other ecosystems there. By 2050, *ceteris paribus*, a more numerous global population will generate even greater impacts.

Soy production impinges negatively on the *regeneration of soil and water quality*; much of current soy production is a mono-culture with adverse consequences for soil structure. These problems may be partly solved by more appropriate farming methods (more nature-inclusive, more diversified, more water recycling etc.). Inasmuch as there are many Latin American soy producers all competing to sell to a limited number of Dutch customers, some arrangement for transnational collaboration between chain actors is essential. An early initiative was the Round Table on Responsible Soy, a private standard setting organization (PSO). Subsequently, in the mid-2000s, the Sustainable Trade Initiative (STI) was established, a Netherlands-based private initiative that was ultimately co-sponsored by the Dutch government.[10] Such transformational physical and informational links among chain players and between private and public parties may facilitate demand for fairly priced sustainable soy and promote an appropriate incentive structure (like legal provisions) in the

[9] Baltussen, W.H.M., M.A. Dolman, R. Hoste, S.R.M. Janssens, J.W. Reijs, A.B. Smit,. *Grondstofefficiëntie in de zuivel-, varkensvlees-, aardappel- en suikerketen.* (Wageningen, 2016).

[10] Eric Hees. *Voedsel, grondstoffen en geopolitiek. Rapportage aan het Platform Landbouw, lnnovatie & Samenleving.* (Culemborg, 2013), pp. 27–28.

source countries.[11] Such initiatives, together with transnational certification organizations, may also re-orient the incumbent chain, and improve coordination between different market arrangements and PSOs.[12]

In principle, this strategy is congruent with the chain's traditional institutional arrangement. However, the chain's orientation to reducing costs is at odds with attempts to achieve more ecologically and socially (a fair price for primary producers) sustainable soy production. Long-term developments in the WTO framework and Europe's changing position in the global economy, not to mention the market's increasing sensitivity to societal pressure, may all help.[13] Moreover, the specific political economy of the soy market harbours paradoxical opportunities.[14] While the Netherlands is the world's second soy importer (30% of EU-27) after China, the latter's share is more than 5 times that of the EU-27 countries put together. Also, China is a major soybean crusher. Since 2010, changing food lifestyles and water scarcity have increased Chinese imports of soy beans. This (increasingly) dominant position in a market with only a few source countries (US, Brazil and Argentina account for 75% of the production) enables China to 'play' with the prices, as part of its resource security strategy.[15] Paradoxically, should European countries be prepared to pay more for sustainably produced soy, they may come to exploit this as an opportunity to include soy in a resource security strategy, as argued for by e.g. De Ridder and Hees.[16]

To be successful, such policies will also have to keep restoring nutrients high on the agenda of players outside the agri-food sector, like the Port of Amsterdam that in 2010 announced its aspiration to become a circular economy hub. While such efforts may hasten the coming of greater circularity, it is quite possible that much of the impetus toward a circular economy will come primarily from established actors in the waste and energy sectors, for whom global food issues may be less central than other problem dimensions.[17] In that case, while manure and residual soy flows may be used more (efficiently) for bio-based production, restoring nutrients may not be high on the agenda. Thus, to facilitate phosphate recovery (an objective in an emerging Dutch policy for a 50% circular economy by 2050), the national government and logistic main ports must ensure an integral approach, properly embedded in a broad societal, economic and policy context, and involving a wide range of

[11] https://www.idhsustainabletrade.com/sectors/soy/ Consulted May, 2017.

[12] Fransen, Luc.´The Politics of Meta-Governance in Transnational Private Sustainability Governance´ in *Policy Sciences*, Volume 48 (2015), No. 2, June 2015.

[13] John Grin, *Understanding Transitions from a Governance Perspective*, (Part III, 2010) in: Grin, John; Rotmans, Jan; Schot, Johan,*Transitions to Sustainable Development. New Directions in the Study of Long Term Structural Change* (New York, 2010: Routledge), pp. 223–314.

[14] Eric Hees, *Voedsel, grondstoffen en geopolitiek. Rapportage aan het Platform Landbouw, lnnovatie & Samenleving.* (Culemborg, 2013), pp. 23–28.

[15] Marjolein de Ridder, Sijbren de Jong, Joshua Polchar and Stephanie Lingemann *Risks and Opportunities in the Global Phosphate Rock Market*. (The Hague, 2011).

[16] De Ridder, Marjolein et al. (2011). *Op weg naar een Grondstoffenstrategie. Quick scan ten behoeve van de grondstoffennotitie*. The Hague: The Hague Centre for Strategic Studies (HCSS); Hees, Eric (2013). *Voedsel, grondstoffen en geopolitiek*. Rapportage aan het Platform Landbouw, lnnovatie & Samenleving. Culemborg: CLM.

[17] Rob Weterings, Elsbeth Roelofs, Roald Suurs, Frans van der Zee. *Tussen gouden bergen en groene business. Systeemverkenning van een biobased economy*. (Den Haag, 2011), pp. 1.

actors and stakeholders dedicated to shaping a circular economy.[18] Even then, full nutrient recovery remains a remote objective.

24.2.2 Regenerating Nutrients Regionally: Replacing Grain from Elsewhere by Dutch Inputs

Alternatively, the Netherlands may reduce pressure on natural capital elsewhere by replacing a portion of the imported soy in animal fodder by domestically cultivated soy or other foodstuffs and use that for regeneration by closing the cycle on a regional level. The main challenge to replacing soy by other foodstuffs is to find fodder material with sufficient proteins – particularly with sufficient so-called essential amino acids – and preferably less phosphates. Substances that fit the bill are fish meal and bone meal (but these are sensitive, and partly prohibited, after the BSE pandemics), peas, waste flows from diverse plant oils, protein from potatoes, milk and traditional crops like rapeseed and lupine. Economically, a mix would be most optimal.[19]

Since the mid-2010s, opportunities for such regional fodder production have been explored. The smaller scale of production and reduced opportunities for cascading with human food production (which is easy with soy and palm oil), may incur 5–10% price increases for fodder.[20] If retailers do not apply a multiplier effect on these increases, as has been the practice in similar cases, this price-hike need not be prohibitive.[21] Different strategies to mitigate these effects against the backdrop of the future global soy market (see above) include: better information flows between primary producers and actors further downstream in the chain,[22] different retail strategies[23] or alternative, more local chains.[24]

That said, regional fodder production would require a shift from the current orientation to discrete products toward more circular (collaborative) business propositions, where the costs and productivity of different products hang together.

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18 Rijksoverheid *Nederland circulair in 2050*. Rijksbreed programma Circulaire Economie. (Den Haag: 2016).

19 Harry Vahl. *Alternatieven voor Zuid-Amerikaanse soja in Veevoer.* (Utrecht: 2009).

20 Harry Vahl, *Alternatieven* (2009); Raad voor Regionaal Veevoer. *Naar 100% regionaal eiwit. Kansen en knelpunten voor eitwitrijke veevoergrondstoffen.*(Amsterdam 2016).

21 Harry Vahl, *Alternatieven* (2009); Baltussen W.H.M. et al. *Prijsvorming van voedsel; Ontwikkelingen van prijzen in acht Nederlandse ketens van versproducten.* (Wageningen, 2014).

22 Baltussen W.H.M et al. *Prijsvorming.*

23 Oosterveer, Peter, 'Restructuring Food Supply: Sustainability and Supermarkets.', in Spaargaren et al. *Food practices in transition: changing food consumption, retail and production in the age of reflexive modernity.* (New York, 2012). pp. 153–176.

24 Roep, Dirk & Han Wiskerk,'Reshaping the Foodscape: The Role of Alternative Food Networks.' 8) in Spaargaren et al. *Food practices in transition: changing food consumption, retail and production in the age of reflexive modernity.* (New York, 2012). pp. 207–22.

Interestingly, the Dutch could mobilise their own historical experience by establishing novel co-operatives of livestock and crop farms, possibly also involving non-agricultural enterprises.

But there are some fundamental problems. First, the primary sector (and associated knowledge institutes) suffer from a lack of knowledge about protein-rich cultivars like lupine, rapeseed and clover, about embedding agriculture in surrounding nature and about the use of animal manure rather than artificial fertilizers. This is rooted in the historical, institutionally and spatially embedded, shift from mixed farming to a husbandry- centered agriculture based on imports of the bulk of the animal fodder. Another fundamental problem is that, inasmuch as the livestock sector has historically far outgrown the capacity for producing animal fodder, a maximum use of regional fodder would require all the crop growing land available.[25] This strategy therefore could not do without some form of reduction of meat production.

A more recently explored possibility is the use of advanced protein sources like seaweed, algae and duck brood. Significantly, these are often phosphate rich (the latter is even used to retrieve phosphates from surface water). Their prices may be reduced thanks to cascading fodder production, bio-energy production and phosphate recovery.[26] For these advanced foodstuffs as well as the more traditional alternatives, pertinent knowledge gaps would need to be addressed while options for cascading need further exploration and development. Over time, pressures from the source countries (which will increasingly have to face the consequences of climate change for their food production and ecosystems) may stimulate such innovations, as may growing awareness about increasing resource scarcity and climate change. In fact, the first set of considerations are included in the Dutch government's support of the Sustainable Trade Initiative, and the second in its 2011 white paper ('Grondstoffennotitie') on resources policies.

24.2.3 Regenerating Phosphates

These pressures may also stimulate the development of a key complement to both strategies just discussed: recovering the phosphates wasted in meat production and consumption, through the food cycle of animals and humans, respectively. While directly closing the phosphate cycle with source countries does not seem viable, a more realistic strategy might be to feed retrieved nutrients back into fertilizer and soil improvement markets. There are basically two options. The first is to retrieve phosphates from surface water (e.g. through duck brood, see above), from waste water (e.g. through bonding P to magnesium to produce struvite; or, more recently, to iron) or from deep soil (by deeply-rooted plants). As of the mid-2010s, interesting

[25] Raad voor Regionaal Veevoer. *Naar 100% regionaal eiwit.* (2016).

[26] Nieuwenhuis, R. & L. Maring. *Naar nieuwe ketens voor het benutten van eendenkroos.*, (Utrecht: 2009).

novel opportunities have emerged like the 'resources factory', i.e. a wastewater treatment facility whose core business is retrieving and marketing resources from waste water rather than discarding them as waste. In the decades up to the 2050s, significant novelties may be expected, and there will especially be room for attractive, circular / cascaded business models.[27]

The second option for regeneration is collecting and re-cycling manure, or at least the nutrients it contains. As of 2016, half of the manure was processed at the farm, often by burning it (sometimes retaining the phosphate-containing ash for use as a soil improver). The rest, including a portion of the first half (sold domestically or exported) was partly used for crop production and partly for the production of bio-energy, generally without nutrient recovery. One urgent goal for regeneration is to develop cascaded forms of bio-energy production, that no longer waste nutrients. A second one is a governmental intervention in the nutrient market to make manure more competitive. The legal obligation to dispose of manure in a proper (and hence costly) manner, the historical path leading to (Sect. 23.3) the widespread availability of artificial fertilisers, as well as the ever more restrictive legal limits on fertiliser use in crop production depress manure prices. Thus by 2016, responsible manure disposal had become a serious burden for the animal sector (about € 250 million per year for the sector), while it saves the crop production sector a similar amount.[28]

24.2.4 Dematerialisation

Dematerialisation might proceed along two tracks. The first is reducing the phosphate content of animal fodder. In the early 2010s, the market undertook voluntary initiatives in this direction, partly out of shared concern but also to avoid government limits being imposed on the volume of livestock. In 2017, PBL estimated that pursuing this option might ultimately reduce phosphate emissions by 10%.[29] The other track is to reduce meat production, tackling both of the above problems by reducing the volume of the mass flows. To be sure, some reduction of meat production in the Netherlands is conceivable, if not likely, as a response to environmental problems and the risk of pandemics. For instance, in 2016, the province of Noord Brabant (home to 38% of Dutch pigs) decided to reduce the number of pig farms by about 30%, retaining only those prepared to adopt sustainable production methods.

The more radical approach is refuse: reducing meat consumption. This is at odds with deeply embedded (e.g. in nutritional education and advertising) cultural notions that meat is important for human health. This idea is rooted in earlier

[27] Bocken, Nancy M. P., Ingrid de Pauw, Conny Bakker & Bram van der Grinten (2016), 'Product design and business model strategies for a circular economy' in *Journal of Industrial and Production Engineering*. 33 (5) published online.

[28] Planbureau voor de Leefomgeving. *Evaluatie Meststoffenwet 2016-Syntheserapport*, (Den Haag, 2017), p. 14, p. 27; chapters 2, 9.

[29] Planbureau voor de Leefomgeving (2017). Evaluatie Meststoffenwet 2016-Syntheserapport, Den Haag: Planbureau voor de Leefomgeving PBL, pp. 146–151.

times, when it had some justification (although vegetarianism was always an alternative practice). Until 1960, diets were often unhealthily low on proteins. But since 2005, vegetarianism has become more popular in both domestic and European export markets. While by 2015 the number of strict vegetarians did not exceed 4% of the population, a middle-course known as 'flexitarianism' had become much more popular. In 2010 and 2015, respectively, some 43% and 55% of the population ate meat not more than 4 days a week. Motives for vegetarianism and flexitarianism vary from concerns about one's own health (antibiotics, cholesterol) to animal welfare and environmental concerns. Also, personal lifestyles are increasingly shaping food choices.[30] In this connection, meat consumption tends to be part of urban lifestyles.[31]

These developments are an instructive instance of how the shift in welfare dynamics beyond meeting primary needs may both produce and help resolve sustainability problems. Thus the future of meat consumption in northern countries like the Netherlands will be shaped by the degree to which societal concerns remain in place (partly dependent on the evolution of meat production) as well as by trade-offs among different cultural changes.

24.3 Gravel-for-Construction

As discussed in Sect. 23.4, the main problem associated with gravel use is the damage caused to nature and ecosystems by its excavation. Wartime excepted, the chain was virtually completely linear: waste was hardly ever re-used. Thus, the balance between imported gravel and domestic gravel excavation has fluctuated with the tensions between national gravel demand on the one hand, and domestic gravel excavation and processing capacity on the other.

Historically, *gravel demand* was shaped largely by the volume of construction, that in turn has been shaped by population growth and the increasing size of homes, initially to improve a primary life need (hygienic conditions) and later, especially after 1960, in response to changing lifestyles: individualisation yielded smaller households and more rooms per household. Counter-tendencies included alternative

[30] De Bakker, Erik en Hans Dagevos. *Vleesminnaars, vleesminderaars en vleesmijders. Duurzame eiwitconsumptie in* een *carnivore eetcultuur*. (Den Haag, 2010); Klintman, Mikael; Boström, Magnus (2012). 'Political Consumerism and the Transition Towards a More Sustainable Food Regime Looking Behind and Beyond the Organic Shelf' in: Spaargaren et al. *Food Practices in Transition: Changing Food Consumption, Retail and Production in the Age of Reflexive Modernity*. (New York, 2012), pp.114–116.; Keuchenius, Cecilia en Bram van der Lelij. *Motivaction Quickscan 2015: eetpatronen van verschillende sociale milieus, duurzaamheid en voedselverspilling.* (Den Haag, 2015), pp. 134–148.

[31] Murray, Shannon, Saman Brock & Karen S Seto. 'Urbanization, food consumption and the environment.' in Karen C. Seto et al. *The Routledge Handbook of Urbanization and Global Environmental Change.* (New York: 2015) pp. 27–40.

construction materials – especially plastics – (since 1970), and the completion of the hydraulic infrastructural 'Delta works' in 1986.

Domestic *excavation* has historically been shaped by political controversies in response to its local side-effects, as well as by strong governmental interventions. The latter was initially a response to scarcity during WW I, after 1980 to protests against landscape damage and somewhat later to a paradigmatically changed waste policy, with more emphasis on re-cycling. In spite of the latter, since 1980 the Netherlands has largely exported its gravel-related landscape damage – retaining, however, a significant domestic institutional capacity for concrete production and innovation (Chaps. 14 and 22).

The chain thus exemplifies cases in which the Netherlands exports its problems, yet retains adequate autonomous potential to make the chain more circular and less voluminous through domestic measures. These strategies will be contextualized for the present gravel regime, and in a long-term landscape. First and foremost, it is expected that population will more or less stabilise towards 2050. By 2010 natural population growth had sunk below 2 per 1000, and it is expected to become negative by 2038 for the population currently living in the Netherlands. After that date, the migration balance and annual population decline are expected to stabilise the population. Different estimates of actual migration, birth rates (life choices, developments in well-being) and death rates (developments in health care) yield a range between 16 and 20 million.[32] Two other trends, ageing (associated with declining birth and death rates) and individualisation, will yield some decline in the number of people per household.[33]

All in all, the total number of households is thus expected to increase from 7,3 million (2010), through about 8,5 million (2030) up to around 8,6 million after 2040. The demand for housing construction will decline from the 50,000 dwellings per year around which it will fluctuate until about 2025, down to 20,000 after 2040, slightly more than the demolition rate (15.000 per year after 2016).[34]

Finally, partly due to the emergence of the information society (miniaturisation and the rise of flex-working) and partly due to market failures in the real estate business, an increasing stock of unused office and industrial buildings has come into being. The associated devaluation of real estate and land that occurred by the mid-2010s adversely affected local governmental budgets and this is likely to affect future construction and land-use plans.[35]

[32] Stoeldraijer, Lenny, Coen van Duijn, Corina Huisman. *Kernprognose 2016–2060: 18 miljoen inwoners in 2034 voorzien.* (Den Haag: 2016).

[33] Hofstra, U, B. van Bree, J. Neele, R. de Wildt. *cenariostudie BSA-granulaten*: aanbod en afzet van 2005 tot 2025. (Delft, 2006), 29; 35; 39.

[34] Poulus, Co, Gerard van Leeuwen, David Omtzigt, Kenneth Gopal, Ruud Steijvers, Marnix Koopman. *Tussenrapportage. Prognose bevolking-, huishoudens- en woningbehoefte 2015–2050.* (Delft: 2016), pp. 21–23.

[35] Janssen-Jansen, L. & Lloyd, G. Property booms and bubbles: a demolition strategy – towards a tabula. rasa? *Journal of Surveying, Construction and Property*, 3 (2012) 2, p. 1–11; Janssen-Jansen, L., Lloyd, G., Peel, D., & van der Krabben, E. (2012). *Planning in an environment without growth: invited essay for the Raad voor de leefomgeving en infrastructuur(Rli), the Netherlands.* (The Hague: 2012).

24.3.1 Restoration: From Down-Cycling to Re-cycling

By the mid-2010s, two trends in restoration could be distinguished: a shift from down-cycling demolition waste to more valuable forms of restoration, and a shift towards designing for re-use.

Crushing concrete into concrete granulates to be used in foundations for road and hydraulic construction has long been a rather common practice, a paragon of down-cycling. Since the 2010s, recycling has been on the rise, i.e. using these granulates to replace gravel in concrete production. Established firms like Mebin now advertise with concrete in which e.g. 30, 50 or even 100% of the gravel has been replaced by granulates.[36] Simultaneously, newcomers like Paro (established in 2010 in the Port of Amsterdam) collect flows of construction waste brought to the Port by ships and sorts them, using innovative processes, into different fractions.[37] While some are down-cycled, others are deemed fit to be sold to other firms (e.g. the neighbouring *Voorbij Prefab*), that specialise in re-cycled concrete materials).[38]

These early adopters reveal that although, historically, practices in the gravel-for-construction value chain changed mostly in response to governmental pressures, by the early twenty-first century, other actors and forces have come into place. Around 2010, the Dutch concrete branch, collaborating with societal stakeholders, launched the Beton Bewust initiative that seeks to promote 100% recycling and that co-founded, in 2014, the global Concrete Sustainability Council.[39] By the mid-2010s, other actors were also bringing their influence to bear on the sector, for example bank real-estate account managers, claiming that "whoever did not yet have a sustainable business model, was actually out of the game. Circularity is the next step. The task of the bank is to promote awareness and create funding opportunities."[40] Given the historical record, however, unless re-cycling becomes clearly economically superior, some (national or EU) governmental intervention will probably be indispensable to move the sector as a whole into the era of sustainable production.

The early efforts just outlined have important technical limits. Not all waste can be recycled as yet, and not all concrete products can presently be made from 100% recycled granulates. The sector's current institutional arrangement, with close ties among concrete manufacturers, R&D infrastructure and government may nurture the necessary innovation. Also, newcomers like Paro may draw on the Dutch tradition of the *trafiek* manufacturing in main-ports. As such, it is part of a wider strategy of the Port of Amsterdam to become a hub in the global circular economy. A poten-

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[36] ENCI, Mebin, Sagrex. Sustainability Update. *Het duurzaamheidsbeleid van de bedrijven van HeidelbergCement Benelux* (2016)*;* www.mebin.nl (consulted June, 2017).

[37] www.paro-bv.nl (consulted June, 2017).

[38] www.voorbijprefab.nl (consulted June, 2017).

[39] www.concretesustainabilitycouncil.org/ and www.betonbewust-csc.nl/beton-verduurzamen (consulted June, 2017).

[40] Rudolf Scholten of ABN AMRO Bank, (April 2017). www.insights.abnamro.nl/2017/04/circulair-bouwen-heeft-de-toekomst/

tial risk is that this may lead to the lock-in of a sub-optimal solution: less than 100% recycling coupled to long-distance transportation.[41]

24.3.2 Designing and Building for Re-cycling

The circularity promoted by the bank manager cited above includes designing for re-use. “A building thus becomes a collection of materials with an eternal life,” he says – a vision summarised by his colleague as “Lego-lisation.” This entails a major, systemic innovation: a different architecture, which ‘designs for deconstruction’, takes available materials as a point of departure and adopts accordingly different aesthetics; novel business models, based on including materials and parts in a cycle (e.g. through conferring a ‘passport’ with their biographies); involvement of suppliers of materials and parts in the design process art the outset; and even different property models, in which e.g. materials and parts remain the property of their supplier, who is seen to provide a service to the owner of building.

An early adopter of such a more radical strategy is *Beton Prefab Veghel*, an innovative family firm established in 1967 as a prefab concrete floors producer. Since 2012 the firm has sought not only to maximize re-cycling in all products, but also to design their products for re-use after 50–100 years, when their initial application is expected to have reached the end of its lifetime. A concept for even more comprehensive steps towards re-use, *‘Lekker Eigen Huis’* (‘Delightful Own Home’) have been proposed by a novel consortium, TBI, a flexible network of a developer and several construction companies (some relatively new enterprises, as well as a pre-war family firm that transformed itself). The core asset is a smart design system that supports a client in designing a home tailored to the clients own authentic desires, meeting high sustainability criteria and re-using materials and parts that are available at the time.[42]

These examples show both a-priori feasibility and the need for a very significant R&D effort, not only aimed at better recycling options, but also at novel design methods for both materials and final construction products. While such options may draw in part on the sector’s incumbent regime, structural change may well be needed for other aspects: new relations between customers, designers and constructors; novelties like a material passport; and new financing schemes that adequately incorporate the value of the materials. The cultural landscape trends of increasing autonomy and individual distinctiveness, which for instance also express themselves in the growth of DIY construction in the Netherlands, may help to overcome these obstacles.

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[41] Port of Amsterdam (2014). Visie 2030. Port of Amsterdam, Port of partnerships. Amsterdam: Port of Amsterdam; Port of Amsterdam (2017). Koers naar de Amsterdam Metropolitan Port. Strategisch plan Havenbedrijf Amsterdam, 2017 — 2021. Amsterdam: Port of Amsterdam.

[42] www.lekkereigenhuis.nl/. (consulted June 2017).

24.3.3 Dematerialisation

Dematerialisation may take four basic forms. First, a ‘reduce strategy’: e.g. using less gravel for the same construction performance by employing more brick (from river clay) or laminated wood and polymer materials.[43] Interestingly, the latter two may be produced through a biotic rather than a technical cycle, implying a shift from restoration to regeneration of resources (but demanding additional sustainable production of raw materials in a more bio-based economy). Second, ‘reduce‘may also result from a longer concrete lifetime (now often shorter than the technical lifetime of the constructions in which it is applied). Emerging options like self-healing concrete (e.g. through calcium phosphate producing bacteria) are estimated to enhance lifetime by 20%.[44]

More fundamentally, given that (see above), around 2040 home demolition and construction rates are likely to be close to each other, while business buildings will increasingly be vacated, not only ‘reduce’ in the sense of construction with zero gravel use becomes conceivable, but also ‘refuse’ in the sense of avoiding construction altogether through using superfluous business buildings for novel purposes. Janssen-Jansen propose ‘planning without growth,’ by adopting a more holistic view of land and property development.[45] By the mid-2010s, re-developing old industrial areas into shared spaces for communal leisure, housing, social functions and creative industry was rapidly becoming popular, and ideas for converting e.g. superfluous office space into small apartments were spreading. Janssen-Jansen argues that these options are promising in many respects, but only if property and power relations can change to suit. Smart, reflexive planning will be needed in order to identify and deal with such difficulties, drawing on the long term trends mentioned above as both the rationale for changing and as a force for change on the incumbent construction and planning regime.[46]

A final strategy for refuse is ‘Design/Build for Change’ (VITO, Flanders): homes and offices grow and shrink with the biography of their use, i.e. through modular design.

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[43] Van Dam, Jan & Martien den Oever. *Catalogus Biobased bouwmaterialen. Het groen bouwen.* (Wageningen: 2012).

[44] Van Lieshout, Marit *Update Prioritering handelingsperspectieven verduurzaming betonketen 2015*, (Delft: 2015).

[45] Janssen-Jansen, L., et al. *Planning in an environment without growth* (2012).

[46] Lissandrello, Enza & John Grin (2011). ‘Reflexive planning as design and work: lessons from the Port of Amsterdam,’ *Planning Theory and Practice*, 12 (2), p. 223–248.

24.4 Plastics for Everyday Life

The plastics-for-everyday-life chain exemplifies the mass consumption associated with contemporary lifestyles, strong non-linearity and the global environmental consequences of local, wasteful use. The problems associated with plastics use and production are (section 23.4) that it is an iconic example of wasteful use of resources (yielding problems for 'later'); and that the waste generated threatens organisms and ecosystems as well as human health (both locally and 'elsewhere', and given the accumulative nature, especially 'later'). These problems are seriously aggravated due to the very massive nature of the chain, its non-circularity from the outset, and its semi-open-ended nature (80% of plastics produced in the Netherlands is exported).

These properties emerged in response to cultural inclinations, and structural and spatial conditions that still shape consumption and production to this day. From its inception around 1945, the use of plastics in everyday life, including the use of disposable packaging, was seen as progress through artificial materials: diffusing convenience, comfort and aesthetics to all classes. It thus exemplifies a chain associated with the mass-consumption, lifestyle-focused well-being that emerged after 1960. The same cultural trends shaped the supply side, so that supply was well-matched to consumer preferences. Supply practices were able to draw, and continue to do so, on spatiality (mainports with major fossil flows) and a helpful platform-like institutional rectangle, tying together polymer producers, polymer processors, and government sponsored knowledge institutes (typical for the era, civil society hardly played a role). Also, value creation around mainports is rooted in the Dutch trafieken tradition. Finally, the chain's non-circularity was reinforced over time by the institutional logic of the massive scale of polymer production, and the institutional logic of the enormous scope of polymer processing.

Future developments will be co-shaped by these spatial, cultural and structural forces, as well as by various long-term trends. First, the emergence of tailor-made production, symbolized by the swift emergence of 3D printing, may both increase plastics' popularity and generate new opportunities for polymer re-use in recycling.[47] Increasing world population and growing welfare in developing countries will – *ceteris paribus* – yield a growing demand for plastics. China, for example, tripled its per capita consumption between 1980 and 2010.[48] Simultaneously, the European plastics industry is under threat as China is increasing its plastic production, and India the volume of its plastics recovery and processing, while oil producing countries are seeking downstream integration and Brazil and other Latin American countries are increasing bio-based plastics production.[49] Other long terms

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[47] Ford, Simon Mélanie Despeisse. Additive manufacturing and sustainability: an exploratory study of the advantages and challenges, *Journal of Cleaner Production,* Vol. 137, (2016) p. 1573–1587.

[48] The European House Ambrosetti. *Excellence of the Plastics Supply Chain in Relaunching Manufacturing in Italy and Europe.* (Milano, 2013), pp. 39–40.

[49] The European House Ambrosetti. *Excellence of the Plastics Supply Chain* (2013), pp. 94–96.

trends that may (be made to) affect the plastics regime are the increasing volatility and geopolitical vulnerability of fossil resources[50] the rapid expansion of use and possession of electronic and electric appliances in daily life (Sects. 23.5 and 23.6); and the politicisation of the side- effects of plastics use, which has become a concern of the plastics industry.

24.4.1 Restoration

By the mid-2010s, a range of efforts had been mobilised to make plastic chains more circular.[51] In the Netherlands, plastics collection, the most basic form, embarked upon a significant volume expansion in the mid-2010s: from 25 kton (3%) in 2009 to 162,2 (20%) kton in 2014 and 250 (30%) kton in 2016.[52] The Plastic Heroes waste collection initiative undertaken by the packaging sector in collaboration with municipalities, yielded volumes of waste plastics and triggered increasing processing capacity. While, in the mid-2010s, a significant share is still being downcycled (making carpets from PET bottles) polymers are increasingly being broken down into monomers (mechanical recycling, already occurring with e.g. PET), or more basic molecules (chemical recycling) – but in what are as yet energy-intensive processes.[53]

On the positive side, the platform-like institutional arrangement between plastics producers and processors offers optimal conditions for connecting flows of collected waste to plastics processing enterprises. As of the mid-2010s, however, economic viability was still problematic. While a reasonable price was usually paid for PET, PE and PP, the price for other less easily processable plastic waste flows (mixed plastics, foils) tends to become negative as soon as oil prices make virgin feedstock cheaper than recyclates. Due to subsidies for domestic waste this is mostly a problem for industrial plastic waste. Thus WEF stipulate that a much better developed after-use plastics economy is crucial.[54] Ongoing innovations that make collection, cleaning and separation easier and less costly, may help here. Food safety regulations, on the other hand may yield another kind of inertia. For most types of recycled plastics there is, as of 2017, no regulation for plastic food packaging in

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[50] World Economic Forum (WEF), *Rethinking the future of plastics,* (2016). p. 36; PlasticsEurope and European Plastics Converters Association (EuPC). *The plastics industry: a strategic partner for economic recovery and economic growth in Europe. Manifesto on the competitiveness of the plastics industry.* (Brussels: 2014), p, 11.

[51] World Economic Forum (WEF), *Rethinking the future of plastics,* (2016).

[52] KIDV & SNM *Factcheck Plastic Recycling*. (Den Haag: 2016) NRK, *Kunststof Recycling in Nederland*, (Den Haag: 2016).

[53] Rahimi, Aliurezza Jeannette M. Garcia.Chemical recycling of waste plastics for new materials production. *Nature Reviews Chemistry* 1 (2017), Article nr 0046 (online journal) doi:https://doi.org/10.1038/s41570-017-0046

[54] World Economic Forum (WEF), *Rethinking the future of plastics,* (2016), p. 33.

place (which may contain impurities).[55] The platform-like plastics institutional rectangle may help overcome these barriers, fostering the conditions listed by WEF i.e. maintaining a "cross-value chain dialogue mechanism", "matchmaking mechanisms" for recycled materials, the redesign and convergence of materials, formats, and finally, after-use systems and policy measures.[56]

A higher form of recycling is re-use of plastics for the same function. More than 20% of the total mass of plastic products could be re-used, especially short-lived plastics products, most notably packaging.[57] In the UK, a small charge for plastic bags has led to an 85% reduction of single use. Interestingly, first experiences in the Netherlands suggest that this may also make consumers bring durable shopping bags from home: a form of de-materialization.

Finally, some 30 mass% of the plastics in use as of the mid-2010s cannot be re-used or recycled absent fundamental redesign or innovation: they are too small (e.g. sweet wraps), multi-material, use uncommon materials (like pill strips) or are contaminated (coffee capsules; waste bags). While ongoing innovations remain to be implemented, dematerialization remains a competitive strategy.

24.4.2 Regeneration

A more recent and innovative kind of recycling is the recovery of plastics from waste water. In an early example, the PHARIO demonstration project, biopolymers from the polyhydroxyalkanoate (PHA) family were produced by mixed microbial cultures from surplus activated sludge, fed with volatile fatty-acid-rich liquors from a local candy industry.[58] The process is part of a cascade with biological nitrogen removal and chemical phosphorus removal. Significantly, and contrary to most biodegradable polymers, PHA polymers degrade relatively swiftly in water – reducing the plastic soup risk. The project is part of the so-called 'resources factory' concept: a waste-water-treatment-plant-turned-resource-recoverer, demonstrating that consistently high quality production is possible in an economically viable way. There are significant energy and greenhouse gas emissions benefits compared with traditional water treatment and with producing PHA bioplastics from monocultures (soy, grain, sugar cane or beet).

Residual biotic flows involving potatoes, sugar beets, grass and the like are also objects of experimentation and debate.[59] Responding to fears that using such crops

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[55] KIDV & SNM, *Factcheck* (2016); Van den Oever, Martien, Karin Molenveld, Maarten van der Zee, Harriëtte Bos. *Bio-based and biodegradable plastics – Facts and Figures.* (Wageningen: 2017); Rahimi and Garcia, 2017. Chemical recycling of waste plastics for new materials production.

[56] World Economic Forum (WEF), *Rethinking the future of plastics,*(2016), p. 13.

[57] World Economic Forum (WEF), *Rethinking the future of plastics,* (2016).

[58] Bengtsson, Simon, Alan Werker, Cindy Visser, Leon Korving. *PHARIO: stepping stone to a sustainable value chain for PHA bioplastic using municipal activated sludge.* (Amersfoort: 2017).

[59] Asveld L., R. van Est & D. Stemerding. *Naar de kern van de bio-economie: De duurzame beloftes van biomassa in perspectief.* (Den Haag: 2011).

for biomass (and biofuel) production will compete with agriculture and ecosystems for land and lead to soil deterioration, sophisticated schemes have been proposed and explored that optimise the cascaded use of e.g. maize to regenerate phosphates and to extract proteins for animal fodder and carbohydrates for bio-based materials.[60] More recently, the breeding of algae and seaweed as an additional source is being explored by major companies.

Even more radical is the idea of producing bioplastics directly from carbon dioxide through artificial photosynthesis.[61] CO_2 and hydrogen may be made to react to produce methanol, which can be used as a building block for larger organic molecules. A more innovative option is bringing the CO_2 molecule as a whole into a carbon-hydrate skeleton to produce novel polymers. One promising example is polypropene carbonate, which contains 43% CO_2 and might be made from methanol and CO_2: a 100% bio-based polymer. Also higher carbohydrate-based polymers (with an even higher CO_2 content) may be made in a bio-based mode. While, by the mid-2010s interesting progress had been made, artificial synthesis remained a formidable challenge and far from trivial.[62] Also, while it may certainly capture a portion of CO_2 emissions, the overall impact on the concentration of greenhouse gases is limited, and it must not be forgotten that given the inert nature of CO_2 these are very energy-intensive processes.[63]

Overall, the use of bio-based plastics is still limited: in 2015 it was less than 1% of all plastics, though it is expected to rise to 2,5% by 2020.[64] Bioplastics tend to be more expensive than traditional ones. An analyst like Nossin is therefore pessimistic about the future role of bioplastics, although he stresses that, technically, 90% of the existing plastics could be replaced by biopolymers. At the bottom of the pyramid, biobased bulk polymers like polyethylene lose the price battle.[65] That may be different for some commodity polymers, like PET, used in bottles. For high performance polymers and specialties, price is less important than functionality, though bioplastics may fall short on the latter count as well. Others, like Harmsen & Hackmann are much less pessimistic, pointing out consumer demand, governmental pressures and the increasing scarcity of oil derivates.[66]

Long terms trends discussed in the introduction to this section – such as the increasing volatility and geopolitical vulnerability of fossil resources and the politi-

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60 van der Hoeven, Diederik and Paul Reinshagen. *Biomaterialen, drijfveer voor een groene economie. Strategie voor een groene samenleving.* (Den Haag: 2013).

61 Van der Hoeven and Reinshagen. *Biomaterialen.* (2013).

62 Purchase, R.. H. de Vriend, H. de Groot, *Kunstmatige fotosynthese. Voor de omzetting van zonlicht naar brandstof* (Leiden: 2015).

63 Van der Hoeven and Reinshagen. *Biomaterialen.* (2013).

64 Van den Oever, Martien, Karin Molenveld, Maarten van der Zee, Harriëtte Bos. *Bio-based and biodegradable plastics - Facts and Figures.* (Wageningen: 2017), pp. 11.

65 Nossin, P. (2012) *Biopolymeren in breder perspectief. Nut en noodzaak*, p.21; cited by Lintsen H., Hollestelle M., Hölsgens R. *The plastics revolution. How the Netherlands became a global player in plastics.* (Eindhoven: 2017).

66 Harmsen. P. en M. Hackmann, *Groene bouwstenen voor biobased plastics. Biobased routes en marktontwikkeling.* (Wageningen: 2012): cited by Lintsen et al. *The plastics revolution* (2017).

cisation of the side- effects of plastics use – might indeed (be mobilised to) promote bioplastics. This is especially so because, while the prices of fossil based plastics fluctuate with oil prices, biomass prices are more stable, and at larger scales (and more cascading in the use of biomass – JG) they are likely to decrease.[67] To further close the price gap, institutional innovations will be important. These will have to support circular value propositions involving the cascaded use of biomass. Such circular products and their associated markets require a different set of relationships, market rules and funding arrangements than linear chains, focused on a single end product – market combination.

24.4.3 Dematerialisation

In regard dematerialisation strategies, it should first be noted that plastic itself has led to dematerialisation through a 'refuse' strategy, partially replacing metals in e.g. home and car construction. That said, there is significant additional potential for dematerialisation through 'refuse' or 'rethink,' especially in regard to plastic's short-lived applications. In packaging, for instance, alternatives like re-usable packaging, and house-to-house delivery and simply less packaging (especially by producers and deliverers) are ready to hand.[68] The challenge is mainly cultural. As the Plastic Heroes campaign noted above has shown, it is possible to change behaviour in regard to e.g. re-usable bags. Using less plastic in e.g. food packaging however, is likely to run afoul of cherished convictions, embedded in legislation on food safety.

Other short-lived applications are endemic especially in everyday electronics and electric equipment, which is often replaced every few years. Repair is often possible, the main problem being that disproportionality between labour and materials / energy costs often make it too expensive – although niche activities began to surface in the mid-2010s like Repair Cafés or mutual services trading networks. In a further developed sharing economy, novel opportunities for dematerialisation might arise. The 'millennials' generation may be more prone to such a way of life than earlier generations, though this may extend mostly to costly items, like cars and luxury goods. Finally, by the mid-2010s combining various functions (a calculator, a web browser, a flashlight and a camera) into one artefact (a mobile phone) was widespread. It had, however, not yet led to abandoning the purchase of calculators, laptop computers, stand-alone flashlights and a proper camera. The cultural inclination to own a wide variety of objects is strong.[69]

[67] Van den Oever, Martien, Karin Molenveld, Maarten van der Zee, Harriëtte Bos. *Bio-based and biodegradable plastics - Facts and Figures. pp. 10.*

[68] Van Ours, J.C. *Gezinsconsumptie in Nederland 1951–1980*. (Rotterdam: 1985).

[69] Raad voor de Leefomgeving en infrastructuur. *Circulaire economie van wens naar uitvoering.* (Den Haag: 2015).

24.5 Electricity-for-Households

Obviously, the most crucial contemporary problem with electricity consumption by households is its significant contribution to climate change. Since the turn of the twentieth century, this contribution has increased due to nearly universal electrification, i.e. (1) increasing numbers and (2) more intensive use of (3) more kinds of appliances. These effects outweighed countervailing developments: (4) drastically increased efficiency of appliances, (5) a steady reduction of the energy intensity of electricity production over the twentieth century – especially since the mid-1970s, and (6) use of a different fuel mix in electricity production.

As argued in Sect. 23.6, electrification proceeded apace because from the outset electricity was presented as an asset 'waiting to be used', and user experiences were folded back in to promoting and developing new appliances. The economic logic of a network connecting centralised provision to decentralised consumption was another driver. The modern idea of progress brought with it a strong cultural inclination towards the 'electric home.' After the Second World War, domestic practices in the Netherlands became Americanised, and since the 1980s dynamic lifestyles have become unthinkable without audio, video and ICT appliances. These factors continue to drive electrification as audio and video appliances, ICT, communication and auxiliary equipment penetrate into ever expanding markets. Additional new drivers of electrification are trends like the termination of the natural gas network and increasing electric mobility.

One countervailing development, the improved efficiency of appliances, has become institutionally and discursively embedded in EU and national regulation, energy labels, parameters in comparative commodities tests et cetera. Increasing awareness of climate change and the Paris Treaty obligations provide additional momentum. Changes in the electricity generation fuel mix have been historically important as a countervailing development; the contemporary functional equivalent is the shift towards renewable resources. This development too is supported by climate change concerns and treaty obligations. The world of finance may well become an independent countervailing factor – key players, especially after 2015, have begun to abandon the fossil sector. The handwriting on the wall has included, internationally, the Rockefeller family's 2014 divestment of the fossil sector as well as Bloomberg advising investors along similar lines. Domestically, we can point to the decision by a major pension fund (ABP) to withdraw more than €5 billion from the fossil sector, as part of a systematic divestment policy.[70]

It is important to note that the change in the 'fuel mix' of centralised generation is being reinforced by a second development: a very significant increase in the share of decentralised electricity generation by households /neighbourhoods and busi-

[70] 'Rockefellers, Heirs to an Oil Fortune, Will Divest Charity of Fossil Fuels', *New York Times*, September 21, 2014; 'Rockefeller family charity to withdraw all investments in fossil fuel companies', *The Guardian*, March 23, 2016; 'Lage grondstofprijzen zet waarde fossiele beleggingen ABP onder druk; *Financieel Dagblad*, March 6, 2016; Corinne Wortman-Kool (CEO), *Nieuw beleggingsbeleid ABP is breuk met het verleden*. (www.apg.nl/pdfs/abp-pensioendoc_2016.pdf).

nesses / industrial zones as well collaborations among them. These developments have a great deal of momentum, anchored not only in increasing climate awareness and the Paris Treaty, but also in strong cultural inclinations. The latter include an appreciation of autonomy, authenticity and a new sense of inclusive entrepreneurship which integrates economic and societal objectives through novel modes of value creation. Roofs, industrial heritage and abandoned buildings become ‘capital’ and in the same movement a new understanding of ‘the commons’ is emerging. Giddens (1991) has interpreted such inclinations as typical of high modernity. They are firmly inscribed in the ‘source code’ of the generations born after 1980, and were reinforced in the aftermath of the financial crisis.[71] That crisis de-blocked the labour market by engendering more entrepreneurial attitudes, especially amongst starters. It also led to low interest rates and thus improved the ‘competitive position’ of investments in individual and collective decentralised energy generation. Moreover, it has created a sense among scholars[72] and upcoming social movements[73] that these modes of value creation are a viable and necessary alternative to the market system that evolved since 1945.

These developments have also yielded a novel type of energy actor: prosumers, i.e. citizens, firms and others who both produce and consume electricity. Together with the rather intermittent character of two key renewable electricity providers, sun and wind, this novel type of actor will profoundly change the structure and meaning of the electricity system. Against this background, we will now discuss in greater detail, first, electrification and increasing efficiency of households, and then the changing electricity networks.

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[71] Van Steensel, Karin. *Internetgeneratie*; *de broncode ontcijferd*. (Den Haag: 2005).

[72] Kemp, R., Strasser, T., Davidson, R., Avelino, F., Pel, B., Dumitru, A., Kunze, I., Backhaus, J., O’Riordan, T., Haxeltine, A. and Weaver, P. ´The humanization of the economy through social innovation.´ *SPRU50* (Brighton: 2016); Van Bavel, Bas *The Invisible Hand? How Market Economies have Emerged and Declined Since AD 500*. (Oxford: 2017); Van der Heijden. *Na het neoliberalisme. Klimaatverandering, sociale bewegingen en politiek.* (Delft: 2017).

[73] Including the transition towns movement in especially the UK and Flanders, the Energiedörfer in Germany, de ‘Nederland kantelt’ movement in the Netherlands, and the transnational ‘city-makers’ Peer2Peer movements. Typically, these movements bring together citizens and community organizations, entrepreneurs and experts. Their structure and operations have been extensively documented in scholarly publications, see e.g.

Seyfang, G., Haxeltine, A. Growing grassroots innovations: exploring the role of community-based initiatives in governing sustainable energy transitions, *Environment and Planning C: Government and Policy,* vol. 30 (2012), p. 381–400.; Broto, Vanesa Castán, Harriet Bulkeley. ‘A survey of urban climate change experiments in 100 cities’, *Global Environmental Change* 23 (2013), p. 92–102.; Seyfang, G., Longhurst, N. Growing green money? Mapping community currencies for sustainable development, *Ecological Economics* vol. 86 (2013), pp. 65–77.; Loorbach, D., Avelino, F., Wittmayer, J.M., Haxeltine, A., Kemp, R. O’Riordan, T. and P. Weaver. The economic crisis as a game-changer? Exploring the role of social construction in sustainability transitions, *Ecology & Society*, 21 (2016), 4.; Scholl, Christian & René Kemp. City Labs as vehicles for innovation in urban planning processes, *Urban Planning*, 1(2016) 4: 89–10.; Longhurst, N., Avelino, F., Wittmeyer, J., Weaver, P., Dumitru, A., Heilscher, S., Cipolla, C., Afonso, R., Kunze, I. and Elle, M. (2017). *“New economic” logics and urban sustainability transitions*. (TRANSIT working paper # 8).

24.5.1 Electrification and Increasing Efficiency, 2010–2050

By the mid-2010s, at least five (relatively) novel modes of electrification may be discerned. Two are still emergent and associated with the necessary *phasing out of fossil fuels*. First, electric cars were declared the key long-term option for individual transportation in the Fuel Vision (2015) one of the elaborations of the 2014 multilateral Energy Agreement. The implementation of this agreement became more urgent in June, 2015, after a sustainability organization, Urgenda, won a court case mandating the government to intensify its efforts.[74] The conclusion of the Paris Treaty in November of that year added fuel to this fire. Widespread use of electric cars will both generate a significant extra demand for electricity, in part in households, as well as add considerable storage capacity to the electricity network.

The phasing out of natural gas, partly to combat climate change and partly because of public outrage about earthquakes above empty gas fields, is firmly anchored in the government's 2016 Energy Agenda, stipulating that by 2050, the natural gas grid is to be terminated. The most likely scenario will be a shift from 'heating' to 'maintaining temperature'. Homes will enjoy more rigorous thermal insulation (part of the 2014 Energy Agreement), so much so that less than 10% of current amounts of external energy supply will be needed. Temperature maintenance may rely on solar collectors, geothermal installations, heat pumps, heat nets as well as providing space in homes to heat-generating business assets, such as servers. Heat may be extracted from waste water coming from showers, washing machines et cetera. The associated apparatus, especially heat pumps and boilers for hot water supply, will imply additional electricity consumption. Tailor-made solutions will be needed, given the requirement to make regional heat plans to co-shape spatial planning and, for instance, new businesses ventures and business zoning.

A rare estimate of the increase in electricity demand due to those forms of electrification implicit in phasing out fossil fuels, mentions a 50% increase.[75] Clearly, and as we will elaborate below, achieving this transition will require novel institutional arrangements – and a significant cultural shift: a shift from the belief that 'practices for living and working may assume that energy is abundant' to the new idea that 'society will become co-responsible for energy provision, both in planning and in every-day life.' Experiences in water management, where a similar cultural shift (from controlling the water in order to support social and economic practices, to living with the water) suggest that this will be far from a smooth process. But to the extent that these changes are perceived as yielding more autonomy and space for the entrepreneurial energies of citizens and businesses, this shift may also draw on the new cultural inclinations just mentioned.

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[74] 'Hague court orders cuts in Dutch carbon emissions', *Financial Times*; John Schwarz 'Ruling Says Netherlands Must Reduce Greenhouse Gas Emissions', *New York Times;* 'Dutch court orders state to slash carbon emissions', *Al Jazeera English Edition* (all dated June, 24, 2015).

[75] de Joode, J. 'The role of power-to-gas in the future Dutch energy system'. *Report ECN_E_14_026*. (Petten: 2014), cited in Daniëls, B. & P. Koutstaal. *De rol van de elektriciteitsvoorziening in het klimaatbeleid.* (Petten: 2016), pp. 7 8. Items included differ somewhat, but 50% is warranted as a rough, indicative estimate.

Other forms of contemporary electrification are related to the *dominant lifestyles of 21st century homo ludens*. The use of domestic ICT and mobile devices is rampant and progressing; the Internet of Things (IoT) looms on the horizon. The growth of electrification due to increasing numbers of laptops, tablets, smart mobile devices and so on per household shows no sign of abating, and novel forms of 'electricity-based leisure' may yield yet further expansion. In all likelihood, the associated lifestyles are here to stay: the desire for self-expression has become a basic need since the 1960s, and these lifestyles reflect a deep-rooted fascination with the technological culture and the cultural inclinations and communication modes driven by long terms trends like individualisation and (transnational) network society.[76] Robotisation may lead to more leisure time. Most of these factors will also promote the Internet of Things, including the robotisation of domestic practices.

History shows that improvements in efficiency may partly compensate for the additional electricity consumption resulting from electrification. Domestic electricity use associated with ICT and communication appliances increased until the early 2000s, but after that was mitigated by improved efficiency. Since 2008, ICT use has shifted from mainly desktop computers to laptops, tablets and smartphones, while new appliances like e-readers also entered the scene. As a result, there are more appliances, although each of them uses less electricity than a desktop. Auxiliary devices such as wifi routers are also swiftly becoming more efficient, partly due to EU regulation.[77]

Extrapolating from these developments, Afman & Scholten foresee that by 2020 we may expect a reduction of about 30% (compared with 2008) in ICT-related electricity consumption (from 2 down to 1,4 TWh/year for all households), and an increase of 30% (from 1 to 1,3 TWh/year) for communications.[78] For 2030, two scenarios are conceivable. First, ICT related electricity consumption will decrease by 15% (down to 1,2 TWh/year) while communication related use will slightly increase (with about 7,5% up to 1,4 TWh/year). Second, the Internet of Things may lead to a doubling of the electricity consumption associated with communication (up to 2,7 TWh/year). The authors consider both scenarios 'plausible'. While cultural analysis is missing, this study of the impact of ICT and the Internet of Things shows that associated changes in electricity consumption depend crucially on the evolution of user practices and parallel improvements in the efficiency of communications devices.

[76] Giddens, Anthony. *Modernity and Self-Identity*. *Self and Society in the Late Modern Age.* (Stanford: 1991).

[77] Afman, M.R. & T. Scholten. *Trends ICT en Energie 2013–2030.* (Delft: 2016), pp. 17–19.

[78] Afman, M.R. & T. Scholten. *Trends ICT en Energie 2013–2030. pp. 50–53.*

24.5.2 Options for the Electricity System

We may conclude that the future of the electricity system is more open than it has ever been since the 1930s. Yet, at a certain level of abstraction, we can identify three features that are likely to emerge.

First, the electricity system will be a mixed network, comprising a wide diversity of central and decentral sources and with many (potentially nearly all) former consumers becoming prosumers.[79] Energy sources will include:

- solar energy (especially decentral: roofs, walls and maybe even roads in the built environment)
- wind energy, both decentral (from farms, villages and industrial parks) and central, especially off-shore (4500 MW, or 4–5 traditional coal/gas/nuclear power plants are planned for 2023)
- hydropower (in the Netherlands, mostly pumped-hydro storage as a medium for supply-demand-match management);
- biomass, with or without carbon capture and storage (CCS). If the biomass is sustainably produced, this may lead to negative CO_2 emissions. The availability of sustainably produced biomass, that is also needed for the bio-based economy, is the most important limiting factor. Novel forms of biomass production, e.g. employing seaweed and algae, may offer partial solutions.
- coal or gas, combined with CCS;
- nuclear (in the Netherlands the most likely way would be through procurement from other EU countries – replacement of the country's sole nuclear plant is politically not salient)
- several relatively new options: osmosis, deep geothermal electricity generation, tidal energy and wave energy (some of these may account for some share by 2050).

Solar and wind will probably form the spine of the future system, but given their intermittent character, several of the other options will be necessary as well. Intermittency may also be dealt with by buffering electricity (e.g. in charged cars, batteries integrated in underground constructions of e.g. a parking garage, and pumped-hydro storage) and by electrifying functions that may be organized in a flexible way, such as producing organic fuels and other chemicals from CO_2 and hydrogen, or producing heat. Realising such provisions will add to energy costs.

The relative contributions that these various sources might make to the electricity mix in 2050 are still unclear. Many analyses are based on a comparison of the costs per ton CO_2 reduced.[80] An alternative logic would consider the costs as investments essential to attaining a competitive position in a new, sustainable economy with

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[79] Daniëls, B. & P. Koutstaal 'De rol van de elektriciteitsvoorziening in het klimaatbeleid', (Petten: 2016); Blanford, G.J., Aalbers, R.F.T., J.C. Bollen, K. Folmer. 'Technological Uncertainty in Meeting Europe's Decarbonisation Goals', *CPB Discussion Paper 301*, (Den Haag: 2015).

[80] Blanford et al., (2015) 'Technological Uncertainty in Meeting Europe's Decarbonisation Goals'.

moderate sensitivity to international developments. In addition, in the new economy, business models (e.g. for bio-ethanol produced in a cascade) will often be circular rather than linear as assumed in these analyses. Also, they typically assume that investments will be forthcoming from major parties in order to fund the centralised production of electricity. Meanwhile, however, decentralised solar power is mushrooming, thanks to the cultural inclinations and financial conditions discussed above. The only certainty seems that the future system will be much more heterogeneous and flexible than our present one.

Second, citizens and businesses will no longer be able to assume that energy is simply abundant, but will increasingly have to cut their coats according to their cloth. First, the network structure and its management will increasingly depend on regional constraints *and* the other way around. What has said above about heating plans may apply in an analogous way to regional opportunities for solar, wind and other forms of electricity generation. Second, the intermittent and variable nature of sun and wind and the changing demand over the course of days and seasons, make matching supply and demand much more of a challenge.

Finally, at least over the medium-term, there is a tension between further electrification and meeting Paris Treaty objectives. Regarding security and reliability of supply in a mixed network, a lot of questions remain to be answered. The same goes for household demand, the combined effect of increased efficiency and continued electrification. Also, little is certain about the rate of electrification of car transport and heating[81] Other scenarios and visions suggest how society could – and should – deal with its electricity system to facilitate continuing electrification, assuming only 'moderate' use of ICT[82] All scenarios share one salient point: recognition of the tensions between meeting the requirements of the Paris Treaty and ensuring supply security and reliability.

In sum, although major changes are afoot, there is still ample reason to support Ganzevles and Van Est's[83] recommendation that *reducing* electricity consumption should become a national objective, canonizing and reinforcing a development already going on since 2004.[84] In Daniëls & Koutstaal's words: "the development of electricity demand is no longer an exogenous given to be taken into account in electricity generation, but also a consequence of choices on the ways to reduce

[81] Blanford et al. (2015); Schoots, K. and P. Hammingh. *Nationale Energieverkenning 2015*. (Petten: 2015); Daniëls and Koutstaal. 'De rol van de elektriciteitsvoorziening in het klimaatbeleid' (Petten: 2016); Ros, J et al. *Opties voor energie- en klimaatbeleid*, (Den Haag: 2016); Enexis. *Eindeloze energie. Inspiratieboek.* (Den Bosch: 2016); International Energy Agency *World Energy Outlook 2015*. (Paris: 2016).

[82] Greenpeace International, Global Wind Energy Council and Solar Power Europe. *Energy Revolution. A sustainable world Energy Outlook 2015. 100% renewable energy for all.* (Amsterdam: 2015), Urgenda *Nederland 100% duurzame energie in 2030. Het kan als je het wilt! www.urgenda.nl/visie/actieplan-2030/* (Amsterdam: 2016)

[83] Ganzevles, Jurgen en Rinie van Est. *Energie 2030. Maatschappelijke keuzes van nu.* (Den Haag: 2011).

[84] ECN, PBL, CBS and RvO. *Energieverkenning Nederland, 2015.* (Petten: 2015). pp. 74–79.

emissions."[85] Crucially, this also pertains to the various options for circularity discussed in previous sections.

The network's heterogeneity and flexibility, and the need for continuous tuning of demand and supply, require novel modes of network coordination and management. Similarly, business models fitting such a system also need to be developed. Given the importance of place and differences in conceivable economic logics, what eventually may result is a system of different, regionally oriented, systems.

Let us consider one perspective, consisting of four scenarios put forth by Enexis, an incumbent network manager.[86] The scenarios may co-exist, and even (more or less lightly and visibly) overlap. In two scenarios, large-scale, central generation dominates. In new housing estates, storage capacity, heat pumps etc. are installed in the neighbourhoods; the second scenario is appropriate to established, perhaps historic urban quarters, depending almost exclusively on external, centralised resources. Either way, network managers control the system, drawing on a flexible configuration of sources, and performing demand management through smart meters and, sometimes, enforcing limited use. Here, the business model resembles the current one: network managers continuously buy and sell electricity from a variety of sources. These options may draw on incumbent institutional arrangements, but presuppose significant institutional trust, and stable relations between citizens and large players.

In two other scenarios, a regional population takes responsibility to ensure an energy-efficient and comfortable way of life, with an emphasis on regional electricity generation. Homes generate solar energy; heat is provided from biogas produced by local farmers from manure; other, tailor-made innovative solutions are installed; there is ICT-based demand-supply management and a regionally oriented, sharing economy. The region may or may not be coupled to the national grid. In the former case, the community may frequently sell excess electricity at profitable prices to other regions; in the latter case, inhabitants choose a form of autonomy or even autarky. Either way, ICT will be used to optimize the business model and realize a fair distribution of costs and benefits. More radically, distributed management is also very conceivable, based, for instance, on the block chain system. Local communities could thus arrange intermittency management through supply-demand matching and storage among their number, with similar communities elsewhere and even with central providers. Both scenarios may be likely outcomes in regions where inclinations for autonomy are strong and trust in big players in industry and government relatively weak, and where there is some minimal level of social capital.

National and EU political choices will also set important boundary conditions. Innovation policy to promote the development of central and decentral modes of electricity generation; physical planning to enable regionally tailored solutions; and legislation to provide an institutional framework. As of the mid-2010s, government seemed to be favouring 'both' options, both in terms of physical planning (working

[85] Daniëls and Koutstaal (2016). pp. 6.

[86] Enexis. *Eindeloze energie. Inspiratieboek.* (Den Bosch: 2016).

both on large scale off-shore wind parks and decentralizing much of the other measures from the Energy Agreement); as well as in terms of legislation (adopting a new framework law on spatial planning, enabling local initiatives by municipalities, citizens and others parties by simplifying the planning process). Innovation policy was still underdeveloped, de facto leaving a lot to the discretion of main market players; while more specific legislation to regulate the electricity market was also still in statu nascendi. Absent more governmental effort, the bets are on the side of the established main players. That said, that prospect may generate a sense of discomfort amongst those with limited trust in main players, and may even foment rebellion among those who are taking energy matters into their own hands.

24.6 Beyond the Welfare Paradox – Towards a New Economy and Society?

The above discussion makes it clear that strategies to resolve contemporary problems of well-being imply vast changes, not only in technologies, but also in social and economic practices of production and consumption. Pursuing them will obviously require a major effort, which will be met with inertia, contestation and resistance. We have weighed the chances of these strategies by considering them in the context of their historically grown structural and spatial embedding, as well as of their long-term sectoral trends. In this concluding section we will add one more generic trend, and discuss two important promises of the transition we have been discussing that, in the most favourable of circumstances, might help generate support for the strategies proposed.

The generic trend is the transition from what Carlota Perez has called the fourth techno-economic paradigm, based on oil, physical mobility on the basis of the combustion engine and mass production and consumption, toward a new paradigm, based on information, network collaboration and tailor- made production as its key characteristics.[87] Clearly, a transition to circular production and smart grids, and to more ongoing alignment between demand and supply, is congruent with this shift, as further argued in Perez.[88] An important qualification she makes is that any acceleration and amplification of this trends depends utterly on governmental agency to effect the necessary institutional transformation.

The first promise associated with the transition discussed is that the idea of 'making ends meet', through circularity and alignment between demand and supply of electricity, may mitigate the source of what economic historian Bas van Bavel has identified as the key source of the repeated failures of free markets – the fact that the

[87] Perez, Carlota, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*, (Cheltenham: 2002).

[88] Perez, "The financial crisis and the future of innovation: A view of technical change with the aid of history", *Working Papers in Technology Governance and Economic Dynamics*, No. 28, (Tallinn: 2002).

market mechanism focuses on transactions of economic commodities, but hardly on the inputs into the economy: land, financial capital and natural capital.[89]

A second promise, potentially, would be that these strategies might help mitigate the welfare paradox identified in Chap. 22: income and fulfilment of basic needs have significantly increased; yet there are widespread sentiments of dissatisfaction and institutional distrust. It is important to appreciate what goes on beneath the surface of widespread satisfaction. Sociologist Arlie Hochschild, in an important ethnographic study on dissatisfied citizens in Louisiana, finds that these people feel marginalized, a moral minority, 'strangers in their own land.'[90] Their wages remain stable or decline; they experience swift demographic change and they detest a cosmopolitan dominant culture of 'white wine and cappuccino.' Though they suffer from pollution and unemployment due to corporations' behavior, they are neglected by the government, which has failed them and which they perceive to be run by a cosmopolitan elite that sees them as bad and backward. Similarly, Belgian cultural-historian David Van Reybrouck, during a long stay in Germany, witnessed similar feelings among discontented people there – alienation prevailing most of all in the former East.[91] He stresses the fact that these people may vote, but lack opportunities to voice their concerns. Anthropologist and investigative journalist Joris Luyendijk undertook a series of interviews with discontented citizens in the Netherlands, and came to similar findings; he sees a connection with the fact that people are increasingly aware that not only banks (as he had found in an earlier book), but also other corporations, hospitals, and so on have become the private playground of investors, to whom they are mere objects of profit making.[92] Such analyses also echo Van Bavel's findings that the contemporary market system is in deep crisis, because crucial inputs into the economy have been monopolized by an elite. As a consequence, there is barely anything resembling a free market, and society is less and less able to make autonomous choices.[93]

If these are the underlying problems, then Kemp et al.'s proposal to re-embed the economy in society and nature points towards an interesting route for solutions.[94] Building on Polanyi, they observe a triple movement in society: marketisation, the spread of market thinking and coordination throughout society, state-based social protection and (here they extend Polanyi's analysis) a humanisation of the economy, re-embedding it into society and nature.[95] With the latter movement, based on a major European research project on social innovation, they refer to "less hierarchi-

[89] Van Bavel, Bas *The Invisible Hand? How Market Economies have Emerged and Declined Since AD 500*. (Oxford: 2017).

[90] Hochschild, Arlie Russell. *Strangers in Their Own Land: Anger and Mourning on the American Right*. (New York: 2016).

[91] Interview with Sander van Walsum in *De Morgen*, October 10, 2017.

[92] Interviews of Luyendijk can be found at: www.kunnenwepraten.nl

[93] Van Bavel, Bas (2017). The Invisible Hand? How Market Economies have Emerged and Declined Since AD 500. (352 p.). Oxford: Oxford University Press.

[94] Kemp, R., Strasser, T., Davidson, R., Avelino, F., Pel, B., Dumitru, A., Kunze, I., Backhaus, J., O'Riordan, T., Haxeltine, A. and Weaver, P. 'The humanization of the economy through social innovation'. Paper presented at *SPRU50*, (Brighton, United Kingdom, 2016).

[95] Karl; Polanyi, *The Great Transformation. The Political and Economic Origins of Our Time.* (Boston: 1944).

cal forms of decision-making in business and public organisations, new and non-profit ownership models, greater self-determination in work, ethics-based forms of consumption (…) commons-based peer production, social enterprises, alternative currencies, communal ways of living and working, the sharing of urban spaces and participatory budgeting (…) in all sectors." (p. 8) It "involves people from different walks of life" and is partly a reaction to marketisation and associated phenomena, and partly an expression of people's need for autonomy, social bonds and meaningful relationships with others, "and desires to engage in meaningful activity (…) and contribute to a better world that is more equal, fair and respectful of people and nature." (p. 11).[96]

It is not difficult to see how elements of the strategies discussed above fit into this picture: re-connecting different agricultural sectors to each other and to ecosystems, re-developing real-estate into shared spaces with communal functions, setting up mixed central-decentral energy systems et cetera. Importantly, Kemp et al. point out that such systems may also fulfill the need for self-determination (understood as autonomy, competence and relatedness) that has been identified as a primary need in a cross-cultural study by Chen et al.[97] Thus, such changes may contribute to reducing feelings of alienation and lack of self-determination that figured so prominently in the above studies into public discontent.

That is the optimist account. In a more pessimist scenario, a darker movement, dominated by radical leaders and subversive forces, wielding internet-based disinformation, may win the battle for people's minds and hearts. As Cox (put it in a remarkably insightful analysis, "Civil society has become the crucial battleground for recovering citizen control of public life."[98] One does not need to be a neo-marxist to share his point that the outcome will depend not only on technical advances but also, and especially, on "resurrecting a spirit of association in civil society together with a continuing effort by the organic intellectuals (…) to think through and act towards an alternative social order at local, regional and global levels."

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[96] Kemp, et al. (2016) 'The humanization of the economy through social innovation'.

[97] Kemp, et al. (2016) 'The humanization of the economy through social innovation'; Chen, B., Vansteenkiste, M., Beyers, W., Soenens, B., & Van Petegem, S.. Autonomy in family decision-making among Chinese adolescents: Disentangling the dual meaning of autonomy, *Journal of Cross-Cultural Psychology*. 44 (2013) 7, pp. 1184–1209.

[98] Cox, R. 'Civil Society at the Turn of the Millennium: Prospects for an Alternative World Order', *Review of International Studies* 25 (1999) 1, p. 3–28.

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