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ARTICLES

A Framework for Sustainability Transition: The Case of Plant-Based Diets

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Abstract Societal and technological development during the last century has enabled Western economies to achieve a high standard of living. Yet this profusion of wealth has led to several outcomes that are undesirable and/or unsustainable. There is thus an imperative need for a fundamental and rapid transition towards more sustainable practices. While broad conceptual frameworks for managing sustainability transitions have been suggested in prior literature, these need to be further developed to suit contexts in which the overall vision is arguably clear, such as in the case of consuming animal-originated foodstuffs. In this article we introduce a novel transition management framework that is based upon the dimensions of sustainability. The suggested transition management process includes the identification of objectives and obstacles, the listing of options and their opportunities and threats as well as the evaluation of the outcomes (the Five O's). We argue that sustainability transition management should be a process in which the identification of the relevant dimensions of sustainability and related objectives forms the foundation for strategic, tactical and operational governance activities. We illustrate the practical applicability of the framework in the case of transition towards plant-based diets.

Keywords Sustainable development · Sustainability · Transition · Animal protection · Meat consumption · Vegetarianism

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Introduction

Human influence on the Earth has increased to unprecedented proportions. The prevention or, at least, alleviation of the imminent threat of a global natural catastrophe necessitates change towards more sustainable consumption patterns (Stern 2007; IPCC 2007). In particular, the agricultural sector has become increasingly important in the sustainability/sustainable development debate as the global population continues to grow and people are consuming an increasing amount of animal-originated foodstuffs (Tilman et al. 2002). However, this consumption has incurred severe environmental costs (Vitousek et al. 1997; Rockström et al. 2009). The agricultural sector utilizes the majority of the ice-free land area; it is the largest consumer of fresh water and has substantial impact on biodiversity (Lang et al. 2010). Moreover, animal agriculture produces large amounts of greenhouse gases, both directly through rumination and indirectly through deforestation and desertification (Stehfest et al. 2009; McMichael et al. 2007). Such problems are expected to become more pronounced over the next 50 years (Tilman et al. 2001; Steinfeld et al. 2006). Due to the environmental effects of meat and dairy production, calls have been made for a transition towards plant-based diets (Goodland 1997; Carlsson-Kanyama 1998; Steinfeld et al. 2006; McMichael et al. 2007; Garnett 2009; D'Silva and Webster 2010; González et al. 2011; de Bakker and Dagevos 2012), veganism (Fox 1999) and other alternative protein sources such as artificially grown meat, and insect-based and algae proteins (see e.g., Aiking 2011; van Huis et al. 2013; Becker 1997).

The need for a transition towards plant-based diets can also be justified on moral grounds as there are a number of scientific theories that refute the acceptability of humans eating non-human animals (for a comprehensive review, see Pluhar 2010). These perspectives include, for example, utilitarianism, which juxtaposes the amount of suffering caused to sentient beings with the benefits derived by humans from consumption of animal-derived products (Singer 1975), and moral rights perspectives, which consider non-human animals to possess inherent value (Regan 1985). In addition, there are a number of world perspectives or religious theories, such as Seventh-day Adventism (Orlich et al. 2013), that condemn the eating of meat. The moral argument for changing the way in which humans act towards other animals (Jamieson 2002) can also be corroborated from the consumer perspective. This is also reflected in EU surveys, in which consumers express concerns about the treatment of animals in the industrial agricultural system (European Commission 2005). Furthermore, when confronted with the issue of animal treatment, some consumers commonly display negative or confused attitudes to meat consumption (Holm and Mohl 2000; McEachern and Schröder 2002; Ngapo et al. 2004).

In addition to environmental and ethical considerations, a transition towards plant-based diets is supported by public health considerations. Comprehensive reviews on the health effects of consuming vegetarian diets suggest that they can offer some health benefits (Campbell and Campbell 2006; Marsh et al. 2012; McEvoy et al. 2012; Sabaté 2001) and reduce all-cause mortality (Orlich et al. 2013). It has been suggested that, based on health effects alone, meat consumption

in the developed world should be decreased to less than half of its current level (McMichael et al. 2007).

For the first time in human history a transition is possible towards large-scale, plant-based diets as technological development and the global market economy have enabled the stockpiling and transport of plant-based foods in large quantities. However, it is quite evident that neither the markets nor traditional state control can achieve sustainability in industrial-scale animal agriculture, which is why governance activities involving a wide array of actors are required. For an effective transition to occur in food practices, multiple actors need to cooperate; for example, policymakers, governmental officials, NGOs, supermarket managers, farmers, and consumer-citizens (Spaargaren et al. 2012). Thus, a framework is needed that enables different actors in government, the civil community, and markets to choose the most suitable measures for each of them. This is particularly important as transition towards sustainability not only concerns willingness to change; structural and practical barriers also play significant roles (Berg 2011).

Multiple policy measures to decrease meat consumption have already been presented in the scientific literature, including taxation schemes (e.g., Goodland 1997; Vinnari and Tapio 2012; Wirsenius et al. 2011), reduction of state subsidies from animal feed (McMichael et al. 2007), banning consumption and educating individuals (Deckers 2010), as well as labeling schemes (Lang et al. 2010). Attempts have also been made to design marketing programs with the aim of increasing acceptance and usage of plant-based foods (Wansink et al. 2005; Kirchhoff et al. 2011). However, very little scholarly attention has been paid to the whole process of transition, including possible obstacles (McMillan and Durrant 2009; Berg 2012), opportunities, and threats. Such a broad perspective is warranted as the desired transition would be on an unprecedented scale in human history, and is likely to encounter various types of cultural, political, and commercial resistance (Friel et al. 2009). As such, the emerging research on sustainability transitions and their management (e.g., Smith et al. 2005; Kemp et al. 2007; Loorbach 2010) shows considerable promise. For instance, Loorbach (2010) has introduced a dynamic framework prescribing how such transitions might be managed. However, to arrive at concrete solutions to well-defined problems, this general framework needs to be further specified (de Vries and Petersen 2009; Kauffman 2009).

This article addresses sustainability transition in the food system[1] and pays particular attention to the effective implementation of governance activities aimed at managing a transition towards sustainable food consumption. The more precise purpose of the article is to develop a five-phase framework (the Five O's) for managing transition towards adoption of more plant-based diets. The focus is on influencing meat and dairy consumption in prosperous Western countries as they produce most of the global environmental burden associated with food consumption (Garnett 2011) and because, in these countries, subsistence farmers' share of the population has decreased considerably (e.g. Lang et al. 2009). The paper does not take a position regarding the extent of the transition; the process presented is as

[1] The whole system involved in producing and consuming food, including administrative and commercial actors, as well as consumers.

applicable to lowering Western meat and dairy consumption only incrementally as to managing a more profound transition.[2] As the research is motivated by phronetic considerations (Flyvbjerg 2001), the practical applicability of the framework is illustrated by offering examples for each phase. Thus, the framework developed in the paper can be employed by various actors for the purpose of advancing adoption of more plant-based diets.

The article proceeds as follows. Section "Sustainability and Transitions in the Food System" reviews the literature on sustainability and sustainability transitions, and presents the five-phase transition management framework. Section "Managing Transition Towards Plant-Based Diets" illustrates the applicability of the framework by first identifying potential obstacles to the transition towards plant-based diets, and by reviewing the governance options suggested in the extant literature: those that have already been implemented, and those that have been developed by the authors of this paper to overcome obstacles identified in the previous phase. Section "Managing Transition Towards Plant-Based Diets" also considers the analysis of opportunities and threats, and the evaluation of outcomes. Finally the fourth section presents the discussion and conclusions.

Sustainability and Transitions in the Food System

Dimensions and Objectives of Sustainability

Defining sustainability is by no means an easy task. As it is rooted in the philosophical and moral perspectives possessed by individuals, it has been characterized as a concept that various actors comprehend in different ways (Robinson 2004). It is important to understand that the notions of sustainability or sustainable development do not offer moral standings per se, but are often employed in a normative manner to promote personal perspectives (Hopwood et al. 2005). It has even been argued that sustainable development is no more than an outline term for users' worldviews (Lang et al. 2009, p. 6). Thus, there is a need to make the terminology associated with the concepts more precise and, in part, to redefine the terms (Campbell 1996).

In the first place, sustainability and sustainable development are different things and have different implications for understanding the production and consumption of animal-based foods, as well as for assessing the economic and social sustainability of the food system. One way to explain the difference between sustainability and sustainable development is in terms of individuals' perspectives on the role of the modernization process in solving environmental problems.[3] While sustainability is indifferent to modernization, sustainable development inherently emphasizes it. Furthermore, sustainability highlights the need for a fundamental

[2] There are some suggestions in the scientific literature concerning the extent of such a transition. See McMichael et al. (2007) for exact amounts or Rifkin (1993) for a composition.

[3] For a corresponding conceptualization and explanation in terms of ecological economics, see e.g., Harris (2003).

value change, while sustainable development relies more on technological solutions to overcome environmental problems (Robinson 2004). In this paper, the focus is on sustainability as it has been indicated that, in addition to technological advances, mitigating the impacts of large-scale global problems also requires changes in consumers' values (Huesemann 2006) and consumption structures (Lorek and Fuchs 2013).

From the perspective of sustainability transition, it is necessary that the various involved actors understand each other's initial standpoints, and agree on the level of transformation sought. The dimensions of sustainability considered in this context are of critical importance as their selection will affect the perspective of the whole discussion (Hajer 1995), and the exclusion of particular dimensions is the easiest way to diminish their importance. Prior research has suggested a variety of dimensions to be incorporated in the concept of sustainability.

Perhaps the most often presented outline of sustainable development is a triangle of economic, social, and environmental attributes (Munasinghe 1992). These dimensions are usually accepted as the fundamental dimensions of any sustainability framework. However, it has been argued that this triangle gives an overly simplistic perspective on the issue. For instance, the importance of including cultural sustainability as distinct from social sustainability has been highlighted in many cases (Hardoy et al. 1992; Vitousek et al. 1997). The main difference between the two is that cultural sustainability mostly concerns the continuation of culture, whereas social sustainability is about social wellbeing (Chiu 2004). Such considerations are reflected in the Food and Agricultural Organization's recent definition of sustainable diets, which contains references to economic, environmental, social, and cultural aspects: "Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy" (Burlingame and Dernini 2012, Annex 1). When evaluating sustainability, the cultural aspect is especially important in relation to consumption of farmed animal products. It is important because of the integral part that animal products, especially meat, play in constructing our perspective on our culture and ourselves (Rifkin 1993; Franklin 1999).

In the particular case of animal-derived food products, it has previously been proposed that sustainability can be examined with the help of a triangle comprising economic, environmental, and ethical spheres (Bonney 2008, according to Rawles 2010); with the ethical sphere perhaps incorporating animal welfare or animal rights issues. The problem that arises from this suggestion is that animal issues might still be ignored as they comprise only one part of the ethical sphere; this would undermine the whole rationale for including animal issues, which stems from a necessary value change emphasizing the quality of a subject's life, not only market led values (Rawles 2010). The whole sustainability or sustainable development discussion needs reorientation in a direction that also includes acknowledging all animals, not just humans (Jamieson 2002, p. 333). Rawles (2010) therefore argues in favor of a rectangle comprising social, economic, environmental, and animal welfare spheres. Such notions have also expanded beyond scientific discussions to the political arena as evidenced, for instance, by the inclusion of animal welfare and

animal health objectives in the UK food strategy (HM Government 2010). Moreover, presenting animal welfare as a separate sphere of sustainability seems to be relevant to at least some consumers as they have stated that animal welfare is one of the most important factors when considering the sustainability of animal farming (Boogaard et al. 2011).

However, the rectangular perspective on sustainability disregards the cultural sphere by incorporating it into the social sphere, which is lamentable as cultural issues are of profound significance when considering the sustainability of animal-originated food consumption. Eating habits have, for example, an integral role in preserving cultural continuity (Schösler et al. 2012). Moreover, the rectangle reduces animal protection to animal welfare only, and excludes the animal rights (i.e., abolitionist) perspective, according to which animals should not be utilized by humans for any purpose at all. Such a reduction is problematic because of the diverging ultimate aims of both perspectives; achieving animal welfare targets can potentially weaken the possibility of achieving abolitionist targets (Francione and Garner 2010). An evaluation of sustainable food consumption from the perspective of animal protection should therefore take into consideration objectives relating to both animal welfare and animal rights. It must be noted here that the inclusion of animal protection as a dimension of sustainability might be considered revolutionary as this "agenda attempts to implement the ethical obligations that we have towards other sentient beings" (Rawles 2010, p. 211). This would represent a major shift in Western thinking, and also in the worldview on sustainability, currently dominated by anthropocentricism (Thomas 1984).[4]

Based on the above arguments, Fig. 1 presents a five-dimensional definition of sustainability in relation to food consumption. This definition, which can be graphically illustrated as a pentagon, aims to fortify the ethical aspirations of sustainable development by supplementing the values of social, economic, and environmental development with those of cultural development (see e.g., Boogaard et al. 2011) as well as animal protection (cf. Rawles 2010). The five dimensions are further divided into more specific objectives.

In the social dimension, objectives of sustainability relate to human health, the right to participation, empowerment, and social cohesion. The objectives of economic sustainability comprise equity, efficiency, and development (see Goodland and Daly 1996). Cultural objectives, in turn, concern the maintenance of cultural identity and traditions, as well as adherence to culturally formed norms. Environmental objectives comprise the conservation of biodiversity and the Earth's carrying capacity, as well as dealing with global issues such as tackling climate change. Finally, the objectives associated with animal protection comprise animal welfare and animal rights targets; both of these objectives can be met if the total number of animals in the system decreases (Frank 2008).

The sustainability objectives shown in Fig. 1 will serve as the basis for operationalizing the sustainability transition framework presented in section

[4] The inclusion of the animal dimension might emphasize the distinction between humans (i.e., social and cultural ethics) and other animals (i.e., animal ethics). The purpose here is not to present such a categorical ethical division but to put forward a conceptual tool for analysing sustainability.

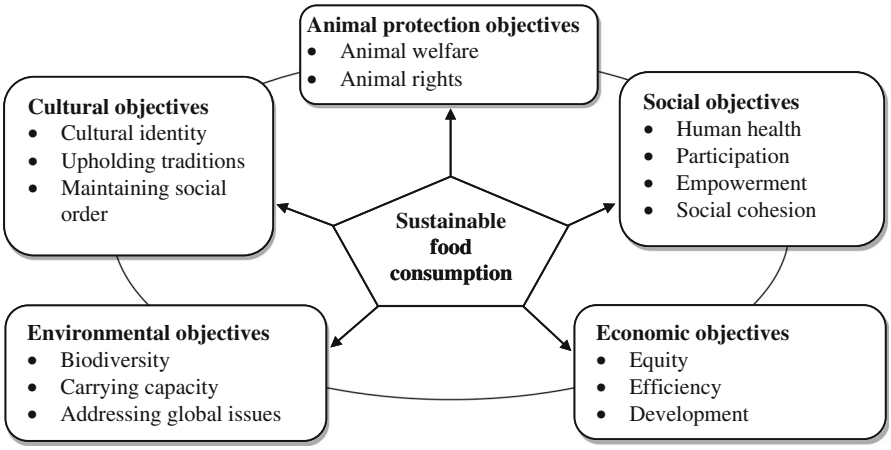

Fig. 1 Dimensions of sustainability in relation to food consumption (objectives are collected and modified from: Munasinghe 1992; Goodland and Daly 1996; Maxwell and Slater 2003; Rawles 2010)

"Conceptual Framework". First, however, it is necessary to provide an overview of the extant literature on sustainability transitions.

Sustainability Transitions

Sustainability transitions can be defined as "long-term, multidimensional and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption" (Markard et al. 2012, p. 956). Sustainability transitions have been the subject of considerable academic interest over recent decades, driven by major problems associated with the rapid rise of the Western phenomenon of overconsumption, especially in energy, transport, and food systems (Farla et al. 2012). Within the various sub-fields of sustainability transition research (for a review, see Markard et al. 2012), transition management, which has its foundations in complex systems theory and governance studies, is of particular interest to this paper. Scholars of transition management are particularly interested in the purposeful reorientation of socio-technical regimes; that is, systems in which technologies and scientific knowledge are inextricably linked to the expectations and abilities of social actors and structures (Kemp et al. 2007). Research on transition management is explicitly motivated by practical considerations and the wish to facilitate a transition towards a more sustainable state of affairs. Thus, a number of studies have examined and evaluated the outcomes of transition management projects in various sectors, often employing an action research approach (e.g., Kemp et al. 2007; Kern and Howlett 2009; Kern and Smith 2008; Loorbach and Rotmans 2010). Such practical experiences have then been utilized as a basis for developing and testing conceptual frameworks and processual approaches to serve as tools in policy-making (e.g., Loorbach 2010).

Although sustainability transition builds on the notion that participation of other groups in addition to state and commercial actors is necessary to eventuate change,

the fundamental role of politics in the process cannot be negated (Voß et al. 2009; Meadowcroft 2012). Political decisions draw the boundaries within which consumers make their choices, and these determine whether or not humankind will ever reach sustainable consumption. Thus, developing tailor-made tools for transforming the political decision-making landscape in such a way that sustainable choices are enabled should be at the core of sustainability transition research. However, this aspect has partly been under-investigated (STRN Steering Group 2010). A rare exception is Loorbach's (2010) four-phase transition management cycle, which builds on his earlier work concerning strategic, tactical, operational, and reflexive governance activities (Loorbach 2007). We describe the elements of this process in the following, and indicate knowledge gaps to justify further development of the framework.

The first phase in Loorbach's (2010) transition management cycle comprises establishing the transition arena, "a small network of frontrunners with different backgrounds, within which various perceptions of a specific persistent problem and possible directions for solutions can be deliberately confronted with each other and subsequently integrated" (ibid., p. 173). The frontrunners' task is to engage in a deliberative strategic discussion and arrive at a shared broad vision on what a more sustainable future might look like in the case of the socio-technical system under investigation. The prescriptive criteria for selecting these frontrunners include consideration of personal competencies, such as capacity for high-level abstraction of problems, and ensuring a balanced representation from various actor groups comprising government, businesses, consultants, scientists, and NGOs. The selection of frontrunners has been identified as the key issue in managing sustainability transitions (Shove 2007; Loorbach and Rotmans 2010); not least as the transition process is considerably complicated by the political interests of powerful groups (e.g., Meadowcroft 2009; Heiskanen et al. 2009). Therefore more systematic selection criteria need to be developed to guarantee an equitable consideration of all aspects of sustainability.

The second phase of the transition cycle involves translating the sustainability vision into more precise transition images and constructing transition paths, which proceed through (quantifiable) intermediate targets to the images. At this tactical stage, the motives and interests of specific actor groups are revealed, and negotiations conducted regarding the role of each group in realizing a transition agenda. As involved organizations are faced with the need to change their strategies and modes of operation, conflicts and tensions between the transition arena and organizational routines are likely to emerge. In this context, Loorbach (2010) mentions in passing that possible barriers to the transition should be considered, for example, though scenario work, but does not provide details on how such considerations might be structured. Such implicit belief in consensus and lack of attention to dissent has been subject to criticism as it glosses over differences between actors groups, space, and time (e.g., Shove 2007). Therefore, more emphasis should be placed on identifying obstacles to the transition to prevent the need for continual revision of the transition agenda.

In the third phase of the transition cycle, transition agendas are operationalized in the form of various competing or complementary actions and experiments that

might fortify existing progressive developments or introduce completely new modes of action. These high-risk actions are first piloted on the micro and meso scales and, if deemed successful, scaled up or transferred to different contexts. The high cost and long time scale of such experiments requires existing infrastructure to be utilized whenever possible, and that the feasibility of the projects is monitored. In Loorbach's (2010) framework, all experiments are categorized as operational activities occurring within a five to ten year period. This approach seems to imply that only operational governance activities can be concretized, and reduces strategic and tactical measures to only developing the vision and agenda for sustainability transition. As such, there is a danger that governance measures that unfold over a mid- to long-term period will not be given full consideration.

The final phase of Loorbach's (2010) transition management cycle comprises monitoring both the transition process and its management to learn from past experiences. It is suggested that such monitoring and evaluation is integrated into the other phases of the cycle.

In sum, despite its various benefits, Loorbach's (2010) cycle does not provide concrete solutions to specific problems, and lacks systematic methods for selecting frontrunners, as well as identifying obstacles and developing solutions with which to overcome them. The framework therefore needs to be further developed to suit contexts in which the overall vision is arguably clear, such as the previously argued case for reducing the consumption of meat and dairy consumption in Western countries. The need for such specification is justified by the fact that environmental conditions might radically transform to such an extent that adaptation and mitigation measures will become necessary in a relatively short period of time. At that point, sector-specific solutions need to be outlined and ready for policy makers to utilize. Similarly, reflecting on their experiences of iteratively developing and testing the transition management cycle over a decade, Loorbach and Rotmans (2010) point out that much research has thus far focused on the predevelopment phase of transitions, while more needs to be known about governing subsequent stages of transition. It is precisely in these stages that the existence of systematic methods for forming the transition arena and charting obstacles will prove useful in terms of saving resources and speeding up the process.

An effective framework for governing sustainability transition can be considered heuristic, that is, a systematic listing of options. In the world of practice, there are no certain options available, as the outcomes of various actions can always differ depending on the context in which they are applied. Effective governance measures should assist in the integration of sustainability issues into different policy arenas (Lafferty and Hovden 2003). Thus, a useful sustainability transition framework will mainly outline the relevant dimensions of an issue, and help define the types of question that should be asked by participants in the transition arena (Geels 2011). The target of the framework should be to help users perceive the connections between the different dimensions, and to consider the issue at hand (ibid.). Moreover, attention needs to be directed at how the transition can be integrated into the policy process at different levels, and to how a politically steered approach can be translated into action among actors in the civil community.

To enable effective sustainability transition, there is also a need to identify the critical barriers that prevent the transition from occurring, and to outline the variety of potential points of intervention. This should help in analyzing the possible rebound effects and negative externalities that singular interventions might engender (Farla et al. 2012). The idea of reflexivity is of critical importance in an effective framework, as the mere planning of the pathways leading to a vision has proved to be ineffective in the past. Nurturing and enabling have become alternative solutions to the planning and controlling of earlier societal vision implementation objectives (Voß et al. 2009).

Conceptual Framework

Based on the above considerations, we propose a five-step process, the Five O's (see Fig. 2), for effectively managing sustainability transition in the context of farmed animal product consumption (cf. Loorbach 2010): the first phase comprises outlining the dimensions of sustainability and the associated objectives that are relevant to the issue. In the case of food consumption, it should be clear that decreasing meat and dairy consumption is a necessary objective due to the environmental, ethical, and human health objectives of sustainability as explained in the introduction. However, it is crucial that other dimensions are also considered and their objectives listed, as uncertainty over relevant dimensions can lead to competing visions of sustainability transition, which in turn might blur the target of the transition (Farla et al. 2012). This is especially important as sustainability is a term that various actors understand in quite different ways (Meadowcroft 2012). The objectives will be established by the transition arena, in the creation of which the government can and should play a key role (Pape et al. 2011).

Some national governments have already been active in developing platforms for promoting sustainable consumption and production; for instance, in Finland the Finnish National Commission on Sustainable Development tries to establish a dialogue between the government, market actors, and the civil community (Prime Minister's Office 2006). Although the emphasis of such platforms is still on production efficiency, some include sufficiency elements (Berg 2011) and, as such, might also be employed to influence the amounts consumed by citizens. Therefore, this type of organization might serve as a basis for creating the transition arena that would enable meat and dairy consumption issues to be considered. Furthermore, as the consumption of farmed animal products is both a national and international issue, such a politically steered transition arena can also establish and maintain contacts with its counterparts in other countries and also relevant international organizations such as the United Nations or World Health Organization.

Although the process is politically coordinated, politicians should not be overrepresented among the frontrunners involved in the arena. In contrast, the frontrunners would be selected corresponding to the dimensions of sustainability, to guarantee that the interests of all concerned groups, including animals, are taken into consideration. This is necessary to prevent the domination of the process by short-term anthropocentric interests (cf. Spash 2012). Politicians, civil community representatives, and other actors involved in this phase of the process need to

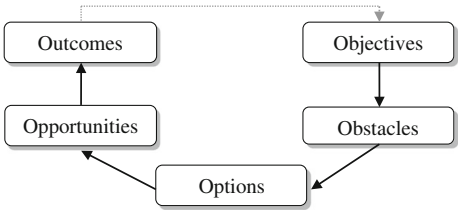

Fig. 2 Process for sustainability transition management (the Five O's)

discuss why particular dimensions should be considered, and what type of objectives are relevant to each dimension.

The second phase of the process identifies obstacles that prevent the transition from occurring in each of the dimensions of sustainability. At this stage, explicit attention is given to the conflicts of interest that are bound to arise as the practical implementation of the objectives formed in the previous phase is discussed. Thus, this framework does not take consensus as a given, but acknowledges that all actors in the process are representatives of a broader constituency whose interests they are trying to advance. Once the obstacles have been exhaustively listed, the third step in the process is to identify potential governance options with which to overcome them. As suggested by Loorbach (2010), these options are divided into operational, tactical, and strategic governance activities. To select the activities to be implemented, the fourth step is to identify potential opportunities and threats of the suggested governance activities, including possible win–win situations and rebound effects. Finally, the fifth step evaluates the outcomes of the selected governance activities, and utilizes these as a basis for restarting the process from the beginning. This highlights the fact that sustainability transition should be considered a continuous process and not an end state (ibid.).

In the following, we will demonstrate the practical applicability of the framework by offering examples of each phase of the process. This is considered of critical importance as the governance literature has been accused of lacking a prescriptive basis (ibid.).

Managing Transition Towards Plant-Based Diets

Identifying Objectives and Obstacles to a Transition Towards Plant-Based Diets

A systematic method for identifying the objectives of a sustainability transition in the food system is to utilize the dimensions of sustainability as outlined in section "Dimensions and Objectives of Sustainability". In this case, the need for plant-based diets is driven mainly by environmental and animal protection objectives (with the exception of human health, a social objective), while economic, cultural, and social objectives need to be addressed simultaneously to arrive at a balanced outcome. As the justifications for including the five sustainability dimensions and associated objectives have already been presented in section "Sustainability Transitions", they will not be repeated here. The ultimate objective in this case will

be a shift away from the consumption of farmed animal products; however, the precise extent of the transition[5] needs to be determined based on consideration of the previously mentioned trade-offs between animal welfare and animal rights objectives. The former target can be met, for instance, with low to moderate consumption of meat and dairy products produced in small-scale organic farms that allow animals to behave in ways characteristic of their species (e.g., year-round grazing), complemented with plant-based and other alternative protein sources. However, meeting the latter target would require a shift to veganism; that is, the consumption of only plant-based sources of protein. It has been suggested that in practice, full-scale vegetarianism might prove too difficult to achieve, and therefore a more realistic target might be, for instance, semi-vegetarianism or a specified reduction in the consumption of animal-derived products (de Bakker and Dagevos 2012).

By applying the pentagon of sustainability, it is similarly possible to identify obstacles to the transition towards plant-based diets in relation to societal, economic, environmental, cultural, and animal protection objectives (see Table 1). Acknowledging the importance of animal-originated foodstuff in people's everyday lives is critical for a successful transition to occur. The strong social cohesion around meat consumption (Adams 1999; Schösler et al. 2012) or beliefs about the nutritional necessity of meat as part of a healthy diet (Sabaté 2001) are strong forces upholding meat consumption. People are also, to a degree, detached from the reality of the animal production system (Jokinen et al. 2012), and there is also evidence that some consumers are even shocked when faced with the realities of modern animal farming (Boogaard et al. 2011). From the societal perspective, institutional structures uphold current practices as consumers can only purchase products that are offered to them in cafeterias or retail stores. Previous studies have identified habits as strong factors that prevent people from switching to a vegetarian diet (Lea et al. 2006; Salonen and Helne 2012). It is therefore important to note that current consumer choices are limited and only partly free (Sunstein and Thaler 2009).

From the economic perspective, the transition towards plant-based diets can meet obstacles in terms of the various actors' equity, efficiency, and development requirements. Those motivated by equity considerations are likely to hold the perspective that producers have the right to earn their living from the production of animal-originated foodstuffs as they have invested in food production technology (Boogaard et al. 2011). This argument also relates to the objective of economic development, as people might have concerns about the economic welfare of producers and others employed in the agro-industry. Those relying on efficiency arguments promote perspectives on the excellence and efficiency of the modern food production system, which results in low prices for consumers. These beliefs have been built into Western thinking to such an extent that their one-sided application has pushed all other sustainability goals aside (Hardeman and Jochemsen 2012). Combined, these perspectives translate into a need to secure the economic interests of farmers and industries subsequent to reduction of meat

[5] Similarly, to avoid excessive top-down control, the decision of how to define "meat" (e.g., whether or not to include white meat) is left to the transition arena.

Table 1 Examples of obstacles to a transition towards plant-based diets

Dimension	Objectives and associated obstacles
Social	Human health: belief in the nutritional necessity of animal-originated foodstuffs in a healthy diet
	Participation: some people are detached from the modern agricultural system, and do not know what it entails
	Empowerment: current institutional structures empower people to eat meat
	Social cohesion: current social cohesion around meat (i.e., meat as the tastiest food and the "main" food)
Economic	Equity: the perspective that producers have the right to earn as they have invested in the current food production system
	Efficiency: belief in the excellence and efficiency of the modern food production system (i.e., low prices for the consumers)
	Development: concern about the economic welfare of producers and players in the agro-industry
Environmental	Biodiversity: unawareness of the link between food consumption and the resulting strain on the environment, which reduces biodiversity
	Carrying capacity: unawareness of the link between food consumption and climate change; for example, disturbance of the nitrogen cycle or fresh water constraints
	Addressing global issues: lack of interest from consumers, and public and private sector actors as environmental issues do not yet influence most people's daily lives
Cultural	Cultural identity: importance of meat eating to cultural identity (i.e., separation of humans from animals)
	Upholding of traditions: ease of continuing current habits, lack of knowledge on modern food production, and false beliefs about our historical diets
	Adhering to cultural norms: willingness to conform to culturally determined norms to avoid seclusion (i.e., eating what others eat)
Animal	Animal welfare: humans consider they possess supreme attributes compared to other animals or disregard other animals' attributes
	Animal rights: humans do not consider themselves to be animals at all due to, for instance, religious beliefs

production. However, in this context it must be noted that as the number of farmers has been decreasing very rapidly in the Western world (EuroStat 2010; Lang et al. 2009, p. 155), managing this transition has already become easier.

The environmental objectives relating to sustainable food consumption do not, as such, present obstacles to the transition towards plant-based diets, which is not the case with consumers who do not acknowledge the environmental dimension of sustainability. Consumers have a relatively low level of interest in the environmental change that is occurring; however, even if they are knowledgeable, they frequently do not act in accordance with their knowledge (Novacek 2008). As knowledge is a prerequisite for voluntary action (Bord et al. 2000), uninformed consumers cannot be expected to alter their food consumption habits without resisting the change. In addition to consumers' lack of knowledge, the tragedy of the commons still prevails with regard to the actions of public and private sector organizations on environmental issues. Until a truly life-threatening state of affairs

occurs, environmental issues are considered less politically significant than, for instance, impending economic crises.

From a cultural perspective, any reduction in meat eating can be resisted based on objectives relating to the maintenance of cultural identity and traditions, as well as adhering to culturally determined social norms. Animal farming can be considered important from the cultural perspective due to the assumed effects that it has on the landscape or the aesthetics of seeing herd animals (Boogaard et al. 2011). Meat eating is considered culturally important as it enforces the perceived fundamental separation of human beings from animals (Spencer 1995; Stuart 2006). Furthermore, the continuation of such established habits is uncomplicated, and is even deemed necessary to avoid being considered deviant within the norms of a particular culture. False beliefs about our ancestors having been mainly carnivorous (for a discussion, see Stanford and Bunn 2001) might also enforce people's notions of meat eating as a culturally appropriate dietary habit. Cultural obstacles to plant-based diets are further enforced by cultural systems[6] that have been built to hide the origins of meat, and to make consumers more readily accept the usage of animals in food production (Vialles 1994). Consumers often feel that production animals should be living "a natural life," which is most often not the case in current agricultural systems (Lassen et al. 2006; Miele and Evans 2006). However, due to the tension between reality and consumers' idealized perspectives on the food production system, there are good opportunities to re-establish consumers' cultural connection with food production (Vinnari et al. 2013).

Similar to the environmental dimension case, the objectives of the animal protection dimension do not present obstacles to the transition per se, unlike consumers' lack of interest or knowledge. To value other animals, people need to perceive that those animals possess particular cognitive capabilities (Herzog and Galvin 1997, p. 238), such as self-awareness or the ability to feel pain. There are, however, possible differences between the "scientific view" of animal abilities and the public perception of those abilities (Kupsala et al. 2013). If consumers do not believe it possible that fish can feel pain, they will, most likely, not be concerned with the conditions in which the animal is bred or how it is captured. It has been noted that beliefs about the mental ability of animals affect the way humans treat animals, and that familiarity with an animal also affects humans' belief in its capabilities (Morris et al. 2012). There is some evidence that meat eating humans are able to deny any moral concerns relating to the animals they eat (Loughnan et al. 2010). An even more fundamental issue that affects people's perception of non-human animals, is the strongly debated biological origins of humans (Dawkins 2006). Evolution is a highly tested scientific theory, for which there is overwhelming evidence (Mayr 2001); however, it remains questioned or not comprehended by some members of the public. Without understanding the scientific facts of evolution and Darwinism it is not possible to understand the moral implications of the theory

[6] Such systems include the linguistic terms separating living animals from their meat (e.g., veal from calves, pork from pigs), as well as the relocation of butchering facilities from inner cities to industrial areas (see Vialles, 1994).

on human treatment of non-human animals (Rachels 1990).[7] Empirical evidence seems to support such claims as a positive association has been found between an individual's belief in evolution and his/her support for animal rights (DeLeeuw et al. 2007).

As demonstrated above, several obstacles can hamper a transition towards plant-based diets. The next section will review existing measures, as well as suggesting some novel ones, for overcoming each type of obstacle.

Governance Options for Promoting Plant-Based Diets

Various governance measures have been suggested for decreasing the consumption of animal-originated foodstuffs and moving towards plant-based diets. Such measures, supplemented with ones that have already been implemented, as well as the authors' suggestions for further measures, are shown in Table 2. To address the obstacles identified in the preceding section, the measures are organized in accordance with the pentagon of sustainability. Moreover, governance options corresponding to obstacles emerging from the different dimensions are divided into strategic, tactical, and operational activities (Loorbach 2010).

Strategic Activities

The effects of strategic governance activities are expected to actualize in the long term (i.e., 15–30 years), and the goal is to transform culture in terms of values, norms, and ethics (Loorbach 2010). Regarding the social dimension, international financing can be allocated to research investigating the nutritional effects of plant-based diets (LAV and Angelini 2012). The other aspect of the same issue would be to analyze the costs that current meat consumption places on society. For example current research indicates that implementing low-meat initiatives can substantially lower the costs of climate change mitigation (Stehfest et al. 2009). In addition, organizations such as the World Health Organization or the United Nations could initiate global efforts to promote citizen participation in food production, as well as programs to learn from various ethnic vegetarian diets.

As food retailers have become the dominant players in the food chain (Lang et al. 2009, p. 166) governance activities should be targeted at diminishing their power. Currently, retailers can act as gatekeepers for new products, affecting consumer purchasing by product placement or guiding consumer decisions towards retailers' own labels (see Björkroth et al. 2012). If this power was in the hands of a governmental institution, it could be employed to guide consumers to make sustainable purchase decisions. As online food purchasing is beginning to gradually increase (Geuens et al. 2003), governments have the opportunity to participate in widening the selection of available products by offering online purchasing services for consumers. This partial nationalization of the food distribution chain would reassign some power in the food distribution chain to public officials. As consumers

[7] It has been argued that the welfare of all beings is at the heart of Darwinism (Rachels, 1990, p. 222), not the domination of the strong over the weak.

Table 2 Examples of governance activities for enabling a transition towards plant-based diets

Objective	Strategic	Tactical	Operational
Human health	Financing research on the nutritional effects of plant-based diets	Acknowledging plant-based diets in national food recommendations	Advice for cooks on preparing healthy plant-based meals in schools
	Financing research on the effects of eating current levels of animal-originated foodstuffs		Promoting the link between positive weight effects and a plant-based diet
Participation empowerment	Global initiatives to promote citizen participation in food production (WHO; UN)	Acknowledging food production and animal farming in school curricula	Enabling small-scale vegetable farming in cities
Social cohesion	Programs to learn from different ethnic vegetarian diets (WHO; UN).	Funding research on historical diets	Promotion of local meat-free days
		Funding research on the value-action gap in relation to meat	Improving availability of vegetarian dishes
Equity	Decreasing subsidies for animal-originated foodstuff production on a global scale	Support for the agro-industry in transition	Finding ways to support farmers in transforming their production
Efficiency	Taxation of externalities caused by fuels and fertilizers	Taxation of environmental and ethical externalities of meat eating	Subsidies for local vegetable and fruit marketers' chains
	Increasing the transparency of agricultural subsidies		
Development	Incentives for the development of artificial meats	Incentives for the development of novel plant-based protein sources (e.g., lupine)	Incentives for utilizing and improving current plant-based protein sources; e.g., soy, wheat (i.e., seitan), beans, and lentils
	Partial nationalization of the food distribution chain	Developing marketing methods for anti-marketing	
Addressing global issues; carrying capacity; biodiversity	Prohibition on advertising animal products that misrepresents animals or the complete prohibition of advertising animal-originated products	Education on the relationship between biodiversity reduction, and climate change and food consumption in schools	Media dissemination of information on environmental issues; plus the popularization of scientific findings
	Funding studies on the environmental effects of animal-based food consumption		
	Global treaties for tackling climate change and protecting biodiversity		
Cultural identity	Global-scale dissemination of information on historically utilized foodstuffs	Disseminating information and utilization on historically utilized foodstuffs	Creating nudges (e.g., better availability) and incentives to use plant-based foods

Table 2 continued

Objective	Strategic	Tactical	Operational
Upholding traditions and adhering to cultural norms	Disseminating information on modern farming in relation to historical practises (i.e., to refute misapprehensions)	Including the preparation of vegetarian dishes in the training programs of catering professionals	Introduction of vegetarian meals as alternatives in public restaurants
Animal welfare	Tightening the regulation of farm animal breeding conditions to communicate the importance of the issue	Tightening the regulation of farm animal welfare conditions to communicate the importance of the issue Animal welfare labels on packaging	Funding animal welfare organizations to help them distribute information
Animal rights	Acknowledging animal rights in relevant international declarations Ensuring that only scientific facts are taught concerning evolution Banning most controversial animal farming types (e.g., broiler farming)	Education on animal capabilities, such as intellect and the feeling of pain Highlighting (animal) ethics in, e.g., biology and home economics classes	Allowing animal rights activists to give presentations in classrooms

consider purchasing food from the internet a good way of acquiring the main ingredients for meals (Hyvönen 2003), this type of arrangement could have a significant impact on citizens' food consumption.

From the economic perspective, decreasing subsidies for meat production will affect meat prices; therefore, the agricultural subsidy system could be established in a way that acknowledges environmental and ethical issues (see Vinnari and Tapio 2012). Meat production and animal-originated foodstuff are profoundly connected to fertilizer usage that largely exploits oil-based fuels (Jacobson 2006). The taxation of fuels would therefore indirectly affect meat prices. From the developmental perspective, cultured meats, or in vitro meats, offer a potential future option for decreasing the consumption of animal-originated foodstuff (Diamandis and Kotler 2012). It has been stated that the development of such products is humankind's "moral obligation" (Hopkins and Dacey 2008; see also Pluhar 2010). This development might be especially important as taste has often been identified as a key factor in food selection (Holm and Mohl 2000). Public policies could be employed to subsidize the development of such technologies, and also ensure that the scale of production is significant enough to affect animal-originated meat consumption. These "in vitro meat products" can offer a solution both to the animal protection issue and environmental concerns; evidence suggests that the environmental impacts of cultured meat would be considerably lower than those of conventionally produced meat (Tuomisto and de Mattos 2011).

A strategic measure for alleviating environment-related obstacles would be to enforce compelling global treaties for tackling climate change and protecting biodiversity. Furthermore, additional funding for studies on the environmental effects of animal-based food consumption could, in the long run, affect consumer decision-making (LAV and Angelini 2012). Policy measures to influence consumer values might also include fundamental regulation of the advertising sector, which affects consumer decision-making (Lang et al. 2009; van den Bergh 2011). This would prevent the false depiction of animals in advertisements, ensuring that consumers are not misinformed about the treatment of animals in the modern agricultural system (Jokinen et al. 2012). Similarly, to some extent, policy measures could prevent the utilization of ungrounded nutritional claims to promote the sales of particular food products. Banning advertisements for food products with the highest environmental burden might also be considered.

From a cultural perspective, the dissemination of information on traditional diets and modern animal farming practices could alleviate concerns that relate to upholding cultural traditions and social cohesion. Moreover, strategic decision-makers need to acknowledge and communicate the necessity for the slow transformation of cultural identity from meat-eating towards plant-based diets.

An animal protection-related measure would be to acknowledge animal welfare or animal rights in relevant international declarations, as such actions would incorporate that dimension of sustainability into discussions and maintain awareness of it by decision-makers (LAV and Angelini 2012). As the theory of evolution can be argued to promote the inclusion of non-human animals within our sphere of morality (Rachels 1990; DeLeeuw et al. 2007), public policies will need to ensure that scientific facts about our origins are taught in the school system.[8] This is especially important if the target is to create a large-scale transition in which animals are understood as being fundamentally linked to humans in nature, and not as creatures placed on earth for our benefit (Thomas 1984). In addition, religious worldviews often include compassion for all living beings, and thus the abilities of religious organizations could also be harnessed to promote plant-based diets. In the long term, it should be feasible to ban some forms of animal farming or, for example, long-haul animal transportation over national borders (LAV and Angelini 2012).

Tactical Activities

Tactical governance activities are targeted at the medium to long term (i.e., 5–10 years) with the aim of influencing structures such as regulations, institutions, infrastructure, organizations, and routines (Loorbach 2010). From a social perspective, it should prove useful to acknowledge plant-based diets in national food recommendations, so that consumers become aware of their nutritional effects. This is important as citizens have been found to lack such knowledge (Sabaté 2001) or even what is meant by a vegetarian diet (Lea et al. 2006; Vinnari et al. 2008).

[8] Although this is already the case in most European countries, the situation might be different globally as indicated, for instance, by the appeal of an international coalition of scientists (IAP, 2006).

Furthermore, it has been noted that so-called "food pyramids"[9] play an important role in communicating food-related information to consumers (Nestle 2002). Therefore policy makers could also give signals about the nutritional adequacy of plant-based diets by including such information in officially published dietary recommendations; for example, as already done by the American Dietetic Association (2003). In this context, consumers also need to be informed on the powerful role of industry associations in determining the contents of food pyramids and other nutritional recommendations. The promotion of ready-made vegetarian meals could also be an important step, as there is a trend towards increased consumption of convenience foods (Schösler et al. 2012). In addition, primary and secondary schools could be given the option to include courses on the food system and farming in their curricula. Societal cohesion around plant-based diets could be increased by funding research on historical human diets, which have traditionally been predominantly vegetarian (Fiddes 1991). Also, more research is needed on why some people express negative attitudes concerning the way animals are treated by modern agriculture, while simultaneously considering it a necessity (Boogaard et al. 2011).

Economic obstacles could be alleviated by offering economic incentives to animal farmers to transfer where possible to crop production or to enter a different profession. The taxation of foodstuffs based on their environmental effects (Goodland 1997; Wirsenius et al. 2011) or both environmental effects and the ethical consequences for animals (Vinnari and Tapio 2012) should, according to traditional economic principles, lower meat consumption. From a developmental perspective, public policy could focus on providing incentives for companies to develop plant-based protein sources that suit national cultivation conditions. It has been noted that taste and time factors in food preparation are critical for people if there is to be a transition in their diets (Kearney and McElhone 1999). Some new plant-based or fungal protein sources (e.g., lupine and mycoprotein) are already available in some shops, and the further development of these products together with the development of a distribution system for them should prove promising in the mid- to long-term. As the food industry has become a dominant player in the food distribution system (Lang et al. 2009, p. 166), there is a need to decrease the power of retailers and marketing, which could be accomplished by developing anti-marketing methods such as anti-commercials.

From a cultural perspective, it should be noted that the over-consumption of meat is a relatively new phenomenon in the Western world (Stuart 2006; Schösler et al. 2012). Thus, it should be relatively easy to argue for more plant-based diets by disseminating information on both historical food traditions and the reality of modern farming practices. Proceeding with such small steps can result in a culturally acceptable pace of transition. Previous studies have shown that animal farming plays an important role in upholding what consumers consider the "traditional countryside" (Boogaard et al. 2011). The transition towards plant-based diets could be implemented in a way that enables farms that practice outdoor

[9] Food pyramids and food plates are graphical representations of the nutritional recommendations given by national authorities such as the US Department of Agriculture or UK National Health Service.

farming, for most of the year, to continue operating for longer than those that do not. In this way, people will have time to adjust to the change. Finally, to assist in the formulation of new cultural norms, the preparation of tasty vegetarian dishes could be included in the training programs of catering professionals.

With regard to obstacles posed by consumers' ignorance of environmental and animal protection issues, current scientific knowledge on animal abilities (see Bekoff 2007) could be taught more thoroughly in biology classrooms and as part of ethical education. Previous studies have identified that beliefs about the environment and animal welfare issues also affect people's food choices (Lea and Worsley 2004), therefore influencing beliefs should be effective. Similarly, including environmental issues in school curricula, for instance, in home economics and biology courses, is also a relatively easy way to reach younger generations of consumers. These courses could be designed to provide factual information and also more practical experiences, which would highlight the equality of humans and other animals from a moral perspective. The latest research results could be made accessible to the general public through the media and at popular science events, and by encouraging citizen participation in science-making (Novacek 2008). Animal welfare labeling on packaging has been proposed as a tool to communicate the importance of the issue to consumers. At the EU level, the acceptability of such labels is currently being investigated as part of the EU Strategy for the Protection and Welfare of Animals, although the aim of the strategy is not to end animal farming. Tightening the regulation of farm animal breeding conditions might also be employed as a tool to communicate the importance of the issue to consumers.

Operational Activities

Operational governance activities refer to experiments and actions with short-term (i.e., 0–5 years) horizons (Loorbach 2010). Regarding social obstacles, city councils and provincial decision makers have multiple options to facilitate practices that enable the selection of more plant-based diets in the short-term. These options include disseminating advice among catering staff on preparing plant-based meals in school cafeterias. Some studies indicate that consumers have positive perspectives on the health effects of plant-based diets, such as lower saturated fat intake and higher fiber intake (Lea et al. 2006); thus, offering positive experiences to consumers could make the transition easier. Political decisions could be taken to promote meat-free days when main courses offered in public cafeterias would be plant-based. Previous studies have confirmed that offering sustainable food options in government cafeterias leads to changes in sustainable food consumption (Wahlen et al. 2012). This practice can begin in schools, as was implemented in Helsinki, Finland in 2010, or as a broader initiative whereby private restaurants are asked to participate, as was implemented in Ghent, Belgium in 2009. Local policy makers also have the option to increase people's participation in food production by enabling farming within cities on areas reserved for that purpose in urban planning. Urban agriculture can improve people's wellbeing and also increase their environmental stewardship (Brown and Jameton 2000).

From an economic perspective, the objective of equity could be met by offering support to farmers willing to transform their production from animal-originated foodstuffs to those that are plant-based. Purchasers of foodstuffs for public institutions (e.g., schools, army, hospitals, and bureaus) could select local vegetable, pulse, grain, and fruit producers as their suppliers. Incentives could also be provided for local cafeterias to purchase alternative plant-based protein sources. Economic incentives could also be provided to utilize and improve current plant-based protein sources, such as soy, wheat (i.e., seitan), beans, and lentils in school and government canteens. In addition, local-level competitions could be organized for the healthiest and tastiest plant-based food servings that can be prepared easily on a large scale.

To overcome cultural obstacles, consumers could be provided with small nudges to consume plant-based foodstuffs; for example, placing dishes in visible places in cafeterias or offering plant-based snacks during coffee breaks (Sunstein and Thaler 2009). Another example of enabling consumers to make preferable choices, is to place available meat-replacing products on supermarket shelves next to conventional meat products as has been done, for example, in the Netherlands (van Otterloo 2012). The number of vegetarian dishes available in public restaurants could also be increased, and consumers could be provided with information on traditional plant-based dishes. Public policy makers could also request the introduction of vegetarian meals as alternatives in public restaurants.

In the short-term, policy makers can further utilize the information distribution systems already possessed by NGOs. This might be achieved by giving additional funding to animal welfare organizations to help them distribute information. Regarding animal protection targets, animal rights organizations or vegan societies should be given a greater platform to promote their knowledge. This would mean that these organizations would also be funded and, for example, be given the opportunity to present their ideas in schools.

Opportunities and Threats in Relation to the Governance Process

As outlined above, there are numerous governance options available from which decision-makers and civil community actors can choose to tackle the various obstacles to establishment of plant-based diets. It is also possible to combine measures from various thematic areas and different levels. There are many possibilities for win–win situations that, in the case of food consumption, include the potential to improve human health by reducing meat consumption (McMichael et al. 2007). In such cases, it might be beneficial to present the information in such a way that the emphasis is on health benefits as it has been shown that, for the majority of consumers, health reasons provide the main motivation for adhering to plant-based diets (Lea et al. 2006).

When managing the transition, it is important to understand that there are always potential negative outcomes that can occur after governance measures have been implemented. For example, large-scale changes in food distribution, such as the nationalization of part of the food chain, can have negative effects on competition and food prices. Also, advertising plant-based diets to promote healthy eating can lead to misuse of this information (e.g., by teenage girls attempting to lose weight) if

animal-originated foodstuffs are not replaced with vegetarian alternatives of equivalent nutritional value (Larsson and Johansson 2002). In addition to these negative outcomes, there is also the potential for rebound effects. To mention a concrete example, the production of more efficient automobiles has actually led to an increase in petrol consumption as consumers have begun to purchase cars with more powerful engines, air conditioning, and power steering features. In the case of farmed animal products, an increase in the price of meat, for instance as a result of a new taxation scheme, might paradoxically result in increased consumption (i.e., meat would become so-called Giffen good) as food consumption forms a relatively small share of consumers' total consumption in the Western world. The possibility of such effects should not, however, mean that no action is taken. The worst case scenario in the current situation is that policymakers are not bold enough to take any real action.

Evaluating both the opportunities and threats of governance options should be part of any good policy process. When analyzing the negative outcomes, the possibility of positive outcomes should also be borne in mind. After the implementation of governance measures, it is important to evaluate all outcomes and to determine whether the objectives need to be adjusted, or if new obstacles have emerged, or new options become available. This cycle emphasizes the continual process of sustainability transition.

Discussion and Conclusions

Due to the impending environmental crisis, there is a dire need to decrease human influence on the biosphere and to prepare adaptation strategies. Decreasing overall consumption is at the centre of this sought-after transition. In this article, it is argued that there is a need to manage the transition by applying a five-step process (i.e., the Five O's) for a successful transition towards plant-based diets. This process comprises identification of objectives and obstacles, listing of options and their opportunities and threats, and evaluation of the outcomes. This relatively simple process is proposed to provide policymakers and civil community actors with a process tool that is organized, but sufficiently easy to comprehend and implement.

In the first phase, there is a need to consider the acceptability of the transition from the perspective of the multiple dimensions of sustainability. Acknowledging the need to identify all dimensions of sustainability is the only way to reach an ethically and morally justified outcome. Debate among actors involved in the transition arena on the dimensions of sustainability and the objectives inherent in each dimension will help to clarify and make real the issue at hand. In cases where governance measures aim to decrease the consumption of animal-originated foodstuffs, the relevant sustainability dimensions comprise the social dimension that has the objectives of improving human health, participation, empowerment, and social cohesion; the economic dimension that has the objectives of equity, efficiency, and development; the environmental dimension that has objectives

including the preservation of the ecosystem's carrying capacity, biodiversity, and ability to address global issues; the cultural dimension that includes the objectives of upholding cultural identities, and socio-cultural norms and traditions; and, finally, a dimension relating to animal protection, which has objectives aimed at animal welfare and/or animal rights. Outlining the dimensions and objectives is just the first step towards an effective transition. The subsequent step is to identify obstacles that prevent the transition from occurring in relation to each of the outlined dimensions. This is a significant addition to frameworks presented in the extant literature, which have tended to neglect issues of controversy and conflict of interest.

It is possible to apply or develop tailor-made governance options for each identified obstacle. Due to the scale of the desired transition, such measures need to be implemented with short-, medium-, and long-term perspectives. As eating habits are such an important part of our identities, any large-scale change is going to take a long time. Thus, it is proposed in this article that strategic, tactical, and operational governance measures are implemented. This type of approach will help to identify activities that are suitable for transforming individual practices in the short term, as well as societal structures and, ultimately, our whole culture. Such a combination of measures can make the transition process more palatable.

Identification of each measure's opportunities and threats is also an important aspect of good governance. As demonstrated with the sustainability pentagon, the governance of food consumption is a multidimensional issue whereby any action can have several outcomes. As such, it is important to try to evaluate the possibilities of any win–win situations or negative outcomes. Optimal results will most likely be obtained with a mix of measures to increase societal and cultural acceptance, create economic incentives, and widen the knowledge base of consumers on environmental and animal issues. As a final step in any successful sustainability transition process, there is a need to evaluate the outcomes and restart the process in a cycle of continuous improvement. While guiding the transition, it is important to bear in mind that there are no certain options available, and each action is always context dependent. Thus, the evaluation of actions is of crucial importance. Simultaneously, it is important to note that taking no action is currently leading humankind in a very undesirable direction.

This article demonstrates how the concept of sustainability can be operationalized to analyze obstacles stemming from the various dimensions, and also to develop options for responding to these obstacles. Future research could analyze the interconnectedness of food and other fields of consumption, and obstacles hindering the attainment of sustainability within these fields. The food industry provides raw materials for many different fields of industry, such as pet food production, and these areas need their own sustainable solutions. The proposed five-step process might also be applicable to systems other than food; for example, it might be utilized when considering how to lower the total amount of passenger-miles accumulated by transport systems or how to decrease households' energy consumption. These require consideration of their own relevant dimensions and objectives to realize sustainability in their specific areas.

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