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Meat consumption and production – analysis of efficiency, sufficiency and consistency of global trends

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ABSTRACT

The sustainability challenges that the food system is facing are ever increasing. The traditional approach to monitoring these changes considers economic, societal and environmental sustainability. A strong case has been made, however, that a fourth dimension, ethical, should also be considered. Conventionally, two main strategies have been used to assess the improvements in sustainability: efficiency and sufficiency. Efficiency is usually linked with technological improvements, and sufficiency is connected with a reduction in production or consumption. We introduce a third strategy to the analysis; namely consistency that is related mainly to the ethical dimension of sustainability. Trends of the indicators related to the three strategies are calculated on both a global and regional scale from 1962 to 2009. Efficiency (measured as land requirement for animal products) has increased by about 13 percent globally, sufficiency (measured as the amount of meat consumed) has declined by 91 percent and consistency (measured as the number of animals slaughtered) has declined by 264 percent. In addition, convergence analysis emphasizes that industrialized and developing countries are moving towards similar patterns of animal products consumption. Such results suggest that measures should be taken to develop a food system that is not only efficient, but also ethically just.

1. Introduction

When considering the future of sustainability, the outline of the food system is a critical aspect. This is especially the case because the importance of the food system as a driver of global environmental change can be expected to increase. There are two main reasons for this growing importance. Firstly, population projections indicate that the demand for food will continue to increase in the future (FAO, 2011). Secondly, income per capita is likely to continue to rise globally, and traditionally this has led to a shift towards the consumption of foods with higher content in animal protein, fats and sugars (Grigg, 1995). The combination of these two factors implies that the sustainability of food production and the ecosystems on which food production depends will continue to face great challenges (de Boer et al., 2006).

Therefore, the consideration of what strategies will secure less unsustainable patterns of the food system in the future is needed. When approaching this issue, it is important to note that sustainability or sustainable development is a concept that has many meanings and that different actors understand the concept in quite different ways (Hopwood et al., 2005). This is the case even though the concept of sustainable development only emerged in broader discussions during the 1980s, in the wake of environmental problems. The definition that is most commonly used nowadays was given at the end of the 1980s in the report Our Common Future released by the United Nations World Commission on Environment and Development (UN, 1987). One reason for the many interpretations around this concept might be because the concept itself is much older (Gamborg and Sandøe, 2005). During the last decades, sustainable development has usually been depicted as a triangle consisting of three dimensions: societal, economic and environmental (Munasinghe, 1993; Rawles, 2010). The food system and especially meat production and consumption have strong links to all three dimensions of sustainability (D'Silva and Webster, 2010). From the 1970s onwards, the food system has been heavily criticized from a fourth perspective: the dimension of animal

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ethics. The development in the arguments of philosophers defending animal welfare (such as Singer, 1975) and animal rights (such as Regan, 1983) has led to the argument that a fourth dimension of sustainability, that is animal ethics, should be considered (Rawles, 2010; Vinnari and Vinnari, 2014). This line of thinking would lead to a definition of sustainability that could be depicted as a diamond. As such, it could be called the *sustainability diamond* in which the corners are environment, economics, society and ethics (Rawles, 2010).

In this paper, the objective is to introduce possible indicators and to analyze trends in the selected indicators in order to demonstrate their usability to analyze all four dimensions of the sustainability diamond. We acknowledge that this is just one possible approach, with its own advantages and drawbacks, but by looking into all these dimensions of sustainability, it is possible to investigate different aspects of different strategies. Such a perspective is seen as essential to achieve a comprehensive view of the food sustainability problem (Garnett, 2014). Therefore, we introduce indicators to evaluate the performance in the relationships of the environment–economy, environment–society and environment–animal ethics interrelations related to the diamond. Because of the fundamental role of the environment in the sustainability debate (Beckerman, 1994), the decision was made that it should be part of all the indicators. As it is today, the food system faces two very relevant challenges: the first is to address the externalities created on the environment by food production, while the second is to ensure that the global population, despite its increasing size, has an adequate food supply to satisfy its nutritional needs (Garnett, 2013). The goal is thus to create a more resilient and environmentally sustainable system that is also more efficient. In order to measure the trends of the progress towards this ideal picture, three strategies can be used: efficiency, sufficiency and consistency (Huber, 2000), which in a wider sense, have been also referred to as efficiency, demand restraint and food system transformation (Garnett, 2014). The first two are relatively well-known sustainability strategies, but the third – consistency – is less well known in the discussion of sustainable development strategies. Our approach is based on the idea that the environmental aspect is relevant for each sustainability dimension. As such, our target is to develop a synthetical framework to analyze the three sustainability strategies and their interactions. The first aim of the analysis presented in this paper is to investigate what are the main trends in the food system in relation to the different strategies of sustainable development on a global scale, and the second aim is to determine whether the trends of the sustainability patterns are converging globally.

2. Conceptual approach

As explained earlier, the challenges that the food system faces today can be assessed by three strategies, namely efficiency, sufficiency and consistency. What is meant here by each of these strategies is elaborated on further in the next chapters. It is acknowledged that each of these goals presents advantages and drawbacks, but by looking at them simultaneously, important insights for food policy formulation can be derived.

2.1. Efficiency strategy

Efficiency can be considered to be the improvement of resources productivity that is often related to increased economic growth (Huber, 2000; DeSimone and Popoff, 1998; Hukkinen, 2001). Advocates of this strategy often argue that it is possible to reach joint effects that result in benefits for both the economic and environmental dimension of sustainability at the same time (Schäpke and Rauschmayer, 2012). Efficiency is thus the strategy preferred by industries and business in the context of the "efficiency revolution" (Huber, 2000). The appeal of the efficiency strategy is also evident in the fact that the World Business Council for Sustainable Development introduced the concept of eco-efficiency in 1992 (Schmidtheiny, 1992). The charm of this strategy is that there is no need for changes in values or in consumer preferences, while sustainable development targets can be reached, if the balance with the dimensions is set correctly (Schäpke and Rauschmayer, 2012). It is, however, highly debatable whether such a strategy will be able to reach the actual sustainability targets needed (Lorek and Fuchs, 2013). One of the most frequent critiques is that of the "rebound effect", a situation first explained as Jevons' paradox (Jevons, 1866), in which the saved resources are in the end less than those used additionally (Figge et al., 2014). Such outcome can take place in both emissions and resource consumption terms (Binswanger, 2001; Herring and Roy, 2007). However, that is not the object of the research presented here as we are only focusing on the trends towards the sustainability strategies presented.

Because efficiency is a strategy that is mainly interested in the production side of the food chain, it can be easily connected with the "economic development" corner of the sustainability diamond (Rawles, 2010). Environmental efficiency expands this type of analysis so that, in the context of agriculture, it is linked, for example, to the optimization of fertilizers or the use of water and pesticides for the production of plants and livestock (Garnett, 2013). The "sustainable intensification" of agricultural practices and technological transfer to under-yielding nations has been suggested as a means to increase the global efficiency of agriculture production (Tilman et al., 2011; Smith, 2013). This includes, for example, the introduction of advanced technologies for irrigation (Liu, 2011), the management of nutrient cycles (Mueller et al., 2012) and the use of all the knowledge generated in the field of agronomy and plant science (Doré et al., 2011). These measures also result in a decrease in the amount of land required to produce a unit of agricultural product. Efficiency can also be linked to improvements on the demand side (i.e. consumption) by, for example, reducing the amount of food waste (Godfray, 2011). The question of increased efficiency has also been the object of a specific field of research, namely Life Cycle Assessment (LCA). The conceptual framework of such method was initially developed in the late '80s and beginning of '90s (Barnthouse et al., 1989; Fava et al., 1991). It was first applied to the industry (Boustead, 1996) and in the last two decades it has been further developed for the agricultural and food sector (van der Werf et al., 2013). Recently, Garnett (2014), has explored the role of LCA for sustainable food security: it emerges that, while LCA can provide useful insights on the complexity of this issue, several issues still need to be dealt with, including the transparency of the analysis and a perspective on the link between sustainability and health. Therefore, we do not include the LCA analysis in our definition of efficiency.

Efficiency is defined in this paper as the use of resources to produce the best possible economic output. In particular, the land requirement necessary for the production of animal products is chosen as a suitable proxy indicator of agricultural efficiency. Croplands are of uppermost importance in agriculture and often act as a limiting factor, as the vast majority of food calories globally are derived from land (Kastner et al., 2012). Such a choice is supported by the fact that economic efficiency is prominently related to the production side, i.e. the supply side of the food system. Efficiency also has a strong link to the environmental dimension of the sustainability diamond. As such, it is a suitable match for the environment–economy interrelation of the sustainability diamond (Rawles, 2010).