
Editorial

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For decades, it has been usual to subdivide economic sectors into the primary, secondary and tertiary sector. Agriculture, fishery and resource extraction was then categorised as the primary sector, manufacturing industry was next coined the secondary sector, while the service sector belonged to the tertiary sector. This distinction has gradually vanished, as the demarcation lines between these three categories have become increasingly fuzzy and useless. For example, agriculture has turned into a modern high-tech industry in many countries, in which ICT and skilled labour is as important as in the manufacturing sector. Admittedly, agriculture has not only changed its mode of production and marketing, it has also shown profound changes in its land use implications, its ecological footprints and its underlying socio-economic ramifications. Consequently, modern agriculture is at the edge of a new development which may be decisive for its future. But what kind of future or futures can be foreseen for agriculture in a modern world?

This special issue of the *International Journal of Foresight and Innovation Policy* aims to address future perspectives for modern agriculture, by providing a series of studies on future challenges, foresight analyses and scenario contributions on possible

pathways of agriculture in the decade(s) to come. This issue was instigated by the clear conviction that the future of agriculture in the developed world will be vastly different from its traditional patterns and appearances.

The background of the changing position of agriculture has been to found in the irreversible transformation of agriculture as a traditional rural activity into a modern, high-tech activity. Technological change, more competition on world markets and ecological carrying capacities have induced a major re-orientation of agriculture in the developed world. The industrialisation of agriculture has also had major implications for rural areas, which were often regarded as green, healthy and quiet places to live. But urbanisation, industrialisation and migration have drastically changed the face of rural areas. The pressure on green areas is increasing, the position of rural tourism is weakening, and rural population is likely decreasing. To safeguard the position of rural areas, sustainable development is encouraged so as to make modern agricultural technology compatible with environmentally-benign development. All these developments prompt a serious reflection on five issues or concerns:

- the linkage between rural areas and agriculture
- the interwoven development of urban and rural areas
- the relationship between a leisure society and rurality
- the ecological footprint of high-tech agriculture
- the re-positioning of agriculture in an open global trade world.

To sketch a roadmap for the future of agriculture in relation to the evolution of rural areas is a major challenge. Such an endeavour would need a careful analysis of various trends, such as international competition and technological progress in agriculture, 'local for local' and 'small is beautiful' movements, the feasibility of ecological agriculture, the development towards (semi-)urbanised rurality, etc.

This special issue of the *International Journal of Foresight and Innovation Policy* contains various contributions on a sustainable development of agriculture.

The first contribution, by Maria Giaoutzi, Anastasia Stratigea, Eveline van Leeuwen and Peter Nijkamp, deals with foresight in agriculture in general, and the use of backcasting scenarios for the EU in 2020 more specifically. It presents the main streams of methodological approaches used for scenario building and elaborates on the stages involved in the design of the backcasting policy scenario approach, as well as on actual applications. The authors show how backcasting scenarios provide information on the level of change required (the gap between baseline and desired outcomes), which is useful for problem identification and prioritisation, for increasing the awareness of stakeholders and the public, prioritisation of policy interventions, etc.

The second two papers focus on life cycle assessment in agriculture. The life cycle assessment method is useful to quantify the impacts of the expected changes in agricultural production technologies across a wide range of environmental impact categories. Nava Haruvy and Sarit Shalhevet aim to establish a set of priorities for reducing the environmental impacts caused by agricultural crops that will make it possible to focus on the changes that can bring the greatest environmental benefits. Technology foresight methods are employed to select a list of potential directions of research to reduce the environmental impacts of agriculture; these research directions are

then compared in terms of the total environmental impacts per ton of produce as well as the impact on their economic profitability.

The work of Susumu Uchida, Kiyotada Hayashi, Mitsuru Gau, Tsutomu Kajiyama, Shigekiyo Shirasawa, Hiroyuki Takahashi, Yoshifumi Terajima, Makoto Matsuoka and Masaru Yoshinaga focuses on the environmental impact of energy crop production. They conduct a life cycle assessment approach in the context of global warming potential (GWP) and cumulative energy demand (CED) that represents fossil fuel consumption. The results illustrate that improvements in cultivation technologies, including breeding, has large potential for saving fossil fuel resources and prevent global warming.

Also, Adele Finco, Deborah Bentivoglio and Peter Nijkamp deal with fossil and non-fossil energy. In order to assess the environmental performance of the production of biodiesel versus fossil fuels, they aim to identify environmental criteria in order to evaluate the impact of the entire biodiesel production chain, from farm to final consumer. Therefore, they perform a meta-analysis of scientific and technical reports emerging from international research efforts that highlight the most important environmental criteria for various types of biomass used in biodiesel production chain. This information enabled the design and implementation of a multi-criteria methodology to support the choices of public policy aimed at obtaining a sustainable development strategy.

The fifth contribution, by Roger Bivand and Rolf Jens Brunstad, focuses on subsidies within the agricultural sector. On the one hand, these subsidies can result in distorting effects to economic growth and international trade. However, on the other hand, agricultural production may have positive external effects on perceived public goods like landscape amenities. The authors claim that if this is the case, and if agricultural support is used to internalise these (positive) externalities, the expected negative effect on economic growth appears, because we are measuring the wrong things, viz. traditional GVA instead of an extended GVA including the value of such amenities. Their findings suggest that when GVA is adjusted for landscape amenity benefit, the negative impact of agricultural support on regional economic growth seems to be moderated somewhat.

Also, Zhihong Shen, Takeshi Mizunoya and Yoshiro Higano studied the effects of policies. Their focus is in China that does not only face severe problems of water shortage, but also a serious water pollution situation. The purpose of their study is to establish a method to truly realise sustainable agricultural development taking into account water environmental protection and a sustainable (regional) economic development at the same time. Therefore, the water pollutants emission rights trading system and its evaluation indicators, as well as changes in the ecological and socioeconomic system over a specified period were considered. The effectiveness and efficiency of the synthetic environmental management policies were analysed by computer simulations including technological policies such as biomass gasification, and environmental financial policies such as WPERTS to improve the environment and increase agricultural production.

The seventh paper discusses the usefulness of narratives in foresight studies. Anastasia Stratigea, Elias Grammatikogiannis and Maria Giaoutzi emphasise that in order to take advantage of the output acquired through participatory approaches, there is a need for tools and techniques capable of handling qualitative data. In this way, participation approaches can be more useful for foresight exercises, which can add value to the output of the decision making process. Through a case-study approach, the authors show that ATLAS-ti, a qualitative data analysis tool, is rather effective in supporting the management of a large amount of qualitative information. The results acquired have

provided a wide range of useful information and have allowed shedding light on important issues that need to be dealt with in the decision making process.

Next, Eric de Noronha Vaz, Teresa de Noronha Vaz and Peter Nijkamp illustrate how gravity concepts can be useful tools in agricultural land-use dynamics. They discuss the issue of socio-economic feasibility of rural areas from a long-term strategic perspective and propose a new spatial land-cover accounting methodology to assess the impacts and changes occurring in the rural world. The methods applied in their contribution are based on gravity concepts in combination with geographic information systems (GIS) in order to identify the compactness of agricultural areas within different regions and to detect the direction of significance of land-use variations. By means of time series and comparative analyses of different agricultural land classes, important land use changes can then be detected.

The final contribution to this special issue deals with the absorption capacity of rural development subsidies in Romania. Zizi Goschin, Anca Dachin, Daniela-Luminita Constantin and Dorel Ailenei offer a retrospective and forward-looking insight into Romania's absorption capacity of the EU agriculture funds for rural development. They find a low capacity of absorption of the EU funds. Therefore, a complex quantitative inquiry into the factors of influence has been performed. In addition, a new composite index is described, which is derived from the average performance scores that serve as proxies for the conditions that are critical to the funds' absorption capacity. The values of the territorial composite index computed at a NUTS3 level indicates significant differences between counties and therefore offers to policy makers a management tool pointing out underprivileged counties that may call for attention and remedial measures. Their study also suggests the need to concentrate on the importance of a pro-active attitude and supportive behaviour of local administration for strengthening the project pipeline and effective fund spending.

The various insights offered by the contributions in this special issue illustrate how agricultural activities affect economic, social and environmental conditions in our world today and most likely in the future. This calls for a joint ambitious effort to study sustainable ways of development in which foresight approaches are indispensable.