ANALYSIS OF AGRICULTURAL SUSTAINABILITY INDICATORS SYSTEM

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Abstract. Agriculture provides the population with livelihood. It promotes commercial activities and sustainable employment in rural areas, thus, improving the living quality and retaining density of rural population. Rural development and sustainable agriculture are closely related components of sustainable development. The tool most frequently applied in practice for planning sustainable development and evaluation of the achieved results is a quantitative assessment of selected parameters, the aggregate of which in their mutual interaction constitutes an indicator system.

Vidzeme Planning Region (VPR) of the Republic of Latvia is a typical agricultural region; however, a balanced and sustainable development model for agriculture has not been developed so far, evaluation indicators are not clearly defined. The research summarizes and analyzes policy documents, previous research, international experience regarding long-term development concept based indicator systems; the development principles, methods and constituent parts; properties of the indicators and criteria of their selection. The research focuses on identification and formulation of the specifics of the agricultural sector which would suit as a basis of methodological recommendations for elaboration of a sustainable agricultural development model for the largest planning region of Latvia, improvement of its policy quality and successful implementation of plans. The study concludes that the current theoretical basis of the development of indicator systems is incomplete; there are generalized references, plurality of views and many unanswered questions which complicate the practical establishment of the system and its adaptation and jeopardize the quality and objectivity of the results.

Key words: agricultural sustainability, indicators, agricultural policy.

JEL code: Q

Introduction

“The principle of sustainable development provides for quality environment and balanced economic development for the present and future generations as well as rational use of
natural, human and material resources, preservation and development of natural and cultural heritage” (Vidzeme Planning Region, 2014)

Sustainable agricultural development is essential both on the global and local scale as it plays a multidimensional role. The agricultural sector provides staple food for the population. The United Nations Population Division forecasts that world population will continue to increase (UNPD, 2005), “the absolute demand for food will also increase” (Pretty J., 2008). To better provide the increase of food products, it is vital to modernize agricultural production and make it more effective which in its turn may have a negative impact on preservation of environment and employability in agricultural areas.

The most significant aspects of agricultural policy in Latvia are: ineffective production and low competitiveness; inadequate skills and entrepreneurial habits; lack of effective management of nature resources (Ministry of Foreign Affairs, 2012).

Therefore, the developers of strategic goals and policy providers of the respective region should determine the features of sustainable agricultural development and affecting factors to find a balance between management and preservation on the basis of nature resources and economic viability, and social responsibility to achieve better results in the future. One of the most appropriate tools for development of scientifically proven proposals for agricultural policy is a balanced and sustainable agricultural development model providing both the evaluation of the existing economic relationships and the impact of specific decisions on particular indicators as well as possible sector development risks and analysis of other issues depending on specific features of the model.

The aim of the research was to compile and analyze policy documents of various levels, earlier research and international experience in different indicator systems to highlight further development directions regarding development of a balanced and sustainable agricultural model for Vidzeme Planning Region.

The following objectives were set for achieving of the goal: to study international and Latvian agricultural policy documents and scientific literature on sustainable agricultural development models; to carry out analysis of the previous experience and theoretical cognitions regarding the principles, methods and ingredients of the established indicator systems; to identify and formulate the specifics of the agricultural sector; to characterize properties of the indicators and their selection criteria; to draw conclusions and elaborate methodological recommendations. The author applied the following qualitative methods of economic scientific research: monographic and content analysis. The study covers the period up to December, 2014.
Research results and discussion

Methodology

Before starting the planning and implementation of a balanced and sustainable agricultural development model in Vidzeme Planning Region it is important to clearly identify the meaning of “sustainable agriculture” and its characteristic criteria.

Pretty J. maintains that “the interest in the sustainability of agricultural and food systems can be traced to environmental concerns that began to appear in the 1950s–1960s. However, ideas about sustainability date back at least to the oldest surviving writings from China, Greece, and Rome” (Pretty J., 2008).

The concept of Sustainable Agriculture and Rural Development (SARD) was one of a number of concepts that crystallized during the 1980s. SARD as a paradigm developed in response to the growing realization that national and international agricultural policies and programmes should encompass a wide range of economic, environmental and socio-cultural issues in addition to the traditional areas of agricultural productivity, production and food security (Food and Agriculture Organization …, 1992). The different indicator systems based on this concept can inspect and evaluate the sustainability of the agricultural system, and can improve the sustainable development of agriculture (QIU Hua-jiao et al., 2007).

Since then various term definitions have been offered; however, interpretations of the term and discussions continue to this day. The lack of agreement about the definition has led some researchers to question the usefulness of the concept of “agricultural sustainability” (Binder C.R. et al., 2010).

The concept of sustainable development is an evolving one, and there are many definitions in literature, some very similar, and others markedly different (Food and Agriculture Organization …, 1997).
Researchers have pointed out the problems that may be faced when elaborating and analyzing the concept of sustainability. First, the temporal nature and its factors. Second, identification of features characterizing sustainability of the agricultural sector. (Gomez-Limon J.A, Riesgo L., 2008). Third, it is complicated to define the proportions and weights of the economic, social and environmental criteria and sub-criteria included in the models as these conditions are related to the multidimensional character inherent in the concept of sustainable development. Fourth, regarding sustainability, agriculture is inconsistent in one farming system. Fifth, sustainability indicators systems are created on the basis of different sources of cognition, different offers of statistical data and peculiarities of countries in different stages of development (Gomez-Limon J.A, Riesgo L., 2008; QIU Hua-jiao et al., 2007).

Gomez-Limon et al. propose the following solutions for some of the listed problems: “Sustainability can be interpreted as a social conception that can be changed in response to society’s requirements. Thus the meaning of sustainability must be considered local and time specific. Both difficulties have limited for a long time the usefulness of this concept as a criterion for guiding the agricultural development. In order to avoid the difficulties mentioned above, a wide consensus has been built in order to consider that the sustainability embodies three main dimensions: environmental, economic and social” (Gomez-Limon J.A, Riesgo L., 2008).

To identify the future course of the study scenario for evaluation of sustainable agricultural development in VPR, the author has compiled previous research methodology.

Goldberger maintains that “environmental, social, and economic sustainability can be assessed using “objective” or “subjective” approaches. Objective approaches rely on
quantifiable sustainability indicators (Goldberger R.J., 2011). Objective approaches are useful for multidisciplinary research and cross-case comparison, they are limited by what can be measured and counted. Subjective approaches, in contrast, explore individuals’ (e.g. farmers’) perceptions of sustainability (Goldberger R.J., 2011). “Another relevant distinction can be made between goal oriented and means oriented approaches” (Binder C.R., 2010).

In most cases of previous research the author found “objective” approaches and the research methodology resulting from it.

Gomez-Limon’s et al. research course ideologically and chronologically is related to Nardo et al., presented in 2005: 1) development of the theoretical framework; 2) selection of basic indicators; 3) multivariate analysis; 4) imputation of missing data; 5) normalization; 6) weighting and aggregation; 7) robustness and sensitivity; 8) links of composite indicators to other variables; 9) return to the real data; and 10) dissemination (Gomez-Limon J.A, Riesgo L., 2008; Gomez-Limon J.A., Sanchez-Fernandez G., 2010).

Binder et al. argue that “for a long time, sustainability assessment in agriculture has focused mostly on environmental and technical issues”, thus, neglecting the social and economic aspects, the multifunctionality of agriculture and the applicability of the results (Binder C.R. et al., 2010). Therefore, several integrative sustainability assessment methods have been developed for the agricultural sector. Binder et al. in their research provide a review of indicator-based assessment methods for agricultural analysis with respect to three dimensions: normative, systemic, and procedural (Binder C.R. et al., 2010).

“Consequently, a wide variety of tools and methods have been developed to assess sustainability in agriculture. These include, among others: indicator lists; environmental assessment of production alternatives; indexes or Ecopoints; linear programming models; trade-off models of production alternatives, considering economic, ecological and health aspects” (Binder C.R. et al., 2010).

Scientists in the Netherlands have created a graphic picture of the study course with actors involved in the processes (Figure 2) which may serve as a basis for the development of VPR development model.

When developing a model, the specific features of the respective country or region should be taken into consideration. Researchers recommend selecting the development indicators based on theoretical guidelines in the given area’s sustainable development programmes and plans (Tolon-Becerra A., Lastra-Bravo X., 2009).

Rural development policy has been strengthened and integrated into the Common Agricultural Policy in the second pillar. The aim of the reform is to raise competitiveness of agroforestry, strengthen the links between the primary activity and the environment, and improve the quality of life in rural areas, to promote cooperation and innovation, and economic diversification of rural communities (European Parliament, 2014).
“Sustainable Development Strategy 2014-2030” for Vidzeme Planning Region, Latvia, is in the discussion stage; it has been developed considering the EU and Latvia’s regional and spatial development policy documents; it has taken into account the vision of the state future and the EU future guidelines (Vidzeme Planning Region, 2014).

The document sets Vidzeme development priorities, goals, and the necessary actions and indicators for achieving them. The regional strategy has been drafted considering requirements of sustainable development; it is permeated with interconnected dimensions: social, economic, and environmental dimensions. Characterizing the region, it is noted that it has an agrarian structure of economy. It is proven by a relatively large number of employees in the agrarian sector and high value added ratio in the industry. Agricultural activities are not diversified in rural areas, and sufficiently strong service economy sector has not been formed so far. In response to the growing demand for food in emerging market countries the impact of large scale intensive farming proportion could increase in Vidzeme. However, introduction of new technologies in production and agriculture leads to reduction in employment. Conservation of natural resources in the region is largely dependent on the economic activity. The strategic part of the document outlines factors influencing the future of the region: population decline and ageing of society associated with it, the country’s economic development rate after the crisis, technological progress, development of transport systems and related changes in...
availability of the region, climate changes, scarcity of fossil fuels, national approach to territorial development, the background of international relations (Vidzeme Planning Region, 2014). In the case of a balanced and sustainable agricultural model development, the information provided by the strategic plan is important, yet it is not complete. Consequently, in the course of study it will be necessary to conduct interviews with policy makers of agricultural and territorial development, experts and representatives of agricultural enterprises, and to analyze the experience of other countries.

Indicators

“In the last two decades much attention has been paid to establishing indicator lists. Composite indicators can help in comparing policy options facilitate the decision making process of policy makers” (Van Asselt E.D. et al., 2014). “The indicators selected in terms of the scientific method can reliably reflect the state, development, and function of the systems” (QIU Hua-jiao et al., 2007).

However, the selection of these indicator lists is not always clearly described, the lists contain both qualitative and quantitative indicators, and they do not equally address all three dimensions (Van Asselt E.D. et al., 2014).

Chinese scientists QIU Hua-jiao et al. in their research “Analysis and Design of Agricultural Sustainability Indicators System” have compiled and analyzed recommendations of earlier researchers regarding indicator selection. For example, the Ministry of Agriculture, Fisheries and Food (MAFF) of England require that indicators should have analytical soundness, measurability, appropriate aggregation level, and be representative of social desirability; the Environmental Protection Agency (EPA) of America propose that indicators are important to the overall structure and function of the agroecosystem, and must be responsive to a range of environmental stresses. These must be simple, cheap, easily explainable, not redundant, with little variation, and of historical data. The indicators should be able to cover the system all-around and should be minimized in number (QIU Hua-jiao et al., 2007).

To establish the most appropriate indicators in the environmental sustainability in agriculture in further research and finding what indicators are most appropriate for tracking progress, the World Resources Institute research of 2014 may serve as an important basis for assessing the candidate indicators of environmental sustainability of agriculture and provisionally identify the landscape of existing agri-environmental indicators (Reytar K. et al., 2014). When drawing the list, it is important to take into account the nature of the indicator. The author has compiled insights of various authors regarding indicator pros and cons (Table 1).

“Of crucial importance is whether the indicators are aggregated into groups, e.g. social, economic and ecological, and how the groups are weighted. Finally, the indicators can be assessed in different ways, i.e. with respect to regulatory standards (e.g. nitrogen in groundwater), targets, thresholds, and ranges” (Binder C.R. et al., 2010).
## Pros and cons of composite indicators

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<tr>
<th>Pluses</th>
<th>Minuses</th>
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<tr>
<td>Indicators are used to make a complex system understandable and to give meaningful information.</td>
<td>The content of the indicators system is different from each other for different countries, regions, and development stages, and is of great subjectivity.</td>
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<td>Indicators enable policymakers, farmers, businesses, and civil society to better understand current conditions, identify trends, set targets, monitor progress, and compare performance among regions and countries.</td>
<td>Indicators may send misleading policy messages if poorly constructed or misinterpreted.</td>
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<td>They also enable us to visualise farm heterogeneity within a single agricultural system with respect to sustainability as well as to analyse the structural and decision-oriented variables that influence it.</td>
<td>They invite simplistic policy conclusions.</td>
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<td>Indicators can summarise complex, multi-dimensional realities (such as agricultural sustainability) with a view to supporting decision-makers.</td>
<td>Indicators may be misused, e.g. to support a desired policy, if the construction process is not transparent and/or lacks sound statistical or conceptual principles.</td>
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<td>They are easier to interpret than a battery of many separate indicators.</td>
<td>The selection of indicators and weights could be the subject of political dispute.</td>
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<td>Indicators help assessing progress of farms, agricultural systems, regions and countries over time.</td>
<td>Indicators may disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action.</td>
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<td>Reduce the visible size of a set of indicators without dropping the underlying information base.</td>
<td>Use of indicators may lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored.</td>
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<td>Place issues of farms, agricultural systems, regions or countries performance at the centre of the policy arena.</td>
<td>As indicators have different dimensions or operate at different levels, it is difficult to compare and assess sustainability.</td>
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<td>Facilitate communication with general public (i.e. citizens, media) and promote accountability.</td>
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<td>Help to construct/underpin narratives for lay and expert audiences.</td>
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<td>Enable users to compare complex dimensions effectively.</td>
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## Conclusions, Proposals, Recommendations

1. The concept of sustainable development is a long-term balance between economic profitability, environmental stewardship and community vitality. Sustainability should be understood as a social construction which changes in certain geographical and temporary conditions.

2. Previous research of sustainability assessment in agriculture has highlighted the following main shortcomings: multifunctionality of agriculture, imbalance regarding ecological, economic and social dimensions of sustainability; the researchers’ wish to fill...
missing knowledge and technologies but to neglect to apply the knowledge for the benefit of the society; the evaluation results are difficult to be implemented in decision making as conflicting goals and the interaction between indicators have not been sufficiently considered.

3. The following issues have to be considered: the underlying sustainability concept; goal setting; and assessment type.

4. Although VPR is a typical agricultural region, the strategic plan of the area in the stage of discussion does not give a clearly defined sustainability goals and objectives for the agricultural sector. So far a balanced and sustainable agricultural development model has not been drafted for the area, there is no study to what degree farmers are achieving sustainable agriculture goals and producers moving in the right direction; and what prevents farmers from achieving better long-term results.

5. The author recommends involvement of researchers, policy makers and agricultural entrepreneurs in the development process of sustainable agricultural indicators as it is vital to consider farmers’ perceptions of sustainability of their operations. Both “objective” and “subjective” approaches may be used to ensure that results reflect a realistic and comprehensive evaluation of sustainability.

6. It is important to understand the character of indicators for selection of sustainable development indicators on the basis of the following criteria: the indicator should be measurable; sensitive to variations; relevant to the case study; related directly to the theme.

7. Candidate indicators should be assessed by the following features: availability of data, accuracy and consistency in how data are gathered, frequency of data, data’s proximity to reality, relevancy of data, and ability for data to differentiate among countries.

8. Agricultural, environmental and macroeconomic policy should provide conditions for sustainable agriculture and rural development. The main tools are: policy, participation, income diversification, land conservation and improved management of inputs. Success in development of sustainable agriculture and rural space development will depend largely on the support and participation of rural people, national governments, the private sector and international cooperation, including technical and scientific cooperation.

9. Indicator systems are increasingly applied as a tool for policy planning, result evaluation and as an instrument for observation of interaction of different processes and factors; they provide comprehensive information for decision makers. As concerns the elaboration and adaptation of the indicator systems, the previous studies manifest many variations, subjective attitudes, contradicting viewpoints and unanswered questions that threaten the result relevance, credibility, reliability, comparability and understandability.
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Bibliography


