

**POLLUTION AND WATER
RESOURCES**

COLUMBIA UNIVERSITY SEMINAR PROCEEDINGS

**POLLUTION AND WATER
RESOURCES**

COLUMBIA UNIVERSITY SEMINAR PROCEEDINGS

GEORGE J. HALASI-KUN (in memory)

EDITOR

**VLASTA ŠTEKAUEROVÁ
ISTVÁN FODOR
VILIAM NAGY
BOTOND SINÓROS -SZABÓ
RICHARD LO PINTO**

ASSOCIATE EDITORS

Volume XLI

2012

**Impact of Anthropogenic Activity and Climate
Changes on the Environment of Central Europe and
USA**

in co-operation with

**Slovak Academy of Sciences
Institute of Hydrology
Bratislava, Slovakia**

**Hungarian Academy of Sciences
Research Centre for Economic and Regional Studies
Institute for Regional Studies
Pécs, Hungary**

Columbia University - University Seminars

The publishing of this book was sponsored by

Columbia University – University Seminars
Slovak Academy of Sciences, Institute of Hydrology, Bratislava, Slovakia
Hungarian Academy of Sciences, Research Centre for Economic and
Regional Studies, Institute for Regional Studies, Pécs, Hungary
Fulbright Commission for Education Exchanges

The author express appreciation to the University Seminars at Columbia University
for their help in publication.

Material in this work was presented to the University Seminars on Pollution and
Water Resources.

ISBN 978-963-9899-59-9

Copyright © 2012 COLUMBIA UNIVERSITY SEMINARS
All right reserved.

The paper's content, form, and orthography are exclusively the responsibility of the author.

Printed in Slovakia

CONTENT

V. Štekauerová, V. Nagy, J. Šútor Meeting of Professor George J. Halasi- Kun	9
G. Lovász Water Temperature in The Rivers of The Carpathian Basin (the Danube, Tisza and Drava)	17
F. Burger Modifications in The Danube River – Riverine Groundwater Interaction after Human Intervention	27
F. Bálint, M. Bulla, A. Torma, Z. Szalay Sustainable Regional Development – The Complex Knowledge Space Model (KTxM) and Introduction into The Application of Environmental State Assessment	41
S. Dénes, A. Megyes, S. Ferencsik Evaluation of Precision Nutrient Management and Crop Protection in Northern Hungary	57
M. Gomboš, B. Kandra, D. Pavelková Evaporation Processes in Heavy Soils of East - Slovakian Lowland	71
B. Baranyi Regional Development Impacts of The Utilisation of Power Plant Waste Heat in North-East Hungary	103
T. Rátonyi, L. Bánszki, R. Víg, E. Harsányi Evaluation of Maize Production for Bioenergetic Purposes on Lowland Calcareous Chernozem Soil in Hungary	121
M. Bara Potential Impacts of Climate Change on Base Flow Formation in a Small Basin	129
A. Dobos, K. Molná, Gy. Vasvár, L. Bánszki, R. Víg Yield Increasing Efficiency of Algae-Based Foliar Fertilisers in Maize Sowing Seed Production	159
V. Novák, J. Lipiec Water Extraction by Roots under Environmental Stresses	165
G. Koltai, F. Hegedüs Mikéné, G. Milics, V. Nagy, V. Štekauerová, K. Rajkai Moisture Status of Land Use Types in the Zitny Ostrov and Szigetköz Danube Lowlands	181
S. Maniak Modern Distributed Geographic Information Systems (WEB GIS)	189
E. Nagy Sustain Ability Problems in Hungary through the Example of one County	203

F. Orsolya „Manifestation of The Eco-Self” – Sustainability of Environment-Conscious Operation	213
G. Milics, I. Balla, J. Deákvári, L. Fenyvesi, M. Jolánkai, V. Nagy, V. Štekaerová, M. Neményi Soil Moisture and Soil Electrical Conductivity Measurements in Site-Specific Agriculture	219
J. Šútor, P. Šurda, V. Štekaerová, V. Nagy Effect of The Time Periods without Precipitation on Water Content Dynamics in The Aeration Zone of The Soil	232
A. Megyes, L. Huzsvai, J. Nagy Modelling The Soil-Plant Water Cycle with an Irrigation Decision Support System	255
Zs. Szántó, B. Sinóros-Szabó Bioenergy Production and Innovation	279
M. Pásztorová, J. Skalová Assessment of Relations of Poiplic Ramsar Locality	293
N. Smuk, G. Milics, M. Neményi The Role and Efficiency of Nutrient Replenishment in Site-Specific Farming	322
I. Szombati Responsibility Matters in The Light of Environmental Protection	329
A. Ványiné Széles, I. Bogdán, D. Sulyok, J. Nagy The Effect of Fertilisation and Irrigation on The Yield of Different Genotype Maize Hybrids and The Economic Aspects of Production	341
I. Fodor, B. Gálosi-Kovács Green Economy – Sustainable Development	361
Members of Seminar	371
Contents of Volumes I-XL	373

Introduction

This volume of Columbia University Seminar Proceedings is dedicated to the memory of Professor G.J.Halasi-Kun, who died during its preparation.

The articles in the XLI volume of “Columbia University Seminar Proceedings” primarily deal with the Environmental Problems in Central Europe including social and economical Aspects.

The editorial Board of the Seminar Proceeding together with the Steering Committee of the Seminar express their appreciation to all contributing members and lecturers.

Their dedicated unselfish effort made the publication possible, material drawn from this work was presented to the University Seminars on Pollution and Water Resources.

It is gratefully acknowledges the Support of the United States Council for International Exchange of Scholars Fulbright Program. Further appreciation is due to the Slovak Academy of Sciences – Hydrological Institute, Hungarian Academy of Sciences – Research Centre for Economic and Regional Studies, Institute for Regional Studies and Columbia University Seminars – Schoff Fund for the generous financial contribution toward this publication.

- [18] ŠTEKAUEROVÁ, V. - ŠÚTOR, J. - FARKAS, C., 2003: Evaluation of soil pedotransfer functions for soils of the Csallókőz Csallókőz and Szigetköz Regions. In Acta Agronomica Hungarica, Hungaria, 3.
- [19] ŠTEKAUEROVÁ, V. - NAGY, V. - KOTOROVÁ, D., 2006: Soil water regime of agricultural field and forest ecosystems. In Biologia : section botany. Bratislava : Slovak Academy of Sciences, 2006, vol. 61, suppl. 19, pp. 300-304.
- [20] ŠTEKAUEROVÁ, V. - SKALOVÁ, J. - NOVÁKOVÁ, K., 2010: Assignment of hydrolimits for estimation of soil ability to supply plants by water. Növénytermelés, Vol. 59, ISSN 0546-8191, Supplement, p. 195-198.
- [21] ŠTEKAUEROVÁ, V. - ŠÚTOR, J., 2000: Úloha monitoringu pri numerickej simulácii vodného režimu zóny aerácie pôdy. Acta Hydrologica Slovaca, ISSN 1335-6291, vol. 1, 2, 203-212.
- [22] ŠTEKAUEROVÁ, V. - SKALOVÁ, J. - ŠÚTOR, J. 2002: Using of pedotransfer functions for assessment of hydrolimits. Rostlinná výroba (Plant production), 48, 9, 407-412.
- [23] ŠTEKAUEROVÁ, V. - NAGY, V. - ŠÚTOR, J. - MILICS, G. - NEMÉNYI, M., 2009: Influence of groundwater level on soil water regime of Žitný ostrov. Ed. M. Harcsa. Növénytermesztési Tudományos Nap - Növénytermesztés: Gazdálkodás - Klimaváltozás - Társadalom, Budapest, Akadémiai Kiadó, pp. 197-200.
- [24] ŠÚTOR, J. - ŠURDA, P. - ŠTEKAUEROVÁ, V., 2011: Quantification of the water capillary flow from the groundwater level into the aeration zone of soil. Acta Hydrologica Slovaca, ISSN - 1335-6291, Vol. 12, 2, s. 243-250.
- [25] ŠÚTOR, J., - ŠTEKAUEROVÁ, V. - NAGY, V., 2010: Comparison of the monitored and modeled soil water storage of the upper soil layer: the influence of soil properties and groundwater table level. J. Hydrol. Hydromech., ISSN 0042-790X, 4, s. 279-283.
- [26] TALL, A., 2007: Impact of canopy on the water storage dynamics in soil. Cereal Research Communications, vol. 35, no. 2, pp 1185-1188.
- [27] TALL, A., 2008: Application of the palmer drought severity index in east Slovakian lowland. Cereal Research Communications, ISSN 0133-3720, vol. 36, 1.190-IF2008, 1, pp. 1195-1198.
- [28] VAN GENUCHTEN, M. T., 1980: A closed equation for predicting the hydraulic conductivity of unsaturated soil. In Soil Science Society of America Journal. 1980, no. 44, p. 892-898.

REGIONAL DEVELOPMENT IMPACTS OF THE UTILISATION OF POWER PLANT WASTE HEAT IN NORTH-EAST HUNGARY

Béla Baranyi

Hungarian Academy of Sciences Centre for Regional Studies Debrecen Department, Debrecen, Hungary; University of Debrecen, Centre for Agricultural and Applied Economic Sciences, Debrecen, Hungary

1. Introduction

The strengthening of the regional role of environmental industry may be promoted by a large-scale investment of the near future planned in *Nyírtass*, a settlement of Szabolcs-Szatmár-Bereg county, in the corner of the so-called triple border region along the borders of Hungary to Slovakia, the Ukraine and Romania. In this micro-region that is a less favoured area of Hungary – in fact, an area of multiple handicaps – a combined cycle power plant is planned whose waste heat could be used by greenhouses, dryers and heated water fish cultures. These establishments and the other developments for the processing and storing of their primary products, together with the other logistics developments, can generate considerable regional socio-economic effects in the narrow and broader environment of the investment. The economic development impacts will have a strong impact on development and reindustrialisation especially in the *Baktalórántháza micro-region*, but its effects will also be palpable in Szabolcs-Szatmár-Bereg county, in fact, the whole of the region of North Great Plain (BIO-ENKRF, 2006–2009).

Every investment in this industrially underdeveloped micro-region – in this case the development of environmental industry is of outstanding importance, as not only the Baktalórántháza micro-region but also the neighbouring micro-regions of Ibrány-Nagyhalász, Mátészalka and Vásárosnamény are among the most disadvantaged micro-regions in accordance with the Government Decree No. 311/2007 (17 November) – what is more, the latter three are among those that are to be developed with complex programmes, i.e. are among the least developed micro-regions of Hungary –, so the whole of the area lags far behind the national average from economic, social and infrastructure aspects.

Within Szabolcs-Szatmár-Bereg county, a county situated in the north-eastern part of Hungary, not one of the micro-regions of Nyíregyháza, Kisvárda, Nagykálló and Záhony are among the micro-regions with the least favourable indices, still they are among those 47 micro-regions that are eligible for special spatial development supports due to their "disadvantaged" situation (practically the whole of Szabolcs-Szatmár-Bereg county is in this category, with the exception of the county seat and the settlements in its direct neighbourhood). The micro-regions of Baktalórántháza, Vásárosnamény and Mátészalka are among the thirty micro-regions in the worst positions in the rank of the 174 micro-regions of Hungary by their complex socio-economic development indices. At the planning and implementation of any development concept targeting the reindustrialisation of this area thus has to consider that the model region locating the combined cycle power plant is in an area belonging to the 47 most disadvantaged micro-regions of Hungary – among these micro-regions we find the micro-region of Baktalórántháza and seven more micro-regions from Szabolcs-Szatmár-Bereg county –, so all investments employing a large number of labour force and promoting the diversification of the local economic structure is of selected importance.

The combined cycle power plant with 2,400 MW nominal capacity, starting its operation after the developments in *Nyírtass*, and the connected further developments – in addition to the significant enlargement of the energy supply capacity of Hungary – means *job creation for approximately 2,000 people*, offering a broad range of jobs with different qualification requirements. The significance of the investment is indicated by the fact that the number of newly created workplaces exceeds the total number of employment in Záhony. In addition, the utilisation of the waste heat increases the efficiency of the power plant, agricultural producers will have an access to cheap thermal energy and the environmental burden caused by the establishment is decreased. The volume and innovative character of the investment makes the power plant unique not only in the direct region but also in the whole of Central Europe, so its competitiveness seems to be secured in the long run, due to the predictability and security of the production.

Besides the adaptation and generation of innovations, the power plant complex will have an extended network of suppliers and relations by which it will play a role in the penetration of new technologies, methods and tools in the region. The energy produced in the power plant and the production of the high-level horticulture establishments built on this energy will both decrease the import dependence of Hungary and lead to the opening of new export markets.

2. Impact area and spatial structural dimensions of the investment

Multi-level impact area

Coming from the size and diversity of the investment, several spatial impacts of varied intensity are expected. The most extended impacts may be felt in a circle of approximately 250 kilometres from the power plant, within which the products manufactured may have a strong market-shaping effect. The boundary of the widest area of action in Hungary is thus Budapest, in northern and eastern direction this area reaches beyond the state border, to East Slovakia, Transcarpathia and Northwest Transylvania. The most intensive relations will of course be made in the direct environment of the power plant, the production district can be built out within a circle of 10 kilometres, in the territory of 8–10 villages (Figure 1).

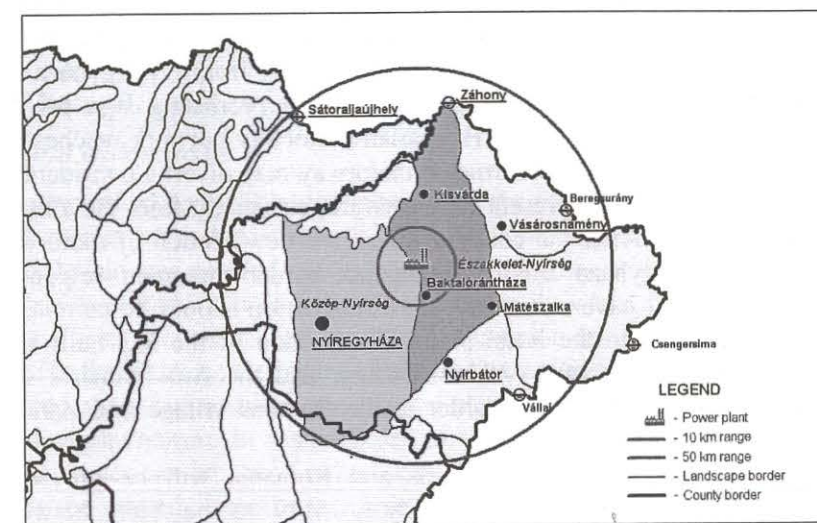


Fig. 1. Boundaries of the production and logistic district of the power plant complex. Source: Debrecen Department of the Great Plain Research Institute, CRS of HAS.

Logistics tasks can be organised in an area within a 50 km radius, which covers almost the whole of Szabolcs-Szatmár-Bereg county, due to the location of the power plant in the proximity of the geometric centre of the county. The varied transport geographical endowments may considerably modify the extent of the area of impact; it may stretch and expand along the main transport routes, while in less accessible areas the investment will

probably have fewer positive impacts. In addition, due to the relations towards Slovakia, the Bodrogköz area – also a disadvantaged area – may be affected, together with Sátoraljaújhely, while the city of Debrecen will be a dominant factor of the spatial structure because of its airport and training and R & D basis. Having all this in mind, an important prerequisite of the investment is the mapping of the regional characteristics of the consumption market in the catchment area of the investment, and the definition of the logistics junctions most optimal for sales, calculated with the time and cost factors.

Impacts developing transport infrastructure

In the direct vicinity of the planned investment there is a very important transport corridor which is part of the Trans-European Network. Road and rail access is very important in the creation of the adequate logistics system. The location of the investment is a spot between main road No. 4., the major transport axis of the region and road No. 41. running from Nyíregyháza via Vásárosnamény to Beregovo in Transcarpathia. A promising sign for the future is that the extension of the Hungarian motorway network reaches the micro-region, and the newly constructed motorway may divert a considerable part of the traffic from the present road network, especially from the already overloaded road 41. After the construction of the new section of motorway M3 between Nyíregyháza and the Ukrainian border the micro-region of Baktalórántháza will have motorway; the construction should be completed until 2015 according to the latest plans. The section of the M3 built as a speedway will bifurcate after Vásárosnamény, and the two branches will reach the Hungarian-Ukrainian border at the Barabás village and Záhony town.

The connections to the Szatmár areas and Romania will be provided, according to the plans, by the speedway M49 to be built between Mátészalka and Csenger. Although the planned speedways will be a considerable progress for the accessibility of the micro-region and its system of regional relations, and will also alleviate the implementation of the logistics tasks necessary for the operation of the power plant, they cannot substitute in themselves the reconstruction and development of lower rank roads, especially in the direct vicinity of the investment. In addition, of course, it will be necessary to have roads that divert the growing traffic from the inner areas of the settlements. Another important logistics task is the transport of the labour force of the power plant that can be solved by the introduction of bus lines run by the company operating the power plant.

Railway must have a significant role in the movement of the considerable amount of agricultural raw materials, as it offers a much more environment friendly solution than road transportation. This can be done by the construction of an industrial railway connected to the main line No. 100 linking Záhony to Nyíregyháza and Debrecen, the dominant rail axis of the region. Although it is a line of smaller capacity, the single-rail non-electrified line No. 116 between Nyíregyháza and Vásárosnamény – located south of the power plant complex, touching Baktalórántháza – should be taken into consideration as an alternative solution. This way the logistics functions of the micro-regions of Baktalórántháza and Vásárosnamény would strengthen. In order to achieve this it is important to examine the intensity of use of the present transport network and the possibility to build access roads to the power plant, on the basis of available traffic data, the information concerning the quality of the roads and the transport development concepts.

3. Natural, social and economic conditions of the investment

Natural endowments

The planned project will be implemented at the meeting point of two physical geographical units, the Middle Nyírség and the Northeast Nyírség. It is an alluvial plain area covered mostly with sand and loess, with low elevations. As regards its climate, it is an area where moderately warm and moderately cool climate types encounter; looking at the precipitation conditions, it is moderately dry. The dominant type of soil is clay-filled brown forest soil; smaller areas are covered with humus-filled sand, wind-blown sand, brown forest soil and meadow chernozem. In a significant part of the physical geographical units subsoil water can be found rather deep, in some places more than six metres below the ground, subsoil water level is only high in the pits among the sand dunes. In areas covered with brown forest soils and chernozem plough lands are typical, spotted with orchards.

Traditional crops of the micro-regions are rye, potato and tobacco, but none of these produce high yields, due to the less favourable soil conditions. It is just the risk factors coming from the bad natural endowments that can be considerably decreased by man-made and operated greenhouse cultures. This way a significant amount of goods can be produced in a small area, irrespective of the weather conditions, which allows the removal of the low quality arable lands from cultivation and their use for e.g. bioenergetics purposes. The volume of greenhouse production will exceed by far the production volume of greenhouse farming around Szentes in the South Great Plain region (presently

in leading position). This way the micro-region, with otherwise unfavourable agro-ecological potential can be in the cutting edge of the Hungarian horticulture. In the vicinity of the location of the planned investment there are no protected natural areas. Nevertheless the detailed and exact assessment of the agro-ecological potential of the area and the mapping of the environmentally sensitive areas are tasks to be done.

Characteristics of the labour market

The *labour market problems* much more serious than the average have impact on the everyday lives of the total population of both the micro-region and the larger region. Szabolcs-Szatmár-Bereg county and the whole of the northeast Hungarian region have traditionally been areas with surplus labour, which is attributable, among other factors, to the typically small number of local jobs during the course of history. Although during the socialist decades the decentralised industrialisation created several industrial plants, the majority of these were soon liquidated during the recession following the political and economic systemic change.

The strong economic decline typical in the first half of the 1990s resulted in East Hungary, including the northern half of the Trans-Tisza region, in serious discrepancies between the demand and the supply side of the labour market, problems that are still palpable today. One of the signs of these problems was the *very serious decline in the employment rate*, and the parallel *very rapid increase in the unemployment rate*. The traditionally underdeveloped rural areas with a shortage of jobs and a surplus of labour were unable to employ the labour force flowing back from the nearby and distant towns and cities, and the labour market situation became critical in several micro-regions.

In employment the spatial disparities within Hungary stiffened, with some slight changes, and practically no palpable change occurred in the positions of the regions relative to each other. In fact, a process very unfavourable for the regional labour market started and accelerated after the systemic change: the number and proportion of economically inactive population increased substantially. In addition, besides the high proportion of health-related disabilities, the level of schooling of the population is low, there is discrimination and other negative phenomena in the area; as a result of all these factors the significant share of the Roma population – whose proportion from the total number of inhabitant of the region is far above the national average – lost all their connections to primary labour market and became inactive earners or passive unemployed.

For the labour intensive harvesting, plant cultivation and goods transport activities that can be done by the most elementary education, in addition to the locally available labour market, there is cheap labour from the other side of the border, mainly from Romania and the Ukraine. For providing labour for the seasonal horticultural works, the adaptation of the legal methods applied in the EU countries can legalise the employment of cross-border labour, for which there are also national "green box" supports. Also, the unskilled labour or those with various levels of schooling from the neighbouring Borsod-Abaúj-Zemplén county are potential sources of labour. The agricultural works mentioned above can be taught easily, and the necessary skills are given at those responsible for the professional management. This means that the employment of labour force coming from other economic sectors cannot be a problem. However, a problem to be solved for the enlargement of employment is the mapping of the number and education level of the potential labour force; other tasks to be done include the survey of the opinions of the local agricultural entrepreneurs about the potentially available labour force, and the assessment of the habits and expectations of the local inhabitant concerning employment and their employees skills.

Training and technology background

The higher education institution of the region of North Great Plain, especially the Centre for Agricultural and Technical Studies of the University of Debrecen and the Faculty of Technical and Agricultural Sciences of the College of Nyíregyháza are a suitable basis for the satisfaction of the emerging R & D & I needs. There are already researches in the fields of plant production technology and mechanical engineering issues related to the investment, which are based to a large extent on the findings of international research programmes and the surveys carried out by foreign partner institutes. An important aspect is the support and the creation of the professional institutional basis for the harmonisation of practice with research and development and consultancy, the background for which is provided by the Research Development Institute working in Debrecen. In Szabolcs-Szatmár-Bereg county there are two institutions engaged with *secondary level vocational training*: the Baross László Secondary and Vocational School of Agriculture (in Mátészalka) and the Bessenyei György School of Agriculture and Student Hostel (in Tiszabercel). In addition, the trainings in the Balásházy János Vocational School of Agriculture in Debrecen have several decades of tradition.

The problem-free operation of the power plant requires the presence of a highly organised *logistics network*, which has implications for training of course. In the supply of trainings in the region there are already trainings and further trainings of logistics character, and they have become popular and marketable in the recent years. Prerequisites for the provision of human resources suitable for meeting the new challenges, above all the qualified labour force with special skills, are the assessment of the skills needed for the investment of the students in the educational institutions of the region, and the mapping of the presence and the deficiency of the skills related to the special activities of the operation of the power plant. This can be supplemented by an opinion survey of the teachers of the educational institutions of the region about the investment as the place of practical training, about the skills and preparedness of their students and last about the amendments of the syllabus of the trainings to meet the new market demands. In addition, the assessment of the foreign professional relations of the training institutions and the possibilities of their expansion in the future must be done.

Structure of the businesses

One of the most important reasons for the employment and unemployment figures much worse than the national average is the economic structure which is unfavourable from several aspects not only in the micro-region but the whole of the region of the North Great Plain. The unfavourable endowments are reflected both in the number and the sectoral breakdown of the businesses, and also in the general shortage of capital basically influencing employment capacities, and the technology disadvantage coming from the shortage of capital.

Looking at the breakdown of enterprises according to the sectors of the economy, we can see that agriculture plays a much more important role than in the average of the country as a whole; the proportion of businesses in industry and construction industry is around the national average, while services sector, generally considered as the engine of the modern economy, is considerably underrepresented. The above average share of agriculture is evidently the consequence of the plain land character of the county and the favourable natural endowments coming from the climatic conditions, but the weight of this sector with an uncertain future and a generally low level of profitability in itself draws attention to the unfavourable local economic structure. This is also proved by the high number of private enterprises operated for want of anything better in the region; the proportion of such businesses in the region is much higher than

the average: the national mean value is 58.8%, while it reaches 65.3% in the county and the region as a whole.

The creation of a business structure optimal for the implementation of the environmental investments requires among other things the survey of the opinion of the local agricultural entrepreneurs about the Production and Sales Cooperative (hereinafter: PSC) to be established in relation to the power plant. The successful operation of the power plant furthermore requires the establishment of an information centre for the producers and the organisation of institutional tasks which supply the local producers and the population with important information and advice of public use and of professional character about the issues concerning the investment.

Transformation of the ownership patterns

The *land demand of greenhouse horticulture* can be solved by land purchase or land leasing. Leasing, however, hides several potential dangers, because the investments require very large amounts of capital, consequently an eventual termination or the non-extension of a contract may result in substantial financial loss. In addition, the relocation of greenhouses is problematic, on the one hand because they receive energy from the power plant, and a significant loss of markets can be the consequence of the suspension of production, on the other hand. It is more advantageous then to purchase the land, but buyers have to know that the laws in effect regulating land purchase only allow a Hungarian citizen to buy land up to 300 hectares and a value of 6,000 golden crowns, and legal entities or economic companies are not allowed to buy land at all. What seems to be a favourable solution is to make the present owners of the land interested in the investments and possibly to include them into the production.

The establishment and operation of PSC preferred and supported by the *European Union* as well could also improve the market competitiveness of the goods produced. According to the decree of the Council of Europe in 2004 it is necessary to reinforce integration within horticulture (PSC-s and producers' groups), by the support of the construction of logistics centres, cooling and packaging units, processing and sales (auction) halls implemented in the management of these integrations and the modernisation of the vegetable and fruit drying devices. It is important to have in mind that the Council of Europe does not support individual producers within the horticulture sector, only PSC-s or producers' groups. The role of the PSC-s established as an effect of the investment may reach beyond the production and sales of the respective goods,

because it improves the competitiveness of the whole sector by the integration of the vegetable and fruit producers of the region (Figure 2).

It is also worth considering the modern production technologies using stone wool. Although the investment costs may be higher than in the case of traditional technology, the yields may be many times more than in the traditional technology (28 thousand seedlings per hectare). As a result of this viable economic units can be established on smaller plots, the labour demand of the complex can be further increased, having a further positive impact on the labour market of the region. The strengthening of the favourable processes must be accompanied by the exact mapping of the land ownership structure, the analysis of the land market of the region and the collection of the experiences of the PCS-s, operating in the region for years now.

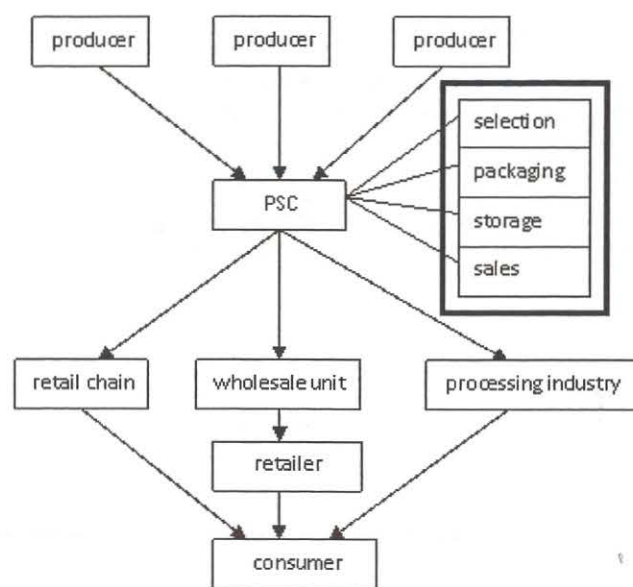


Fig. 2. Draft structure of the operation of the PSC. Source: by the author, after Erdész-Padisák.

4. Logistics functions and tasks

Taking the Western European examples as a basis, the goods produced in greenhouses located as an effect of power plant investments can be exportable if transport is also developed, there are enough and large enough cold stores and a viable logistics centre is established. In the territory of

Szabolcs-Szatmár-Bereg county there are several cold stores and insulated storage facilities already in operation, all of which have been established by the producing companies presently using them, but they only have extra capacity seasonally and thus storage hiring is not possible. In the latest logistics and storage databases we cannot find any building for sale or for long-term lease. The newly established storage facilities are built in junctions with the best transport endowments, both in the direct vicinity of the power plant complex and within the complex itself. The major logistics tasks necessary for the successful implementation of the environmental industry investment are as follows:

- An analysis of the location factors of cold stores and insulated storage facilities from a logistics view.
- Enumeration of the companies dealing with storage and contacting them, opinion survey of those involved in job storing and job cooling on the potential cooperation, and the enumeration of the capacities available.
- Assessment of the geographical location and accessibility of the operating storehouses, cold stores and cooling facilities.
- Regional breakdown of the consumer market, definition of the main directions of development and on the basis of this the designation of the optimal location of the logistics bases.

5. International relations

Cross-border relations

In the last decade and a half cross-border cooperations have become more and more intensive in all seven border regions of Hungary. One of the main objectives of the institutionalised relations and cooperation strategies between neighbour areas is economic development and the promotion of economic relations; however, resources are often not available for this purpose. The regions neighbour to Szabolcs-Szatmár-Bereg county are not competitors for the planned complex in the sectors of greenhouse plant cultivation, i.e. they can be consumption markets, suppliers and sources of seasonal labour if good quality and reasonable prices are offered by the Hungarian establishment.

During the planning of cross-border relations and cooperations we must take into consideration the regional characteristics that the project is implemented in an area surrounded by the three state borders – the Hungarian borders to the Ukraine, Romania and Slovakia –, where the presence of the borders is not only a disadvantage but can also be advantage, especially in the case of internal Schengen borders. A key issue of the

development of cross-border relations can be among other things the 137 kilometre long Hungarian-Ukrainian state border, the total length of which is bordering Szabolcs-Szatmár-Bereg county. For the developments of environmental industry it is still important then to preserve and develop the former intensive and broad relations to Transcarpathia, especially because the natural gas fuelling the power plant of Nyírtass arrives from this direction and the region is also important for other cooperations in the fields of environment protection and water protection. When talking about the Hungarian-Ukrainian border we have to mention that this is also an eastern external border of the European Union, so it is of special importance for the economy, due to the rather different endowments of the two sides. The number one objective of the cooperations under preparation is the utilisation of this economic potential. The three major cities in Transcarpathia (Uzhgorod, Mukacevo and Beregovo) can be major potential markets.

As regards the cooperations towards Romania, close cooperations across the Hungarian-Romanian border have been established among the neighbouring four Hungarian and also four Romanian counties and their centres. Due to its geographical proximity, the county of Satu Mare in Romania can be the most important, which has already built out cooperations with Szabolcs-Szatmár-Bereg county, with special emphasis on the promotion of the relations among the businesses. When making the regional designation of the marketing activity, however, this is not the only county to be taken into consideration: we have to calculate with the whole of the Northwest Region of Romania, especially the rapidly developing big cities (Satu Mare, Oradea, Cluj Napoca and Baia Mare).

We cannot neglect the issues of the Hungarian-Slovak cross-border relations in this region, either. Although the territory of Szabolcs-Szatmár-Bereg county is bordering Slovakia in a no more than six kilometre section, and there is no border crossing station across this short border, the south-eastern part of the region of East Slovakia are within 50 kilometres from the location of the investment as the crow flies, and the centre of the Slovakian region, Košice is only 119 kilometres on road from the location of the power plant in Nyírtass, which is a 2 hour and 20 minute travel. Slovakia is already one of the main target areas of Hungarian vegetable export, and the natural endowments of East Slovakia are definitely unfavourable for horticulture, so it can be an important potential market.

Taking all this into consideration, during the sustainability – and development – of the cross-border relations a very important priority is the mapping of the market conditions and commercial networks in the neighbour countries, with

special regard to the marketing of vegetables and fruits and the assessment of the possibilities in other cross-border cooperations.

Potential international relations

Regarding the globalisation and the European integration processes, the importance of greenhouse vegetable production, not sensitive to extreme weather conditions, is expected to increase. The two main species of vegetable produced in greenhouses are tomato and paprika, whose export potentials are quite different. The export-import balance of fresh paprika is very much positive for Hungary, the main export markets are *Germany*, *Austria* and the *Czech Republic*, while import – which is only a negligible part of the export – mainly comes from Spain, Morocco and the Netherlands. From the neighbour countries the main customers are Slovenia and Slovakia. The balance of the trade of fresh tomato is the opposite, even the export to the major markets (*Austria* and *Slovakia*) remains below 500 tons, while Hungary imported from Spain alone 6,000 tons of tomatoes in 2004, and also a quantity in excess of 1,000 tons from Italy.

On the vegetable market of European Union, among the main competitors of the Hungarian producers *Spain* has enormous capacities, but the quality of the Spanish products have frequently worsened due to plant protection problems; also, the average wages have considerably risen and the transport costs from Spain to the region of Central Europe are substantial. The Netherlands and Belgium are characterised, thank to the 50 years of continuous development, by an extremely developed technology, large production plants and high level of automation, as labour force is expensive and logistics costs are among the lowest in Europe. Eighty per cent of sales takes place in the super- any hypermarket chains. The countries of Southeast Europe (Bulgaria, Greece) and North Africa (Morocco, Egypt) are capable of vegetable growing at a relatively low cost level.

Besides the present energy prices, the winter vegetable growing in Hungary cannot be competitive with the Mediterranean region but the waste heat available from the combined cycle power plant can decrease the production costs, and the substantial costs of transport of goods from the Mediterranean region, and the better food safety conditions make this region of Hungary more competitive in vegetable growing. Markets for the fresh and more marketable goods can be, in addition the already traditional market of Germany and Austria, the neighbouring countries of Central Europe, where, following the example of Holland, the recently built retail chains could be targeted.

Another market that must be taken into consideration for the volume and efficiency of investments is *Russia*. It is well known that the significant part of the agricultural production of Szabolcs-Szatmár-Bereg county had been marketed on the eastern, mainly the Soviet markets before the systemic change, and the loss of these markets had a considerable role in the emerging and deepening of the crisis lasting for several years. The reappearance of solvent demand allows the regaining of some of the formerly lost markets, although with different products and better quality. A possibility for this is provided by the intention of the Moscow based food industry holding called "Ardex" to create a commercial and logistics centre in the vicinity of Moscow, on business grounds, definitely for Hungarian business circles, not exclusively but primarily for agricultural businesses. The concept of the project is about the creation of a large centre of 125 thousand m², including a rail and road destination, storage facilities, cooling capacity, exhibition space, customs office, meeting rooms and banking infrastructure. The hypermarkets of the large Russian cities can be a large market for the vegetables grown in greenhouses. Transport may be by air, using the regional airport of Debrecen.

An important professional, research and practical prerequisite of the development of international relations in any direction is the continuous monitoring of the international goods markets, collection of regular information on the costumers demand in the potential target countries of sales, and the monitoring of the international trends of customers habits.

6. Creation of product market lines

A basic problem concerning the sales of the products of vegetable growing is that packaging is usually below the quality of the product and is not attractive enough for the customers; and not last, marketing activity is often not efficient enough. In addition, the average-size farms in Hungary are unable to produce weekly transports, so it is much simpler for the supermarkets, the largest purchase markets, to buy goods from – often foreign – partners offering a large and reliable quantity. Considering the present amount of minimal wage in Hungary, an average family with four persons can have enough income from vegetable growing from an unheated area of 0.8–1 hectare. Such small size holdings, however, are unable to continuously produce and transport a large quantity of products week after week, i.e. they are incapable of providing a quantity of goods acceptable for a supermarket. At least for our five holdings of this size are needed for the production of a quantity that may be competitive from commercial aspect.

The goods produced can have better market positions if the production activity is accompanied by different *follow-up works*, so-called *post-harvest activities* in fruit and vegetable growing, including marketing activity, packaging, cooling, post-ripening, market organisation etc. The post-harvest facilities (storage, packaging), besides improving the market competitiveness of the product, are excellent practice locations for higher education students, promoting this way the modernisation of higher and vocational education by the emphasis on practical activities. For the efficiency of such works, it is necessary to discover the best practice facilities and production plants dealing with post-harvest activities, and contacting them for the collection of professional information. Further tasks to be done in this respect include the full survey of the knowledge of local farmers and entrepreneurs on the post-harvest activities and special works, and a thorough analysis of the demands of multinational supermarkets working in the catchment area of the investment concerning the fresh products. A closely related task to be done is the survey of the demands, expectations and preferences of the customers in the respective supermarkets and shopping centres.

7. Product protection and food safety

In the European Union the quality requirements concerning vegetables and fruits were standardised with the use of former standards and these new standards have been in use since 1996. The requirements were adapted by Hungary before its accession to the Union and they made parts of the Hungarian Food Code (Codex Alimentarius Hungaricus). After the accession these standards were taken out from the Food Code and are applied as separate EU decrees. The clear key word of the EU standards concerning the fresh goods market is *homogeneity*. These standards regulate in detail all requirements concerning the quality, appearance and packaging of the products. The multinational retail chains, with an ever increasing weight in trade, consider these standards as relevant. The relevance of the standards is of course extended to the other sales channels (e.g. small local market, wholesale market), but their consistent use is still not a general practice in these establishments.

A factor having a favourable impact on the investment in Nyírtass is that the trade of goods produced as products of green houses *using waste heat* is not affected by the European quota system – with exception of industrial tomatoes – so their production and marketing can be carried out without limitations. The production of several goods can be supported by intervention purchase, the vegetables for which intervention prices are valid are tomato (4.8 € cent per kilo), aubergine (3.9 cent/kilo), cauliflower (7.1 cent/kilo), water melon (4 cent/kilo) and melon (4 cent/kilo). Withdrawal is the competency of the PSC-

s, private producers can only have intervention payments through the PSC-s. It is not worth offering the goods produced for intervention, as the price does not even cover the costs; in addition, the Western European markets have a large purchasing capacity, so the fruits and vegetables can be marketed with a reasonable profit. The EU, in order to protect its own producers, does not only impose duty (5–20%) on the products from ex-EU countries but also defines an access price system for products produced in large quantity at certain times, i.e. extra duties have to be paid after the import goods cheaper than the access price. Access price is defined for the following vegetables: cardoon, zucchini, water melon, cauliflower, tomato, melon, aubergine and cucumber.

The prospects of the Nyírtass investment are improved by the fact that the vegetable market is hardly regulated in the EU, so there is a free and open competition in Hungary as a part of the integration. By the abolishment of duties the EU did not only become a huge single market but also a joint production area. It is typical of the whole Union that the proportion of exported and imported vegetables is growing year after year, which is also due to the unbelievable development of transport in the recent years. Today it is not a problem to transport tomatoes on road from Spain to Sweden or to Hungary on time. These factors brought a competitive advantage in vegetable growing for those countries and regions where the natural endowments are better for the respective vegetable and which are able to produce homogeneous and quality products in large amounts.

The products grown in the planned greenhouses can only have market of their own and compete with the largest European vegetable exporters (Spain, the Netherlands and Turkey) and the more and more rapidly developing exporters of North Africa, East Asia and South America if storage, packaging and transport are solved. In addition, it is of basic importance to carry out continuous innovation activity built on the local knowledge base, which increases the amount of products grown and decreases production costs. The increase of the yields is possible by the use of up-to-date technologies; the introduction of these is evidently costly but in the long run the investments can double the innovation potential of the region. The positions of the investments can be significantly improved by the working out of a quality control system applicable in practice for the production and storage of the given products, and by the continuous search for markets for the goods produced.

References

- [1] APÁTI, F., 2007: A jó színvonalú magyar és német almatermesztés összehasonlító gazdasági elemzése [A comparative economic analysis of the high level Hungarian

- and German apple growing]. Doctoral thesis. Doctoral School of Interdisciplinary Social and Agricultural Sciences, Debrecen, (Manuscript).
- [2] BALCSÓK, I., 2005: A munkanélküliség területi egyenlőtlenségei és legjellemzőbb folyamatainak alakulása az 1992–2002 közötti időszakban [Spatial disparities of unemployment and the development of its most characteristic processes in the 1992–2002 period]. Doctoral (Ph.D.) thesis. Debrecen, University of Debrecen.
- [3] BARANYI, B. – BALCSÓK, I., 2004: A munkaerőpiaci képzési és átképzési programok eredményességének vizsgálata regionális és kistérségi vetületekben [A survey of the effectiveness of labour market training and retraining programmes at regional and micro-regional level]. – In: A tudomány a gyakorlati szolgáltatásban. A foglalkoztatási szint bővítésének korlátai és lehetőségei [Science in the service of practice. Limits and possibilities of raising employment level]. Eds.: Pritz, P. [et al.]. Budapest, Hungarian Academy of Sciences. pp. 86–111.
- [4] BARANYI, B. – BALCSÓK, I. – KONCZ, G. – NAGYNÉ DEMETER, D., 2008: A kombinált ciklusú hőerőművi-hulladékhő hasznosításának térszerkezeti dimenziói egy modellterület példáján [Spatial structural dimensions of the use of waste heat from combined cycle power plants in a model region]. – Hungarian Economic Development and Subsidies Centre Ltd., Kutatás, Fejlesztés és Környezet. Vol. XII/7 Nr. 5. September–October. pp. 31–39.
- [5] BARANYI, B. – BALCSÓK, I. – KONCZ, G. – NAGYNÉ DEMETER, D., 2008: A kombinált ciklusú hőerőműhöz kapcsolódó hulladékhő hasznosítás munkaerő igényének- és munkaerőbázisának felmérése [A survey of the labour demand and labour force pool of the use of waste heat from combined cycle power plants]. Debrecen, CRS of HAS. (Manuscript)
- [6] BIOENKRF, 2006–2009: The study was made in the framework of the so-called BIOENKRF (2006–2009) research programme called Establishment of a Bioenergetics Innovation Cluster and Implementation of R & D Programmes in the field of the use of biomass, at the Debrecen Department of the Centre for Regional Studies, Hungarian Academy of Sciences, led by Béla Baranyi, Doctor of the HAS.
- [7] BENKŐ, J., 2000: Logisztikai tervezés – Mezőgazdasági alkalmazásokkal [Logistics planning – with agricultural applications]. Budapest, Dinasztia Kiadó.
- [8] DOBOS, K., 2000: Családi gazdaságok [Family holdings]. Budapest, Mezőgazdasági Szaktudás Kiadó.
- [9] ERDÉSZ, F. – PADISÁK, G., 2003: Közös piaci rendtartások hazai alkalmazása; Zöldség – Gyümölcs [Application of the common market policy in Hungary; vegetables and fruits]. Budapest, Perfekt Gazdasági Tanácsadó, Oktató és Kiadó Részvénytársaság.
- [10] PFAU, E., 1998: Mezőgazdasági vállalkozások termelési tényezői, erőforrásai [Production factors and resources of agricultural businesses]. Debrecen, DATE.

Summary

The experiences collected from the use of the waste heat of the combined cycle power plant in Nyírtass can be utilised for other investments. However, the impact mechanisms possibly induced by the investment, the diversity of the possible problems and the multi-level catchment area of the complex up to 250 kilometres all justify the necessity of further thorough academic researches, for both the concrete investment and any other development of similar character. Due to the complex impact mechanisms concerning spatial structure, economy – with emphasis on trade –, foreign relations (markets,

suppliers etc.), local society and the environment, it is not only specific assessments before the investment that should be made but also a continuous monitoring in the medium and long run. The analyses thus lead to a more or less regularly updated data and document basis that allows the monitoring of the efficiency and the catchment area of the investment year by year, which would allow a more rapid reaction to the suddenly changing market conditions, on the one hand, and would also alleviate the further adaptation of the innovative technology, on the other hand. For the development of environmental industry, the issue of the development of combined cycle power plants raises new challenges and tasks to be solved. One of these is that a growing environmental burden can be demonstrated by the tendencies of the latest period in Hungary in connection with the thermal water and natural gas heated plastic houses and glass greenhouses. This comes from the fact that many producers, due to the substantial rise in the energy prices, use traditional coal heated furnaces in the winter season. Because of the effort to reach a more cost efficient solution absolutely competitive against natural gas, however, the heating systems can only be partially automated, also, the amount of hazardous materials emitted to the air increase considerably at local level. Due to the global climate change and the improvement of the quality, the support of the substantial increase of production (of vegetables and ornamental plants) in covered places is manifested through co-financing in the development programmes. Another important environmental aspect of the developments is that operational costs can be greatly reduced by the cheap energy, so the implementation of the investment based on economic interests can decrease the emission and concentration of flue gas hazardous for the environment and human health. The competitive advantage of thermal water heated greenhouses seems to be granted for a while, despite the auxiliary costs (water use fee, environmental fees, environment pollution fine, extra costs of pressing thermal water back into the aquifer etc.), but in medium and even more so in the long run the vegetable growing built on the waste heat of power plants can gradually utilise the advantages lying in the technology, besides the parallel decrease of the emission of the power plant itself. It is an issue of basic importance then to evaluate several factors when planning an investment of this type, enumerating the environmental burdens during operation, above all the potential sources of pollution. Last but not least, an important subjective prerequisite for the environmental industry developments is the expansion of the knowledge of the concerned population on the investment, the survey of their opinion and the dissemination of the information on the environment friendly character of the investment.

EVALUATION OF MAIZE PRODUCTION FOR BIOENERGETIC PURPOSES ON LOWLAND CALCAREOUS CHERNOZEM SOIL IN HUNGARY

T. Rátonyi¹, L. Bánszki¹, R. Víg¹, E. Harsányi²

¹ University of Debrecen, Centre for Agricultural and Applied Economic Sciences, Institute of Land Utilisation, Technology and Regional Development, Hungary

² University of Debrecen, Centre for Agricultural and Applied Economic Sciences, University Regional Development Centre, Hungary

Abstract

There is practically no Hungarian farm that does not deal with maize production for either commodity production or foraging purposes on a significant part of its available sowing area. In recent years, the importance of crops produced for energy production purposes increased in Hungary, due to EU regulations, ever-changing economic factors and transformation of the nation's agricultural structure. As a result of the extreme weather conditions of the last one and a half decades and agrotechnical shortcomings, the average yield in lowland calcareous chernozem soil is rather fluctuating (30-50%). Maize is sensitive to the quality of soil; therefore maize is more commonly grown on soils that have better quality.

The objective of our study was to evaluate the starch content and starch yield of maize hybrids grown for bioethanol production.

After the laboratory sample preparation the starch content determination of the hybrids was carried out with a *Foss InfratecTM 1241* type crop analyzing device.

During our examinations, we established that the productivity and the starch content of the maize hybrids is significantly different as a function of their genetic potential, but starch content is independent of productivity.

Keywords: maize hybrid, yield, starch content, starch yield

1. Introduction

In the recent years the production of fuel alcohol from renewable energy resources has received remarkable interest. In order to be able to more completely understand the hybrids getting into common production, the factors influencing quality have to be examined to a more detailed extent. The data about each hybrid help the producer and the integrator in