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Editors' welcome

June 23–24, 2011, the second AGRIMBA-AVA congress was organised in Wageningen, The Netherlands. Its theme was: Dynamics of International Cooperation in Rural Development and Agribusiness.

This conference was successful both in terms of number of participants as in the quantity and quality of the paper presentations. Participants came from east and west Europe, and from other parts of the world. Lively discussions were reported during and after the sessions.

Through a process of selection the editors arrived at 23 papers, that are published in this special issue of Apstract, skilfully edited by two members of the organizing committee: Harry Bremmers and Johan van Ophem. They have done an excellent job!

To a large part, the success of the congress can be attributed to the enthusiasm and professional support of two other members of the organizing committee: Karen van der Heide and Marian Jonker. Without their assistance it would have been impossible to reach such a high standard.

Also Ruud Huirne, the director of the Department of Social Sciences of Wageningen University, contributed much to the success of the congress. I would like to take this opportunity to thank him for that.

During the AGRIMBA meeting in Wageningen it was decided that the annual meeting in 2012 will be organised in Bolzano during the ICA week of conferences on June 21st and 22nd. I am looking forward to meet a substantial part of the members of our network there.

Another important topic was the planning of our next AGRIMBA-AVA congress in 2013. It was decided that our third bi-annual congress will be organised in Podgorica, the capital of Monte Negro. Member of the Board, Prof. Dragoljub Jankovic, was appointed chairman of the organizing committee. I wish him success in organizing this important event.

Wageningen, December 2011.

Wim Heijman
Editor in chief

EDITORIAL ON DYNAMICS OF INTERNATIONAL COOPERATION IN RURAL DEVELOPMENT AND AGRIBUSINESS, A SPECIAL ISSUE OF APSTRACT

From June 23–24 the second AGRIMBA-AVA conference was held in Wageningen, the Netherlands. The theme of this conference was *Dynamics of International Cooperation in Rural Development and Agribusiness*. Agribusiness and rural development are both fast developing research areas, especially in the numerous universities for Life Sciences in Europe and beyond. During the congress, attention was paid to both the agro-food sector and rural development. Sessions were organized around themes as: *Entrepreneurship in rural areas and agribusiness; International agribusiness: west to east and east to west; Stimulating innovation through cooperation; Improving food safety and quality: policy implications; New ideas in agribusiness and rural development; Rural resilience and the role of social capital in rural development; The role of education in modernizing agribusiness and rural areas;* and *The effects of global economic crisis on agribusiness and rural development.* The conference was very successful both in terms of number of participants as in the quantity and quality of the paper presentations. Participants came from eastern and western Europe, and some even of distant other parts of the world like the USA an India. Lively discussions were reported during and after the sessions. Through a process of selection and self-selection we arrived at more than 20 papers, that are published in this special issue of Apstract.

As a basic scheme for categorising the contributions, we use Oliver Williamson's classification of four levels of social analysis (Williamson, 2000[1]): embeddedness, institutions, governance and resource allocation. Embeddedness concerns long term factors affecting social ordering and economic structuring, like culture, tradition, effects from and by education and baseline political premises.

Both keynote speeches not only described the functioning of agriculture and agribusiness from an immediate and short term perspective, but provided insight in the societal dynamics which affect the prospects for decennia to come. Political groundstreams of European institutional arrangements, like the CAP, resulting from post-war initiated efforts to improve food security, can be allocated to the first and second level of social analysis. In his contribution **Cees Veerman** – among others former Netherlands' Minister of Agriculture, Nature and Food Quality and first president of Wageningen University and Research Centre – discussed the issue of feeding the planet and the role of the Common Agricultural Policy (CAP). If we take a broader view on subjects such as climate change, world food policy and energy and the role of agriculture, we are in need of new perspectives. In his view, the CAP will and should be changed from supporting production to stimulating development in various directions.: "It is an opportunity to subject the subsidiarity principle and the proportionality principle to critical review and perhaps adapt the co-financing system to it". This keynote speech, entitled *Feeding the planet and the role of the Common Agricultural Policy (CAP)* is printed as a first article in this special issue. Next, **András Nábrádi** (professor of Agricultural Economics and Dean at University of Debrecen and **József Popp** (dsustainable agriculture in their keynote speech entitled *The challenges for food, energy and environmental security*. In the introduction, the following quotation gives an overview of the main challenges: "Human population is projected to grow at 70 million per annum increasing by 35% to 9.1 billion. By 2050 this increased population density, coupled with changes in dietary habits in developing countries towards high quality food (e.g. more consumption

[1]O. Williamson (2000). The New Institutional Economics: Taking Stock, Looking Ahead. Journal of Economic Literature 38 (3): 595–613.

of meat and milk products) and the increasing use of grains for livestock feed, is projected to cause the demand for food production to increase by 70%. The increase in production has to happen at the same time as the climate is changing and becoming less predictable, as greenhouse gas emissions from agriculture need to be cut, and as land and water resources are shrinking or deteriorating". In their conclusion they propose subtle policy recommendations in view of the many externalities involved.

In their paper *Education as a factor of awareness development of organic product consumers* **Tomi *et al.*** state that for developing a habit of consuming organic food it is necessary to educate the younger population so that they can get accustomed to the fact that organic food is a source of both human health and a sustainable environment. The main objective of the paper by **Contò *et al.*** *The role of education, knowledge an human resources for the agricultural development in the perspective of the new cap: a hypothisis of change in Basilica* is to verify the role of investment in human resources and, consequently, in services for the agricultural development for the dynamics of rural development, trade and international cooperation of agribusiness.

The now following papers can be attributed to level 2 of social analysis, the level of the institutional setting for agriculture and agribusiness. The complexity of India's institutional environment of the agricultural sector is addressed in **Raghothama *et al.*** *(Disentangling the complexity of India's agricultural sector).* It is shown that the connection between policy making and societal structuring is complex and can be scientifically assessed using gaming as an instrument. aim of the paper of **Bremmers *et al.***(*Legal-Economic barriers to price transfers in food supply chains*) to identify the factors which affect the smooth pricing of foodstuffs in the European Union and define policy alternatives to improve it. a knowledge-based economy intangible assets are indispensable to achieve competitive advantages. Resources like intellectual capital are perceived as crucial factors especially for regional growth. Intellectual capital is comprehended as a multidimensional concept, defined and explained in many various ways, depending on the context and further application. The article of **Bronisz *et al.***(*The assessment of intellectual capital in Polish regions*) considers the role and the importance of intellectual capital for regional development and competitiveness in Poland. authorities face the challenge to strike a fair balance between the interests of consumers to ensure the safety of innovative foods and agricultural products and the interest of innovative businesses. Worldwide prior authorization schemes are applied. The contribution of **Van der Meulen and Szajkowska**(*Regulatory challenges of innovation in food and agriculture*) characteristics, pros and cons of such schemes. It identifies concerns but also best practices that may contribute to improving food safety without unduly hampering innovation.

Level 3 in the social analysis typology of Oliver Williamson concerns governance such as contracting arrangements, the transaction costs thereof, or alternative methods of supply. The governance mode which is chosen in food supply chains is dependent on the network setting. In *Green networks: innovative capacity of SMEs in the Dutch greenhouse horticulture industry* by **Schout and Harkema** the effects of collaborative networks on the interplay between innovation in new production systems, automation, energy consumption reduction and scarcity of factor availability is addressed. Transactions on agricultural markets, investments and stakeholder participation are influenced by available accounting information. In the paper by **Burykin *et al.*** (*The development if integrated accounting in small and medium-sized companies in the agri- and food sector of the Russian Federation)* a research outline is proposed to improve accounting systems, to be able to evaluate business results and improve decision making at internal and external markets. In *Complex problem analysis of Hungarian dairy farm*s by **Blaskó *et al***., idea sharing on the organisation of the Hungarian dairy sector and its development was put central. *Externality effects of honey production*, which positively contribute to welfare and sustainability but cannot be traced back to higher prices, were put central in the article of **Ványi *at al***. (*Externality effects of honey production*), while the effect of contractual arrangements between farms and agribusiness were reviewed in the contribution of **Dries** *et al.* (*The role of agribusiness in stimulating on-farm investments – case study of the Armenian dairy sector*). The functioning of the Hungarian labour market is described by **Nagymáté** (*Labour market attributes of disabled people in Hungary*). She shows that rehabilitation firms provide a positive contribution to the functioning of the labour market for disabled people.

Level 4 concerns the factors that influence the allocation of resources that in turn affects business and social performance. Resource allocation is preceded by the gathering of information on factors that contribute to value added. An application to the sheep sector is described in **Cehla and Kovacs**' *Analysis of the influential factors on gross value added in the Hungarian sheep sector*. Certainly one of these factors is the economic crisis that makes it harder for companies to finance and organise their business activities. In *The global financial crisis: implications for capital to agribusiness* **Ahrendsen** goes deeper into the financing problems which occur. These appear to be milder in the US than elsewhere, because of the sound financial position of US farm businesses. In *Impacts of the global financial and economic crisis on the agro-food industry and rural livelihoods in Serbia* by **Bilali *et al.*** it is elaborated - from a Serbian perspective- that the government should play

a prominent role in mitigating the crisis effects, by means of subsidies, improvement of access to market information and credits to finance investments. In rural areas of Hungary small farms are threatened by the present market conditions, which make it hard for them to compete and survive. In the paper *Semi-subsistence farming situation and policy –the example of Hungary* **Forgács** describes the interplay between farmers' interests and struggles to survive and governmental agencies' efforts to support. Resource allocation decisions have a direct effect on competitiveness. The competitiveness on a sector level is reviewed by **Jovovic**' *Competitiveness of the Montenegrin fruit and vegetables sector and recommendations for improvement*. Research on innovation and its results can improve resource allocation decisions and in doing so contribute to social and economic welfare. **Takács-György** analyses the economic factors which influence the adoption of new technologies in agriculture in *Economic aspects of an agricultural innovation – precision crop production*), while marketing innovation is addressed in **Losó** *et al***.** (*Comparison of the performance of a trained and an untrained sensory panel on sweetcorn varieties with the PanelCheck software*).

All in all, a wide variety in topics are included in this special congress issue of Apstract. The different contributions express the similarities, differences, opportunities and joint problems of the agro-sector in western and eastern Europe.

This special issue would not have been accomplished without the help and assistance of many people. We thank the contributors to keep to the time schedule in the process of revising their articles. **Moragg Mitchell** from the SAC in Aberdeen did a great job in reviewing and improving the English of some of the included papers, together with the editor's staff from Debrecen, Hungary. **Karen van der Heide and Marian Jonke**r from Wageningen University provided excellent secretarial support and organisation.

The guest-editors:

Harry Bremmers/Johan AC van Ophem
25th November 2011
Wageningen University
The Netherlands

FEEDING THE PLANET AND THE ROLE OF THE COMMON AGRICULTURAL POLICY (CAP)

Prof. dr. C.P. Veerman

former Minister of Agriculture, The Netherlands

Keynote speech held at the Second AGRIMBA-AVA Congress 2011 on Dynamics of International Cooperation in Rural Development and Agribusiness, 23-24 June, 2011, at Wageningen, the Netherlands.

Ladies and Gentlemen,

Indeed I am honoured to address to you at this congress, being the 10th speaker in a row of such famous and eloquent contributors in the traditional series of the former so called "Mansholt Lectures", currently WASS (Wageningen School of Social Sciences) Lectures.

Indeed it is a pleasure to speak about agriculture these days, because agriculture is back. One could even say: "There is no business like agribusiness."

In this light we should ask new questions and try to find new solutions and reformulate priorities.

Sicco Mansholt, one of the most influential founders of the Common Agricultural Policy, surely would have agreed with us. During the last part of his life in which we became friends and partners in contributing to the discussions about the future of the CAP., he was aware of the need for fundamental changes, but also deeply convinced of the necessity of some forms of government interventions in agricultural markets. So here we are now: in a totally changed perspective as was the case at the end of his life.

So what shall we do with the CAP? Although fundamental decisions have been taken in forms and levels of support on quota of milk and sugar, on shifting money from pillar one to pillar two, on modulation and capping all this seems not enough to conclude that a well-balanced system of agricultural policy in the EU is constructed. If we take a broader view on subjects such as climate change, world food policy and energy and the role of agriculture, we are in need of new perspectives. In short: the challenge to make agriculture more sustainable and focus on its contribution to feed the world. I will focus on the challenges for a CAP in the framework of climate change and world food perspectives.

My contribution contains three elements: first some history; second, I give attention to climate change, food production and energy and thirdly, I would like to share with you some thoughts about the future of the CAP.

To obtain the complete picture it is necessary to look at certain facts and agreements that have been made. After the substantial reforms of 1992 (MacSharry) and 2003 (Fischler), subsidies for farmers were in most cases decoupled from production levels, and the most disruptive effects of subsidies on trade were eradicated. Compared with other EU countries, the Netherlands receives a relatively modest level of (decoupled) income support: EUR 800 million for no more than a third of its total agricultural production.

Until 2013, the real value of subsidies paid to individual farmers in the old Member States will fall by some 30%, as these subsidies are linked to a ceiling that was established in 2002 and will only be corrected for inflation at a reduced rate (a maximum of 1%), by applying modulation (transfer of funds from direct farming subsidies to rural development schemes), by paying limited compensation for decreased price support, and

by applying a general reduction in subsidy payments that will be introduced if subsidies threaten to surpass the ceiling ("degressivity").

The 2003 reforms also mean that the CAP's share of the EU budget will fall from the current level of 45% to 39% in 2013. The costs of the CAP amount to no more than half percent of the EU's GNP, or almost 1% of all government subsidies within the Union.

There have been a number of reviews in recent years: a health check on the reformed CAP in 2008, as well as a comprehensive budget review in 2008/2009 which offers prospects for co-financing formulas. Furthermore, in 2009 the discussions on milk quotas were focused on whether we should gradually phase out the current system during the period until 2015.

In my view, a more interesting issue, and one that escapes the focus of current political debate, is the effect developments after 2013 will have on agriculture, the rural area, and the relevant policy.

Let us consider climate change and energy supply. The consequences of the predicted climate change will be radical and manifold an increased risk of flooding in low-lying areas is set against overwhelming drought in other areas; hundreds of millions of people worldwide are at risk of being uprooted, while a rise in temperature of just 2 degrees will reduce the amount of water available to agriculture in Southern Europe

by 20%. And that is not all: dwindling food harvests, particularly in Africa (the population of which will double in the next 40 years) leading to a growing host of starving people, increasing poverty in what are already the poorest countries, and serious damage to ecosystems – a global rise in temperature of 2 degrees could threaten to wipe out between 15 and 40% of the world's species.

The changes wrought by global warming have been explored in various scenario studies. The predictions inevitably come with some degree of uncertainty, but the general picture is that Northern Europe will become warmer and wetter while the south becomes warmer and drier. The shifting of climatic zones will inevitably lead to shifts in crop conditions. As the climate in Southern Europe becomes drier and hotter, the agricultural resources in Northern Europe may become more important for the food supply. In global terms scientists anticipate fewer negative effects for Europe than for other parts of the world. In other words, climate change is a perfect example of a new distribution issue facing Europe. After all, if Europe ends up being one of the major food suppliers to the world in the coming decades, this not only gives us new responsibilities, it also offers new opportunities.

The anticipated change in the climate also underlines the importance of agriculture as a supplier of non-food crops. The volatile price of fossil fuels and the need to reduce carbon emissions have made the extraction of fuel from vegetable and waste matter more economically viable. More energy crops are grown than ever before, and much investment has been poured in processing them. On a world scale interest in the production of ethanol and biodiesel is enjoying unprecedented growth. Although of course crude oil prices are volatile. One thing is for sure: exploration and exploitation are facing increasing costs and political uncertainty.

But it is not just for the sake of energy that vegetable products are enjoying resurgence. They are also prized as a source of new sustainable materials. This could cause tension in the market for raw materials between energy and food use. The competition between food, feed, and non-food uses will intensify. Concepts like "bio refineries", where waste materials and vegetable matter could be processed, will take on increased significance. Total waste of food and food products in the Western World amounts to 25% of total production. And if the mineral issues surrounding waste from the fermentation process can be resolved, it would provide an additional impulse for this form of environmentally- friendly energy production. Also the cultivation of woody crops for use as fuel, either directly, or by means of fermentation could present possibilities.

The second relevant trend I want to address is the global demographic development and the burden it places on the environment, particularly through water consumption. The United Nations estimate that the world population will reach around 7.8 billion by 2025 and 9 billion by 2050. That is an increase of 50% in 50 years. The population of Europe is not growing and is ageing rapidly. These two facts have very significant repercussions for the world's future food demands, in terms of both quality and quantity. If we add to that the strong economic growth and associated rise in incomes in emerging economies, such as China and India, and the empirically established stable relationship between standard of living and the consumption of animal protein, we must conclude that the demand for higher quality foods (and so for sheer volume of original biomass) will increase sharply. This in the face of the fact that nearly one billion people are undernourished.

We should further more bear in mind the following relevant facts:

- Productivity growth in agriculture in the period 1960–± 2000 was about 3% p.a. in the most recent decade about 1% p.a.
- About a more than 70% increase in food production in the coming 40 years is needed, which is considered more difficult than the 150% growth in the past 40 years.
- In developing countries about 30-40% of the harvest is lost in the post-harvest process.
- The so called 'land grabbing' in Africa already amounts to more than 65 mln hectares (30 times the agricultural land of the Netherlands).
- Productivity differences over the globe are enormous.
- Available fertile land is bounded, a potential increase in use of 25-30% will seriously harm biodiversity and enhance climate change.
- And last but not least one should be fully aware of the essential dependence on fossil fuels of modern agriculture (causing a forward loop to climate change) and the depletion of the stock of vital minerals.

Without a doubt, our efforts to reduce hunger in the world – a positive thing in itself – have taken their toll on the environment and the soil through erosion, salinization, desertification, mineral saturation and deforestation. The highest price has been paid by the environment and soil in the developing countries. According to a report from the US research organization IFDC, erosion threatens to reduce harvests in Africa by 17% to 30% in next 15 years. In particular areas there has been a huge loss of biodiversity. This can threaten the existence of ecosystems and lead to the permanent loss of genetic resources.

Water consumption is another factor: global freshwater consumption is doubling every 20 years. At this year's Fourth World Water Forum in Mexico, all the facts pointed in the same direction: water is becoming such a scarce commodity that it will increasingly become a source of conflict. Let me give some examples from agriculture: farming accounts for 70% of all water consumption: half the food is produced by supplying water by artificial means. One thousand five hundred litres of water are needed to produce one kilo of wheat, while the production of one kilo of beef requires 15,000 litres. Europeans consume an average of 700 m^3 litres a year, Africans less than 200 m^3. And we must also take into account the problems of drinking water quality and its associated consequences for people's health.

Here, too, in addition to absolute scarcity, we see a major distribution problem. The rich developed countries in the west have consumed much of their natural resources or brought them within their sphere of influence, and emerging economies like India and China are rapidly following suit. The moral question that arises here is, whether we are entitled to dispute their right to strive for similar levels of prosperity in the light of this scarcity of resources. And whether we would be prepared to compensate for the ensuing ecological damage.

A third trend is globalization and liberalization. There is little doubt that globalization has increased over recent years, and the trend is likely to continue as modern technologies are making this possible. Emerging economies in Asia and South America will play a leading role in markets of labour-intensive agricultural and industrial products and raw commodities. Europe is bound to feel the consequences, as it already does, with, for instance, clothes, shoes and poultry meat, and there is more to come. It will also happen in areas where my country is a prominent player, such as floriculture.

Globalization and liberalization go hand in hand. The question of whether liberalization is deemed desirable is, in my opinion, less relevant than the question of whether it is possible at all to stem the tide. It is more relevant, I believe, to consider the manner, pace and conditions employed to realize liberalization and market access, including access to the European market, so that there is sufficient time for adaptation, phasing out and development to take place in an orderly fashion. And even more relevant is the question of whether globalization and liberalization can be supported by new, institutional arrangements at an international level. Studies have revealed that without accompanying measures the industrialized countries would benefit most from the positive effects, instead of the poorest countries where it is most needed. That is why we should guarantee institutional support for the market processes taking place at international level as we do for our own liberal market economy at the national and European level. At international level too, where markets do not work as they should, governments should intervene and control. This is true for competition policy as well as for areas like the environment, health and safety, working conditions and animal welfare. So if we intervene in our national economics for these purposes, why then not at international level? Why is international intervention seen as trade distortion and not as a corrective measure for a failing market? In other words, why not internalize the negative external effects of private economic acts and really work towards the best possible prosperity? In global integration processes accompanied by trade liberalization or the abolishment of national rules, new rules and institutes are set up to correct market failings, and monitor the public interest. Freedom and responsibility cannot be divorced. To put it in the words of Gandhi: Business without morality is a sin against society. And since the financial crises we are once again being convinced of the wisdom of these words.

The emergence of the new economic superpowers in Asia and the developments in Central and South America have their impact on the global trade agenda; people in those countries have a different view of the liberal ideology of free trade from people in western countries. But here too the belief in neoclassical liberalism is waning and people are seeking a fuller and more open concept of freedom and prosperity. Liberalism does not automatically lead to the realization of the values desired by society. What I see is that people in society are increasingly placing value on quality, the quality of food and the quality of food production. Food quality of our lives; preferences are increasingly fanning out in all directions, they are getting more diverse and more unpredictable. One moment a good glass of wine and a delicious meal and a fast food snack, the next.

There is another important aspect linked to issues of food: food quality in relation to public and animal health. Obesity and its health consequences is an example of a growing problem that places a substantial financial burden on society. The same is true for animal health: raw commodities from all over the world, mixed into animal health feed, may pose a threat to both public and animal health on account of the wrong composition, inferior raw materials and migrating pathogens. Stringent quality requirements and adequate enforcement throughout the production and marketing chain are therefore imperative and require substantial outlays.

One thing is clear: the concept of quality (which traditionally referred to a product's physical characteristics) is being re-defined and fleshed out. In addition to a product's characteristics – whether it is nourishing, tasty, wholesome – there is a growing interest in production methods: the use of pesticides, aspects of animal welfare manufacture, the use of additives, and so on. The story behind a product increasingly becomes a matter for consideration for the consumer. This is translated into market demand and entrepreneurs with a vision respond to this.

This brings me to the fourth and final trend I would like to address: the greater value people place on the conservation and strengthening of regional identity, on an attractive and living countryside and on animal welfare. A trend I would like to summarize as care for the quality of life. The widely felt need to be in touch with the authentic, peaceful and familiar countryside forms a counterpoint to the hectic life in an urban environment. Recent studies indicate that people living in the countryside feel less stress and live longer in the average. It is the need for relaxation, for experiencing nature, space, simplicity and the quest for one's own sources of life. These needs are growing and are to a large extent determined by levels of prosperity. If I am not mistaken, the re-evaluation of the countryside, a trend that is most prominent around strongly urbanized regions, will continue. I expect that interest in the countryside and what is going on there in terms of nature conservation and rural development will grow, not only in densely populated regions but I foresee that it will also spread to regions beyond. The car is a symbol of the freedom to move around and the bicycle as a means of recreation are closely related to this.

Care for the quality of life is not restricted to human life: it increasingly includes animal life as well. When a couple of

years ago, in front of a gathering of parliamentarians from several Member States I remarked that after the emancipation of workers and women we were now on the eve of the emancipation of animals. I was greeted with howls of derision from some. But who in our country would dare to deny that the care for animals is not a topical and emotive theme? Recently a fierce debate in Dutch Parliament started about practices of ritual slaughtering. And this trend will continue: didn't Kant and later Gandhi say that the greatness of a nation and its moral progress can be judged by the way its animals are treated? The challenge is to link this to consumer purchasing behaviour. Transparency and cooperation in the production and marketing chain are vital here. Enforcement with its associated costs is part and parcel of this.

We are facing huge dynamics of global developments. And in this maelstrom of events the European Union and its individual Member States should reconsider and redefine their position. What does all this mean for Europe? The shifting of climatic zones and the scarcity of water that will affect many parts of the world will change conditions in many farming regions. The demand for food and other agricultural products will simultaneously change dramatically over the coming decades and agriculture will have to realize the fuller concept of quality.

At a more abstract level it comes down to finding new balances in the triangle formed by people, profit and planet. The widely used concept of sustainability is sometimes unjustly reduced to the balancing of profit and planet or profit and people. But the essence of the issue is finding a new point of gravity in the triangle born from the new realities and priorities in society. Particularly the priorities based on the values we wish to respect and found our actions on. Therefore the issue is not merely a technical one, a matter of finding a way to extend our triangle, but also involves a moral choice: what do we wish to emphasize? Sustainability is about ethics. For the technical side of the issue the development and application of knowledge is vital. I believe that in the future agriculture will increasingly be a knowledge-based sector.

Farmers will have to deal in a more efficient way with raw materials, soil, water and air and will continually have to meet society's requirements for animal welfare, landscape and food quality. Europe is also in a position to be a leading player in the global food market of the future. Our highly developed farming sector can benefit from the old economic law of comparative advantage. I see great opportunities for the further development of sustainable, socially responsible agricultural entrepreneurship. It is important to acknowledge that using the best technologies and intensive production on highly fertile land is the best contribution to feed the world population and contribution to natural conservation and safeguarding biodiversity. Or as my friend and colleague Prof. Dr Louise Fresco puts it: good agricultural practice and new cropping and life stock systems in order to intensify agriculture on the most productive lands reduce the pressure on natural ecosystems

Innovation and developments in technology can make substantial contributions towards resolving the global problems. And it is here, in Europe, where the opportunities lie. Not only traditional technological innovation, but biotechnology in its various forms also opens up interesting and promising perspectives. I need not go into them here, but I would like to point out to the other side of the technological breakthroughs: the social concerns that is evident throughout Europe for the long-term consequences that the implementation of these technologies may have on biodiversity and natural ecosystems. There is also the ethical issue about the extent to which boundaries are being crossed. The co-existence debate on the simultaneous and neighbourly existence of genetically modified, conventional and organic crops is a case in point. EU countries have fundamental differences of opinion on how to deal with this.

The opportunities provided by the new technologies may be promising but some, like modern biotechnology, also give rise to new dilemmas. The challenge lies in overcoming these dilemmas for the sake of global needs, particularly in areas like food, and the environment, and deal with them wisely. I expect modern technology will increasingly become part of our lives, even if the scope and manner of their implementation will differ according to region. There is also a difference in the degree to which these new technologies find acceptance: they are more readily accepted for bio-energy and medical purposes than they are for food. Transparency by labelling products is necessary to allow consumers to make an informed choice. But here too, enforcement and controls are equally necessary and will bring more costs to society. The debate in this will go on for some years before a political decision is taken mostly influenced by the fact that GMVs are everywhere present in the meantime.

I believe it is crucial that our policies meet the demands of society. When the CAP was designed in the 1960's the focus was on production volume to ensure our own food supplies and savings on foreign exchange. As time moved on, we have successfully shaped and adapted our common agricultural policy to meet the circumstances and needs of the times. The development of a "second pillar" of rural development policy, and the reforms of the past then to fifteen years demonstrate this. But I also want to mention the enlargement of the EU with 12 new Member States from central and Eastern Europe which at once tripled the number of European farmers from 5 to 15 million and greatly increased the various stages of agricultural development in the Union and the variety in landscapes and biodiversity.

Finally I will attempt to outline some elements of a new common policy for the European rural area so for a common European rural area policy a CRP. I think we should start our reflection on the basis of the following question: What will be the *function* of the European rural area in the coming years? I see four main functions for the rural area, which to some extent overlap. In the first place I see it as a production space to secure the production of high quality food and raw materials for food preparation, renewable raw materials and

energy. Healthy primary production of these products, suited to local circumstances, linked to processing and marketing sectors supported by high quality technology is essential for the stability and welfare of Europe. In an unstable world, Europe should at least attempt to avoid too great a dependence on other countries for the provision of its food. It is possible to imagine scenarios in which the strategic aspects of food security will play a greater role than we ever could have dreamt of. In this context, the question of whether some form of border protection for the most important products should be maintained for reasons of internal stability, for instance to prevent disasters, should be answered in the affirmative.

To meet the extent and type of needs a combination of activities and different sorts of processes are necessary. This will result in the emergence of a large number of "new mixed farms", combining plant and animal production and geared to energy efficiency. Europe's high level of knowledge and technology will make it possible to develop totally new combinations of businesses and processes.

This whole process is primarily market-driven. The role of the government, whether at national or European level, will be to lay down the conditions, facilitate and forge links. The government will place limits on developments based on its public duty of care, for instance regarding the environment and animal welfare. It will also enforce the quality requirements, possibly by supervising private systems to control the sector and services, both during production and on import and export. The government role should be restricted to support knowledge development and dissemination and support entrepreneurship with education and research and to create a favourable business climate for entrepreneurs and innovative developments. And also by allowing scope for experiment and robust legislation and limiting the administrative burden. In view of a perspective of higher volatility of prices as a result of less governmental stabilization, new instruments like future trade systems in order to reduce the ups and downs of incomes and prices should be facilitated by the EU.

This development will be concentrated in those regions and in those businesses which have the most suitable conditions. Market forces will be decisive and the government's role is aimed at promotion, setting frameworks and protecting the collective values. There can be no principal justification for supporting the incomes of primary producers apart from that. As the situation in 2013 from a political point of view will not lead to a complete abolition of income support, it is more sensible that some form of dismantling scenario, perhaps in the form of bonds, will be developed. But I believe that any dismantling scenario would be limited in size and expensive. Also in its first phase the Common Agricultural Policy was partly aimed at discouraging over-hasty migration from the countryside to the city. This issue is still current in the new Member States and it is therefore important to pay special attention to it. Let us not forget with accession of the 12 new Member States the number of farmers has risen from 5 to 15 million.

In the second place I see the rural area as production space for collective or semi- collective goods and services. These would include the stewardship of nature and landscape values. Intrinsic values that merit the care of public or private bodies to be secured for the future. These values enjoy protection on the basis of international treaties or because of their wider significance for welfare in general. I refer for instance to health, clean air, and not least to fixing of CO_2. They are values that form part of a cultural heritage of which we can be proud and they are often significant for the identity of specific regions or communities. In that sense they are useful public commodities which require collective involvement and an institution-based structure. These are primarily interests that go beyond the interests of the individual Member States. A common approach will also increase effectiveness. Farmers can play an important role being stewards of these values. As far as income support is necessary to realize these goals, targeted payments are the right and more effective form.

The third function of the rural area can be found at the point where the two previous functions meet, that is the production of food and renewable raw materials in regions or under production conditions that are not optimal because of natural circumstances such as type of soil or lack of water, or because of restrictions imposed to protect other values or interests such as nature or valuable man-made landscapes. Within the Union this will in practice involve sizeable areas with very diverse limitations. This is the category for which it is most difficult to decide what is "just", to decide to what extent and in which form public funds can legitimately be used and to provide this effort with durable public support.

Legitimization of the public contribution derives from the public interest associated with continuing these production activities that is if they contribute to the production of social values, such as preservation of characteristic, valuable landscape, keeping communities viable, or combining agricultural activities with nature conservation or development. One important precondition is that this does not involve constructing a large central bureaucratic control mechanism. Local and regional co-financing is the best guarantee for proper behaviour and quality control by those people directly involved and closes vicinity of co-financiers. I believe that there must also be some combination of regional and European funds, in other words co-financing.

The extent of co-financing should be based on the extent of a broader European interest; it should be aimed at a longer period through contracts with the entrepreneurs involved and be based on a reasonable payment in the form of income support. A mechanism to determine a "just" amount for income support, decoupled of course from production, could take the form of an auction, based on scientifically developed methodology and practical experience. I do not underestimate the difficulties of implementing such a system, but it is absolutely necessary to acknowledge the essential role farmers play in preserving a versatile and energetic countryside. A study by a task force of RISE directed by Prof. Allan Buckwell shows very interesting possibilities on

this issue. Valuable work has also been done by several authors of this great university and research centre here in Wageningen.

The second and third functions I have identified have gained in importance and will continue to do so, because of the umbrella function of the rural area as consumer space for a busy population with little time to spare. I would like to point out the potential of the rural area to provide city-dwellers a taste of the good life; to experience peace and space and a feeling of freedom.

Enjoying authentic, regional products. To feel that you are taking part, even for a moment, in another life. To experience the feeling of the authenticity of "the rich, uncomplicated thinking of the carefree country-dweller". Relaxation in the enjoyment of peace and wonder for the unknown, to co-exist with other living beings. Or enjoying the sensual refreshment and deepening spiritual experience in the midst of others: nature, that fascinating world around us. The world outside us that for centuries has been the source of inspiration for writers, painters, poets, musicians and scientists; and becoming a citizen and participant of that world again.

In the wording of one of the romantic poets:

I wandered lonely as a cloud
That floats on high o'er vales and hills,
When all at once I saw a crowd,
A host, of golden daffodils,
Beside the lake, beneath the trees
Fluttering and dancing in the breeze.

The waves beside them danced but they
Out-did the sparkling waves in glee: –
A poet could not but be gay
In such a jocund company:
I gazed -and gazed -but little thought
What wealth the show to me had brought.

For oft, when on my couch I lie
In vacant or in pensive mood,
They flash upon that inward eye
Which is the bliss of solitude;
And then my heart with pleasure fills
And dances with the daffodils.

William Wordsworth

I believe that the importance of this function of the rural area will grow. The European economy will change considerably in the direction of services, knowledge and leisure economy. Demographic developments will enhance this trend.

Life is getting faster; as demonstrated by people who experience burn-out at an early age, and those who want to take early retirement. These are the characteristics of the changes in our economic and social life. In addition there are groups in society that feel excluded, or under threat of social exclusion. Urban issues are increasing. The necessity of exercise to reduce health problems is obvious. The rural area as consumer space for relaxation, recreation and leisure experience offers many opportunities for rural entrepreneurs. A broad range of activities, whether or not farming, gives rise to what is known as diversification or multifunctional agriculture. A new meaning can be given to farming life by taking on care services at the farm, to help give life more meaning to people with a handicap.

I see it as the government's role to facilitate this process and draw up its framework. The suitable regulation and scope for manoeuvre has to be developed primarily at local level. European authorities, having placed support for broad rural development in the second pillar, and planning to expand this, should concentrate on supporting those entrepreneurs who are willing to provide this sort of service, perhaps with limited co-financing schemes, in order to supplement income not provided by the market. But the most important element for successfully developing these activities is in my opinion: give room to entrepreneurship.

Discussions on how the future common agricultural and rural development policy should be designed are often reasoned on the basis of the budget or WTO ambitions and rules. I think the WTO negotiations are nearly dead, due to strongly increased and unforeseen drawbacks of the galloping globalization and deregulations like the financial crises and the food crisis.

I would make a plea for an approach that has at its heart the functions of the rural area and the significance of the rural area for the people of Europe. I feel that this is the only sound principle for a meaningful debate on the development of common policy in these areas.

This view highlights the need for a changing role for government: now and in the future this will no longer involve supporting production, but supporting development in various directions. That will also demand a fundamental reflection on the relationship between Member States and the Union: the region, rural inhabitants and entrepreneurs are the drivers of development. The government will have to create scope where possible and provide support where necessary. It is an opportunity to subject the subsidiarity principle and the proportionality principle to critical review and perhaps adapt the co-financing system to it. Would it not be more sensible, reasoning from the perspective of the four future rural area functions outlined above, for the EU to co-finance national agricultural and rural area policy, instead of the other way around, as is now the case?

Finally

But what about the interim period, between now and 2013? How can we prepare for these developments? I think that in the first place Europe should reach a common vision of where the future challenges lie. We have to agree on this, and only then will we have a sound base for the new road to be taken, and only then other choices can be made. This will

involve the growing awareness that the old policy will gradually die down, as illustrated by the current discussions on milk quotas. In the coming years government must be in the vanguard of these discussions, provide clarity and where necessary develop policy to ease the transfer to a new situation.

Financially the repercussions of the economic and financial crisis will strongly limit the increase of the budget. Of the budget of the EU surely the euro crisis will enhance the pressure even more. On top of that new policy priorities like energy, climate and infrastructure will demand substantial means. So the budget for the CAP will become under serious pressure. It is not to bold to expect a 10 to 20% cut will be the target for the next budget period after 2013. The preparation for this budget period will take place under the presidency of Poland and Hungary and after the Lisbon Treaty the EP has gained substantial influence on the budget. This will surely be of influence on the discussions for the CAP budget and the future policy for the rural areas because of the huge structural problems the farming sector in Member States like Romania, Bulgaria and Poland. The new Member States being at the top of their income support schedule in 2013 will not be inclined to accept radical cuts right after that moment. So my conclusion on this is: the pathway of gradually changing the CAP and the bring-down of the budget will be the most likely outcome of the undoubtedly intensive debates in the years to come. But the most important challenge for the future CAP is, so I tried to make clear today, that we develop a new vision about the future of the rural areas in Europe based on their functions in the 21st century.

Or to say it in the wordings of a Dutch proverb: If you do not know where to sail to, every wind will suit you. It would indeed be a pity if the winds of change caused by immense global problems and of course more specifically the actual problems of the monetary union would not be used by responsible politicians to sail on the compass of a sound and inspiring vision of the future of the land and its people and every living creature that dwells there. So we are very much in need of visionary politicians like Sicco Mansholt and dedicated scientists.

Ladies and Gentlemen, we face a great endeavour to contribute to wise and sound decisions. All we need is courage, vision and above all trust. I do wish you a fruitful congress.

POLICY CHALLENGES FOR FOOD, ENERGY AND ENVIRONMENTAL SECURITY

Nábrádi, András & Popp, József

Abstract: Limited land is available globally to grow crops for food and fuel. There are direct and indirect pressures on forests and other lands to be converted from growing food for feedstock to be used for biofuel production. The balance of evidence indicates there will probably be sufficient appropriate land available to meet demands for both food and fuel, but this needs to be confirmed before global supply of biofuel is allowed to increase significantly. There is a future for a sustainable biofuels industry, but feedstock production must avoid encroaching on agricultural land that would otherwise be used for food production. And while advanced technologies offer significant potential for higher greenhouse gas (GHG) savings through biofuels, these will be offset if feedstock production uses existing agricultural land and prevents land-use change. GHG savings can be achieved by using feedstock grown mainly on marginal land or that does not use land, such as wastes and residues. To ensure that biofuels deliver net GHG benefits, governments should amend, but not abandon, their biofuel policies in recognition of the dangers from indirect effects of land-use changes. Large areas of uncertainty remain in the overall impacts and benefits of biofuels. International action is needed in order to improve data, models and controls, and to understand and to manage effects.

Keywords: Food, energy, environmental security

Introduction

Human population is projected to grow at 70 million per annum increasing by 35% to 9.1 billion by 2050 (FAO, 2009). This increased population density, coupled with changes in dietary habits in developing countries towards high quality food (e.g. more consumption of meat and milk products) and the increasing use of grains for livestock feed, is projected to cause the demand for food production to increase by 70%. The increase in production has to happen at the same time as the climate is changing and becoming less predictable, as greenhouse gas emissions from agriculture need to be cut, and as land and water resources are shrinking or deteriorating. The provision of additional agricultural land is limited, as it would have to happen mostly at the expense of forests and the natural habitats of wildlife, wild relatives of crops, and natural enemies of crop pests. Furthermore, a higher proportion of agricultural land may be used industrially to produce biofuel or fibre instead of food. Thus, we may need to grow food on even less land, with less water, using less energy, fertiliser and pesticide than we are using today. Given these limitations, sustainable production at elevated levels is urgently needed. Increasing productivity on existing land is by far the better choice.

1. Food security

The food crisis in 2007/2008 and 2010/2011 caught the world by surprise. Do we now expect a new policy paradigm from open markets to protectionism, from food security to self sufficiency, from imports to outsourcing (land acquisition) and from private to public market intervention? More recent transnational land deals are partly a consequence of the larger changing economic valuation of land and water. Higher agricultural prices generally result in higher land prices because the expected returns to land increase when profits per unit of land increase. Given that the food price crisis has increased competition for land and water resources for agriculture, it is not surprising that farmland prices have risen throughout the world in recent years.

An increasing number of countries are leasing and purchasing land abroad to sustain and secure their food production. Food-importing countries with land and water constraints but rich in capital are at the forefront of new investments in farmland abroad. Some agreements do not involve direct land acquisition, but seek to secure food supplies through contract farming and investment in rural and agricultural infrastructure, including irrigation systems and roads (*Braun and Meinzen-Dick,* 2009).

These include the acquisition of 690 000 ha of land in Sudan by South Korea, and around 320 000 ha of Pakistani land by the United Arab Emirates, as well as a pending Saudi request for 500 000 ha of Tanzanian land and Chinese attempts to secure more than one million hectares in the Philippines. A major evolution from past patterns is the transition from overseas profit oriented investments for tropical cash crops to farmland acquisition for growing basic staples, with an eye to bolstering a country's food security *(Table 1)*.

Although additional investments in agriculture in developing countries by the private and the public sector should be welcome in principle, the scale, the terms and the speed of land acquisition have provoked opposition in some

target countries (the Philippines, Madagascar). Well-documented examples on these developments are scarce. The lack of transparency limits the involvement of civil society in negotiating and implementing deals and the ability of local stakeholders to respond to new challenges and opportunities.

Table 1. Transnational land acquisition, 2006-2009

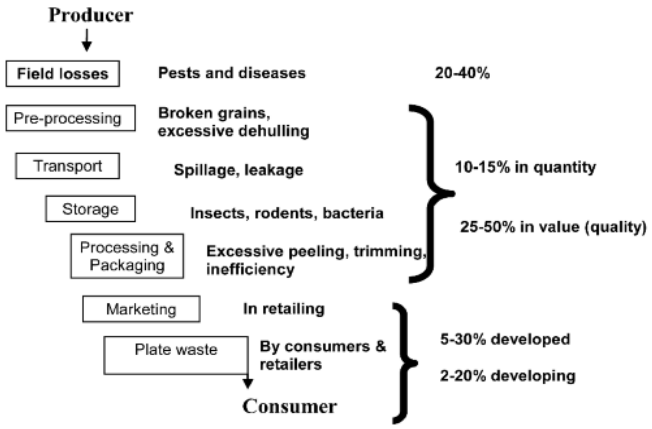
Country investor	Country	Plot size (hectares)
Bahrain	Philippines	10 000
China (with private entities)	Philippines	1 240 000
Jordan	Sudan	25 000
Libya	Ukraine	250 000
Qatar	Kenya	40 000
Saudi Arabia	Tanzania	500 000
South Korea (with private entities)	Sudan	690 000
United Arab Emirates (with private entities)	Pakistan	324 000

Source: Braun and Meinzen-Dick (2009)

The main concerns today are the declining rate of food self-sufficiency and a growing sense of the potential for disruption to domestic food supplies in an uncertain world (climate change, energy security, safety concerns over imported food, geopolitical tensions and the food price spike in 2008 and 2010). We face a future of food scarcity, with high, albeit very volatile prices both for inputs and outputs. Food scarcity is aggravated by managed trade and lack of finance and eventually also by environmental degradation. More responsibility is needed regarding food trade, and more responsibility in cutting GHG emissions. Well-functioning markets can help to reduce this risk. Domestic food supplies are not less risky than imports (energy), but it is sensible to plan for systemic risks (such as nuclear fallout, port strikes, etc.). We experience food poverty due to a lack of entitlements, not lack of food availability.

If there is going to be enough food at affordable prices for the global population, we may also have to change our food habits and decrease food waste. Globally, an average of 35% of crop yields are lost to pre-harvest pests. In some developing countries pre-harvest losses can go as high as 70%. The conservation of fertile soils, the development of high-yielding varieties and the reduction of current yield losses caused by pests, pathogens, and weeds are major challenges to agricultural production Whilst technology will undoubtedly hold many of the keys to long term global food security, the development and testing of new varieties or techniques takes time. It may be 10 years or more before people see the benefits. However, there is a lot we can do today with existing knowledge. Part of the key is also to avoid waste along the whole length of the food chain. In addition to the pre-harvest losses (35% of crop yields) transport, pre-processing, storage, processing, packaging, marketing and plate waste losses are relatively high too (Figure 1). We can save also water by reducing losses in the food chain. The insects, weeds and microbial pests cause the most problems but research, education and training can play a key role in helping the world lose less after harvest along the food chain.

Helping farmers lose less of their crops will be a key factor in promoting food security, but even in the poorest countries those rural farmers aspire to more than self-sufficiency. They want to improve their livelihoods so as to buy higher quality, more nutritious food and to afford a better standard of living, healthcare and education. So we also need to build the knowledge and skills that will help them earn more for their crops. In an increasingly global food system, this is about quality as well as quantity.



Source: IWMI (2007)

Figure 1. Losses along the food chain

World population growth is the biggest challenge: 75 million more people a year, rising to 9 billion by 2050. Consequently, there is a rapidly growing demand for crop products, including feed with increasing meat consumption. Other major global trends are globalisation, urbanisation and motorisation. With production moving to the most competitive regions, food trade is becoming more liberalised but also more concentrated. Growing energy demand and climate change will also influence food production, with agriculture contributing to emissions; agriculture will also suffer or benefit from changing climates depending on climatic zones. Additional challenges are increasing market volatility, resulting from yield and end stock fluctuations and consumer sensitivity to food quality, safety and price. There is uncertainty regarding the timing and application of innovations as regards biotechnology, nanotechnology, precision farming, carbon sequestration, and information technology. These challenges are aggravated by global irresponsibility, regarding food and energy security, water and environmental sustainability.

There is good potential for new land cultivation in Latin America, Africa and Eastern Europe (Ukraine and Russia). However, new land is insufficient, and either inappropriate because of poor or polluted soils, or difficult to use for food production (due to doubtful property rights and/or poor finance and/or due to government mismanagement and lack

of transportation infrastructure). Moreover, cultivated land is diminishing fast, not just because of expanding deserts, but also because much of it is being lost to urbanisation and motorisation. The addition of some 75 million people every year claims nearly 3 million hectares for housing, roads, highways and parking lots. The main reasons why world food supply is tightening are population growth and accelerated urbanisation and motorisation[1], changes in lifestyles, falling water tables and diversion of irrigated water towards the cities (The Earth Institute, 2005). All this leads to losses in soil availability, quality and use for food production.

By 2050, global food output must increase by about 70% due to higher food demand, changing diets towards high quality food, urbanisation and Motorisation. Urbanisation will double domestic and industrial water use, not to mention climate change and bioenergy production. Without water productivity gains, crop water consumption will double by 2050 *(Table 2).* The water "bubble" is unsustainable and fragile because 7 billion people at present have to share the same quantity of water as the 300 million global inhabitants of Roman times. About 80% of water for food production comes directly from rain, but an increasing part is met by irrigation (IWMI, 2007).

Table 2. Water security

Water use	***Litres of water***
Drinking water	2-5 litres per person per day
Household use	20-500 litres per person per day
Wheat	500-4 000 litres per kilo
Meat	5 000-15 000 litres per kilo
Biofuel	1 000-3 500 litres per litre
Cotton t-shirt	2 000-3 000 litres
Agriculture	3 000 litres per person per day 1 litre per calorie

Source: IWMI (2007)

Both the physical water productivity (more crop per drop) and economic water productivity (more value per drop) have to be increased by investing in rainfed agriculture and irrigation. Water productivity improvement is feasible, but farmers optimise land productivity rather than returns to water, particularly where water is subsidised. We do not know what the adequate incentives are, but farmers in the EU are fighting for a higher irrigation water subsidy without impact analysis of water productivity improvement. Promoting food trade from water rich, highly productive areas to water scarce areas contributes to global water productivity improvement.

To meet world demand the necessary production growth will, to a large extent, have to be met by a rise in the productivity of the land already being farmed today. However, this will be difficult to accomplish as global agricultural productivity growth has been in decline since the Green Revolution of the 1960s and 1970s. Global crop yield increases have plummeted from 4% per annum in the 1960s to 1980s to 2% in the 1990s, and, to barely 1% in 2000 to 2010 (FAO, 2008). Yield increases have generally exceeded areal increases. While substantial expected yield increases in India, the USA, Russia and Ukraine are expected in the future, Europe's role and share as supplier of food to the world is diminishing. The net crop-trade position of the EU-27 can be expected to deteriorate. The EU's capacity to help fight world starvation will be reduced at a time in which food production will decline predominantly in those countries which already have record increasing food import needs.

The sharp rise in prices of basic foodstuffs created extreme difficulty for a large part of the world. Those who have been most affected by the sharply rising food prices are those who spend a larger share of their income on food. One indication of it is the remarkable amount of civil unrest and political instability that happened in 2008 and 2010 in dozens of countries (Ethiopia, Egypt, Mexico, Thailand, Tunesia, Lybia, Syria, etc.), as people were unable to afford basic nutrition. There were also some extraordinary political responses. Much of the world's system of trade in foodstuffs broke down temporarily as food exporting countries moved to limit, or in some cases completely ban exports in an attempt to provide some protection to their domestic consumers (*Krugman,* 2009).

International trade in commodities futures has expanded enormously; food and commodity prices went up very sharply in 2008, and then fell significantly. Trading commodity futures only affects the price to the extent that speculation leads to withdrawal of real supplies, which leads to hoarding. However, that was not the case with agricultural commodities, as food stocks were at record lows at that time. It is not correct that it was a speculative bubble. The rise and fall of commodity prices affected not only commodities with large futures, but those without such as iron ore or oil. Trading commodity futures only affects the price to the extent that speculation leads to withdrawal of real supplies, which leads to hoarding. However, that was not the case with agricultural commodities, as food stocks were at record lows at that time. With an economic slump, the real price of commodities always falls and *vice versa*. The great depression showed a spectacular collapse of agricultural prices. The fall in prices in 2008 was the consequences of a global recession. With the end of crisis, resource constraints plus bad policies has created a major problem for the supply of food in the world. Aside from food prices being still on an upward trend, price volatility is a clear problem. People do not eat only in the long term, they eat every day. High prices from 2008 re-occurred in 2010, which is a very serious problem, as people are very vulnerable to such high prices.

[1]An estimated 40 000 ha of land are needed for basic living space for every one million people added and 20 000 ha of land for every 1 million vehicles added.

The poor have no access to ways of diversifying risk and they have no protection against high food prices. What can be done at this point? One thing is to invest in future food production and this includes both physical and R&D. We tend to think of agriculture as being an economics one on one – market producers and consumers getting the market right. This is true only up to a point. Agricultural production and progress in production depends heavily on public goods, especially R&D. There has been much less emphasis on this research and physical infrastructure for agriculture in recent years largely because people thought these problems were solved. It looks like we have seriously underinvested and need to play catch up (*Krugman,* 2009).

With the end of recession, we are back in a world that has a growing population, growing purchasing power and a growing consumption of foods heavily reliant on cereals for their production. For example, meat uses a lot more basic agricultural production than does the consumption of grain. Water is a concern and so too is the use of potential arable land. When arable land is diverted to non-agricultural uses, it usually raises world GDP, but it also has the effect of reducing the incomes of those already at the bottom of the earning scale. We face a very serious outbreak of human suffering and political instability resulting from a increasing food price of food. There are no such mechanisms in place yet to deal with these issues.

2. Energy security

Energy prices have seen a steady decline (in constant dollars) over the last 200 years. The latest energy price hikes have not even brought us back to the price levels of some 30 years ago. The tragic reality is that political zeal has led governments to keep energy prices as low as possible, thus frustrating most attempts to increase energy productivity. Energy price elasticity is very much a long-term rather than a short-term affair, yet the investments in infrastructure that are crucial to the creation of an energy efficient society are very long term. Creating a long-term trajectory of energy prices that slowly, steadily and predictably rise in parallel with our energy productivity would give a clear signal to investors and infrastructure planners that energy efficiency and productivity are going to become ever more necessary and profitable (*Krugman,* 2009).

There is much debate about the potential contribution of agriculture to renewable energies. The problem is that with existing technology, renewable energies may be renewable, but they are mostly not green. Whether second generation biofuels can escape most of the pitfalls of the first generation is open to doubt, although admittedly they do not use the food component of plants.

Biofuels

Bioenergy covers approximately 13% of total world energy supply. Traditional unprocessed biomass accounts for most of this, but commercial bioenergy is assuming greater importance. Liquid biofuels for transport are generating the most attention and have seen a rapid expansion in production. However, quantitatively their role is only marginal; they cover 2% of total transport fuel consumption and 0.5% of total energy consumption worldwide. Large-scale production of biofuels implies large land requirements for feedstock production. Liquid biofuels can therefore be expected to displace fossil fuels for transport to only a very limited extent. Even though liquid biofuels supply only a small share of global energy needs, they still have the potential to have a significant effect on global agriculture and agricultural markets, because of the volume of feedstocks and the relative land areas needed for their production.

The contribution of different biofuels to reducing fossil-fuel consumption varies widely when the fossil energy used as an input in their production is also taken into account. The fossil energy balance of a biofuel depends on factors such as feedstock characteristics, production location, agricultural practices and the source of energy used for the conversion process. Different biofuels also perform very differently in terms of their contribution to reducing greenhouse gas emissions. Second-generation biofuels currently under development use lignocellulosic feedstocks such as wood, tall grasses, and forestry and crop residues. This should increase the quantitative potential for biofuel generation per hectare of land, and could also improve the fossil energy and greenhouse gas balances of biofuels. However, it is not known when such technologies will enter production on a significant commercial scale.

Liquid biofuels such as bioethanol and biodiesel compete directly with petroleum-based petrol and diesel. Because energy markets are large compared with agricultural markets, energy prices will tend to drive the prices of biofuels and their agricultural feedstocks. Biofuel feedstocks also compete with other agricultural crops for productive resources; therefore energy prices will tend to affect prices of all agricultural commodities that rely on the same resource base. For the same reason, producing biofuels from non-food crops will not necessarily eliminate competition between food and fuel. For certain technologies, the competitiveness of biofuels will depend on the relative prices of agricultural feedstocks and fossil fuels. The relationship will differ among crops, countries, locations and technologies used in biofuel production.

Biofuel development in developed countries has been promoted and supported by governments through a wide array of policy instruments; a growing number of developing countries are also beginning to introduce policies to promote biofuels. Common policy instruments include the mandated blending of biofuels with petroleum-based fuels, and subsidies. The exact contribution of expanding biofuel demand to these price increases is difficult to quantify. However, with increasing oil prices, biofuel demand will continue to exercise upward pressure on agricultural prices.

Modern bioenergy represents a new source of demand for farmers' products. At the same time, it generates increasing

competition for natural resources, notably land and water, especially in the short run, although yield increases may mitigate such competition in the longer run. Competition for land becomes an issue especially when some of the crops (*e.g.* maize, oil palm and soybean), that are currently cultivated for food and feed, are redirected towards the production of biofuels, or when food-oriented agricultural land is converted to biofuel production. Biofuel policies have significant implications for international markets, trade and prices for biofuels and agricultural commodities. Current trends in biofuel production, consumption and trade, as well as the global outlook, are strongly influenced by existing policies. Policies implemented in the EU and USA, which promote biofuel production and consumption, while protecting domestic producers especially in case of ethanol production, typically exert much influence.

Trade policies *vis-à-vis* biofuels discriminate against developing country producers of biofuel feedstocks, and impede the emergence of biofuel processing and exporting sectors in developing countries. Many current biofuel policies distort biofuel and agricultural markets and influence the location and development of the global industry, such that production may not occur in the most economically or environmentally suitable locations. International policy disciplines for biofuels are needed to prevent a repeat of the kind of global policy failure that exists in the agriculture sector.

There are three traditional biofuels options: bioethanol, biodiesel and biogas. Each differs in terms of feedstock source, net energy yield per hectare and investment cost. The net energy yield per hectare with biogas can be much higher than with bioethanol production, provided the entire crop is fermented in the biogas plant. However, bioethanol would come closer to the net energy yield of biogas when cellulose is fermented to alcohol. Additionally, the investment costs are much higher for biogas than for bioethanol.

These differences explain why bioethanol is predominantly produced in countries with an abundance of agricultural areas, such as the USA or Brazil. The analysis of ethanol production from maize in the USA is totally different from that from sugarcane in Brazil due to the availability of land, energy conversion rates and technologies used. In more densely populated regions such as the EU, farmland is more expensive. Therefore, the net energy yield per unit area is more important and, thus, so is biogas production. Additionally, the population density results in more waste from food use and livestock production. The more expensive the farmland – and the more waste and manure available – the more attractive option biogas may become.

The main challenge of the biofuels industry in the coming years is how to cope with relatively low fuel prices. The longer-term outlook for fuel prices however remains bullish. The question for the biodiesel sector will be – how many companies will survive the hard times? An adjustment in production capacity seems inevitable and manufacturers which are part of conglomerates and/or are integrated in the value chain usually have better chances of survival.

The economics of first generation biofuels are location specific – as are environmental benefits. Both the USA and the EU have many of the same players supporting and resisting biofuels growth. The EU appears to be further ahead in raising issues of sustainability, including mitigating the threat to biodiversity, the effect on climate change, and concerns related to food supply. However, these issues are gaining attention on both sides of the Atlantic. The growth of biofuels and the impending evolution to second-generation biofuels present considerable challenges in terms of policy development, trade and certification of sustainability. Heretofore, these issues have been dealt with on a "local" basis; but the time has come to take a global approach as well.

Is there any market relationship between the agriculture of foodstuffs and that of energy? Is there available land? Biofuels are not the primary driver affecting worldwide food prices. However, the role of biofuels in food prices is increasing. At present, feedstock for biofuel occupies just 1-2% of global cropland. Rising population, changing diets and demand for biofuels will increase demand for cropland. The balance of evidence indicates there will be sufficient appropriate land available to meet this demand to 2020, but this must be confirmed before global supplies of biofuel increase significantly. Current policies are not entirely effective in assuring that additional production moves exclusively to suitable areas – and attempts to do so will face challenges in terms of implementation and enforcement. Governments should amend but not abandon biofuel policy in an effort to recognise these issues and ensure their policies deliver net GHG benefits.

An increase in the use of grains for fuel ethanol occurred, mainly due to a higher output in the USA and Europe. Net use of grains for fuel ethanol is about 6%, as ethanol yields dried distiller grains (DDGS) as by-product (F.O. Licht, 2011). The bulk of the worldwide use of grains in alcohol production comprises maize in the USA and China. The share of biodiesel in total vegoils use is around 11%. What about the impact on use of agricultural land? In Brazil, sugarcane is grown on 2.5% of the arable land and 1.5% of arable land is dedicated to ethanol production. In the USA, according to the Renewable Fuels Mandate, 136 billion litres of biofuels will be needed by 2022 requiring feedstock production on up to 15% of total arable land (own calculation). In the EU, by 2020 the 10% of biofuel impact on land use means that 15% of EU-27 total arable land will be used for biofuel feedstock production (EC, 2009).

The development and evolution of trade rules regarding biofuels is becoming a pivotal issue in both the EU and the USA. Europe is questioning biofuel production on agricultural lands. While the USA has more land, it does appear that substantial farmland could be made available in new EU Member States. Otherwise, biofuels will need to be supplied by countries outside the EU. The existence of a global market of food and biofuel requires the development of expertise in building agribusiness systems that are increasingly transnational and sustainable. This global biofuel market will involve more production, compulsory

legislation and the standardisation and certification of the ethanol itself. Market structure has been influenced by policy, so strengthening the market is essential. Stakeholders focus on their local markets first (the concept of "home grown" is attractive) and international investment in biofuels has been limited. Oil prices are largely demand driven, but global recession has led to significant price falls. Investments in alternative energy sources are risky in this environment without policy measures that ensure against major drops in oil prices. Policy is a key to promote sustainable biofuel trade. At present, uncertain classification, a wide range of government measures (tax incentives, tariffs, subsidies), and a web of varying technical and environmental standards do not facilitate trade.

It should be possible to establish a genuinely sustainable biofuels industry, provided that robust, comprehensive and mandatory sustainability standards are developed and implemented. The risks of indirect effects can be significantly reduced by ensuring that the production of feedstock for second-generation biofuels takes place mainly on idle and marginal land – and by encouraging technologies that take best and appropriate advantage of wastes and residues. Sustainable production is being increasingly regarded as a prerequisite for market access. Sustainability certification has three main dimensions: environmental, economic and social. A schematic for certification must overcome the difficulty inherent in measuring and verifying what, in many cases, are aspirations or principles. Certification requires an institutional environment with requirements that can be effectively and consistently implemented, and an organisational environment that supports reliable monitoring and evaluation.

The main initiative for certification of biofuels has come from national governments, private companies, non-governmental organisations and international organisations. Most are in the early stages, while other may come into force in the near term. There is considerable variance in terms of the principles they include and the procedures and organisational processes involved. And most are based on existing systems for the agriculture, forestry or energy sectors. This certification system must cover all biomass (regardless of the end use) and all relevant bioenergy – and it must take a global approach as biomass and bioenergy sources become internationally traded commodities. Systems that focus simply on national or EU-wide implementation, for example, will not help solve major sustainability issues. Additionally, the system must take a holistic approach or risk forfeiting all relevance. For example, if the relatively small quantities of palm oil used for biodiesel production are produced in a sustainable manner, but the large volumes consumed in the food sector are not, all the effort expended would be invalidated. As certification criteria are considered, each country should prioritise the areas of law, production and products, communications, distribution and logistics, and human resources. Higher targets for biofuels in the marketplace should be implemented carefully to ensure these fuels are demonstrably sustainable. Any criterion related to competition, or demanding more than just a reporting obligation, could potentially lead to an infringement of the World Trade Organization (WTO) rules.

Long-term strategy is needed to incorporate biofuels into the energy supply chain. Fixed mandates can amplify price volatility by drawing down stocks. Inflexibility caused by mandates should be addressed: variable mandates would contribute to protect consumers from shocks to food supplies or changes in biofuels mandates and from shocks that increase petroleum prices. A switch to second generation feedstocks is a relatively inflexible commitment: diversion to food is expensive. Biofuels production may increase even in the absence of mandates at oil prices above USD100/barrel. Removing trade distortions and investing in R&D of advanced biofuels will contribute to reducing reliance on fossil fuels without jeopardising food security. However, improved regulation, functioning and transparency of food and fuel policy is needed.

3. Environmental security

Biodiversity losses have accelerated, most notably in the tropics. The depletion of fisheries and fish stocks has continued, and in some cases has accelerated. China's growing appetite for mineral and energy resources in Africa and elsewhere is cause for concern, and India, Brazil, South Africa, Angola and others are all aiming to fuel their high growth rates with accelerating resource extraction, and there is no end in sight to this trend.

In terms of climate change and the overall ecological situation, the picture is even grimmer. By adopting the right policy mix, we can decouple wealth creation from energy and material consumption just as we decoupled wealth creation from the total number of hours of human labour. That was the great achievement of the industrial revolution, and labour productivity has risen at least twentyfold in the course of mankind's last 150 years of industrialisation. Resource productivity should become the core of our next industrial revolution. Technologically speaking, this should not be more difficult than the rise in labour productivity.

We now start to recognise that the (over)exploitation of our entire ecosystem and the depletion of natural resources (the reserve/production ratio of oil reserves is rapidly declining) must carry a price which must be paid today to compensate future generations for the loss (or costs of substitution) they will be faced with tomorrow. Moreover, world population growth by 30% during the next 40 years, causing new scarcities (*e.g.* water) and pollution (*e.g.* CO_2 emission rights), is reinforcing this issue. Corporations in energy-intensive sectors need to start taking future CO_2 prices into account in their investment decisions and public disclosure policies now. Because the scarcity of emission rights has been recognised, an active market has been created in the EU and CO_2 emission rights now have a price; more regional cap and trade markets for CO_2 have been (in the USA), or are in the process of being created.

The EU has taken the political lead in addressing global warming, setting up the European Trading System (ETS) for CO_2 emissions. The USA has given clear commitments to mitigating global warming, and China too has become very serious about tackling pollution, climate change and energy efficiency. Renewable energy sources now constitute a dynamic growth sector, and the Convention on Biological Diversity (CBD) is enjoying increasing visibility in the signatory states which means nearly all countries around the world except the USA.

The foundations for a new wave of growth based on the technologies for a low carbon economy is of great importance. The investments would drive growth over the next two or three decades, ensuring it becomes sustainable. Providing a strong, stable carbon price is the single policy action that is likely to have the biggest effect in improving economic efficiency and tackling the climate crisis. Lord Stern calculated that governments should spend at least 20% of their stimulus on green measures to achieve the emission targets (*Stern,* 2006).

The environmental resource scarcity issues also still look entirely real. Depending on the extent of climate changes, many agricultural patterns may become disrupted, and the poorest countries are the ones most vulnerable in the face of this. In the long term, environmental security is the mirror image of food security, because there is no food without substantial clean water resources, productive soils, and appropriate climate. In turn, failure to tackle environmental degradation jeopardises the future of agriculture and the countryside. Climate change puts all businesses and society at cumulative, long-term risk. The failure of agriculture alone would lead to widespread hunger in developing countries and mass migration of people (half a billion according to the UN), mostly to developed countries.

The search for more environmentally friendly agricultural inputs and practices must continue. Scientists are working to improve the efficiency of photosynthesis, carbon capture, nitrogen fixation and many other cellular processes that boost biomass yields. It may also become possible to plant crops in soils lost to salinisation, and develop genetically modified plants that can grow in marginal or otherwise unusable farmland.

Mankind is directly influenced by the loss of biodiversity. With the extinction of species we lose possibly crucial opportunities and solutions to problems of our society. Biodiversity provides us directly with essentials like clean water and air, fertile soil, and protects us from floods and avalanches. These aspects can all be economically valued. It is a difficult and complex task, but through this valuation it becomes clear how important they are for human well being and economic development *(Table 3).*

Many people are unaware of the speed at which we are using up our natural resources, and that we are producing waste far faster than it can be recycled. It is important to clarify the items of public goods and services with arguments whether or not market failures are linked to the provision of services. Market failure is a crucially important justification for taking measures to protect our landscapes. Corrections in market failures could also be achieved through investments and the provision of payments to reward land managers who provide public goods and services (EC, 2008).

It is important to demonstrate the economic value of ecosystem goods and services. We not only need to know costs, but also to be assured of the benefits. There is increasing consensus about the importance of incorporating these "ecosystem services" into resource management decisions, but quantifying the levels and values of these services has proven difficult.

Our research has revealed a disappointingly small set of attempts to measure and value these services (Amstrong-Brown *et al*. 2009). Chronologically the first is the quantification of global ecosystem services by Constanza *et al. (*1997). Estimates were extracted from the literature of values based on willingness to pay for a hectare's worth of

Table 3. Scenario of the future: 2050

Actual	2000	2010	2050	Difference	Difference	Difference
Area	**million km^2**	**million km^2**	**million km^2**	**2000 to 2010**	**2010 to 2050**	**2000 to 2050**
Natural areas	65.5	62.8	58.0	-4%	-8%	-11%
Bare natural	3.3	3.1	3.0	-6%	-4%	-9%
Forest managed	4.2	4.4	7.0	5%	62%	70%
Extensive agriculture	5.0	4.5	3.0	-9%	-33%	-39%
Intensive agriculture	11.0	12.9	15.8	17%	23%	44%
Woody biofuels	0.1	0.1	0.5	35%	437%	626%
Cultivated grazing	19.1	20.3	20.8	6%	2%	9%
Artificial surfaces	0.2	0.2	0.2	0%	0%	0%
World Total	108.4	108.4	108.4	0%	0%	0%

Source: Braat et al. (2008), Cost of Policy Inaction, OECD, COPI.

each of the services. These were all expressed in 1994 USD per hectare and there was some attempt to adjust these values across regions by purchasing power. The results were that central estimate of the total value of annual global flows of ecosystem services in the mid 1990s was USD 33 trillion (*i.e.* 10^{12}) and the range was thought to be USD 16-54 trillion. To put this figure into some kind of context, their central estimate was 1.8 times bigger than global Gross Domestic Product (GDP) at that time. We should take the figures only as the roughest of approximations – indeed the authors warn of the huge uncertainties involved in making calculations of this kind.

The "Stern Review" parallels "The Economics of Ecosystems and Biodiversity (TEEB) study into the economics of climate change (Stern, 2006). Climate change could have very serious impacts on growth and development. The costs of stabilising the climate are significant but manageable; delay would be dangerous and much more costly. The review estimates that if we do not act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. In contrast, the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around 1% of global GDP each year. Key to understanding the conclusions is that as forests decline, nature stops providing services which it used to provide essentially for free. So the human economy either has to provide them instead, perhaps through building reservoirs, building facilities to sequester carbon dioxide, or farming foods that were once naturally available.

The World Wildlife Fund's "Living Planet" Report demonstrates that mankind is living way beyond the capacity of the environment to supply us with services and to absorb our waste (WWF, 2008). They express this using the concepts of ecological footprints and biocapacity, each expressed per hectare per person[2]. Humanity's footprint first exceeded global biocapacity in 1980 and the overshoot has been increasing ever since. In 2005 they calculated the global footprint on average across the world was 2.7 global hectares (gha) per person[3] compared to a biocapacity they calculated as 2.1 gha per person; a difference of 30%. That is, each person on earth is on average consuming 30% more resources and waste absorption capacity than the world can provide. We are therefore destroying the earth's capacity and compromising future generations.

The study on TEEB is fundamentally about the struggle to find the value of nature. There are about 100 000 terrestrial protected areas on Earth, covering 11% of the land mass of our planet. These protected areas provide ecosystem services and biodiversity benefits to people valued at USD 4.4 trillion to USD 5.2 trillion (*i.e.* million millions) per annum. As a comparison, that is more than the revenues of the global car manufacturing sector, steel sector and IT services sector combined! Calculations show that the global economy is losing more money from the disappearance of forests than through the recent banking crisis, as forest decline could be costing about 7% of global GDP. It puts the annual cost of forest loss at between USD 2 trillion and USD 5 trillion. The figure comes from adding the value of the various services that forests perform, such as providing clean water and absorbing carbon dioxide. But the cost falls disproportionately on the poor because a greater part of their livelihood depends directly on the forest, especially in tropical regions. The greatest cost to western nations would initially come through losing a natural absorber of the most important greenhouse gas (EC, 2008).

The study shows that diversity is crucial for survival and the importance of biodiversity for economic development. It might be possible to substitute some of the ecosystem services by human-made technologies, but the study results clearly show that it is often cheaper to invest in the conservation of biodiversity than to invest in new technologies to substitute the services nature provides for us. Therefore, it is essential for the safeguarding of our natural resources to jointly create a co-ordination of economic interests. We need to give the ecosystem services of biodiversity a market value to create incentives for developing countries to conserve their biodiversity.

Market-based instruments are helpful for giving the peoples of the world a chance to secure the natural resources and secure their livelihood simultaneously. In this context the inclusion of the private sector into the process of conservation and sustainable use of biodiversity has high priority. The goals of conservation and sustainability will only be achieved if the main drivers of ecosystem and biodiversity loss are actually addressed through appropriate intervention and response based on credible valuations. Businesses have to accept biodiversity as the indispensable resource which it is and have to treat this resource with respect and care.

The Global Canopy Programme's report concludes*:* "If we lose forests, we lose the fight against climate change". International demand has driven the intensive agriculture, logging and ranching which have lead to deforestation. Standing forest was not included in the original Kyoto protocols and stands outside the carbon markets. The inclusion of standing forests in internationally regulated carbon markets could provide cash incentives to halt this disastrous process. Marketing these ecosystem services could provide the added value forests need and help dampen the effects of industrial emissions. Those countries wise enough to have kept their forests could find themselves the owners of a new billion-dollar industry (Parker *et al.*, 2008).

Currently, there are two paradigms for generating ecosystem service assessments that are meant to influence

[2] The Ecological Footprint "measures the amount of biologically productive land and water area required to produce the resources an individual, population or activity consumes and to absorb the waste it generates, given prevailing technology and resource management" (WWF, 2008).

[3] A global hectare is a hectare with a global average ability to produce resources and absorb wastes.

policy decisions. Under the first paradigm, researchers use broad-scale assessments of multiple services to extrapolate a few estimates of values, based on habitat types, to entire regions or the entire planet (Costanza *et al.*, 1997). This "benefits transfer" approach incorrectly assumes that every hectare of a given habitat type is of equal value – regardless of its quality, rarity, spatial configuration, size, proximity to population centres, or the prevailing social practices and values. Furthermore, this approach does not allow for analyses of service provision and changes in value under new conditions. By contrast, under the second paradigm for generating policy-relevant ecosystem service assessments, researchers carefully model the production of a single service in a small area with an "ecological production function" – how provision of that service depends on local ecological variables (Kaiser and Roumasset, 2002). These methods lack both the scope (number of services) and scale (geographic and temporal) to be relevant for most policy questions (Nelson *et al.*, 2009).

Spatially explicit values of services across landscapes that might inform land-use and management decisions are still lacking. Quantifying ecosystem services in a spatially explicit manner, and analysing tradeoffs between them, can help to make natural resource decisions more effective, efficient, and defensible (Nelson *et al.*, 2009). Both the costs and the benefits of biodiversity-enhancing land-use measures are subject to spatial variation, and the criterion of cost-effectiveness calls for spatially heterogeneous compensation payments (Drechsler and Waetzold, 2005). Cost-effectiveness may also be achieved by paying compensation for results rather than measures. We have to ensure that all possibilities for creating markets to provide environmental services are fully exploited to minimise the public costs (and the extent of government bureaucracy etc).

Creating markets for environmental services could encourage the adoption of farming practices that provide cleaner air and water, and other conservation benefits. Products expected to generate the greatest net returns are the ones generally selected for production. Since environmental services generally do not have markets, they have little or no value when the farmer makes land-use or production decisions. As a result, environmental services are under-provided by farmers. The biggest reason that markets for environmental services do not develop naturally is that the services themselves have characteristics that defy ownership. Once they are produced, people can "consume" them without paying a price. Most consumers are unwilling to pay for a good that they can obtain for free, so markets cannot develop. Can anything be done other than relying on government programmes to provide publicly funded investments in environmental services?

Governments play a central role in creating markets for environmental services, as has been done for markets in water quality trading, carbon trading and wetland damage mitigation. These markets would not exist without government programmes that require regulated business firms (such as industrial plants and land developers) to meet strict environmental standards. In essence, legally binding caps on emissions (water and carbon), or mandatory replacement of lost biodiversity (wetland damage mitigation) create the demand needed to support a market for environmental services. So-called cap and trade programmes create a tradable good related to an environmental service (Ribaudo *et al.*, 2008).

Mandatory reduction pledges can be experienced in all developed nations apart from the USA. The same is true for project-level reductions in developing countries. Mandatory cap-and-trade programmes have been introduced in north eastern USA and EU. The USA and Australian governments announced that they will also institute a mandatory cap and trade programme to create financial incentives to limit energy use or reduce emissions.

In the case of water quality, it is necessary to establish caps on total pollutant discharges from regulated firms in some watersheds, and issue discharge allowances to each firm specifying how much pollution the firm can legally discharge. In markets for greenhouse gases, carbon credits are exchanged. Contracts also include renewable energy credits and voluntary carbon credits.

No-net-loss requirements for new housing and commercial development require that damaged/lost wetland services be replaced, creating demand for mitigation credits, which are produced by creating new wetlands. In all of these cases, the managing or regulatory entity defines the tradable good and enforces the transactions.

Simply creating demand for an environmental service does not guarantee that a market for services from agricultural sources will actually develop. A number of impediments affect agricultural producers' ability to participate in markets for environmental services. Purchasers may be unwilling to enter into a contract with a farmer who cannot guarantee delivery of the agreed-upon quantity of pollution abatement, wetlands services, or other environmental service. Some markets prevent uncertain services from being sold. For example, the Chicago Climate Exchange does not certify credits from soil types for which scientific evidence is lacking on the soil's ability to sequester carbon. Transaction costs can also undermine the development of markets for environmental services (Ribaudo *et al.*, 2008).

If markets are to become important tools for generating resources for conservation on farms, government or other organisations may have to help emerging markets overcome uncertainty and transaction costs. Government can reduce uncertainty by setting standards for environmental services and can play a major role in reducing uncertainty by funding research on the level of environmental services from different conservation practices. For example, the government can develop an online Nitrogen Trading Tool to help farmers determine how many potential nitrogen credits they can generate on their farms for sale in a water quality trading programme.

While markets have many desirable properties, they are limited in what they can accomplish, even with government

assistance. Public good characteristics that defy ownership discourage markets for environmental services from developing – and prevent the full value of environmental services from being reflected in prices The prices of credits in water, carbon, and wetland markets also may not reflect their full social value, only their value to the regulated community. A national cap-and-trade programme could establish a national market for carbon credits. Others, such as water quality trading or wetland damage/loss mitigation, may be limited to a few specific geographic areas.

Enthusiasm can be observed for green public procurement, linked to certification/labelling, and supported by due information on embedded water/carbon/biodiversity or simply guidance to help public procurers buy less biodiversity harmful goods/commodities. It is a useful stepping stone towards due biodiversity reflective procurement in public sector establishments in due course (schools, hospitals).

"Ecosystems" markets will change the present, economics-only value-paradigm, with winners and losers. As an example, countries and companies with significant carbon-sink potential will benefit. On the other hand, applying the "polluter pays" principle, CO_2 emitters must pay a price for continuing to be able to do so. The concept of limiting (capping), auctioning and trading emission/access/user rights must be further developed beyond CO_2, in scope (*e.g.* water) and scale (worldwide). On the basis of valuing our ecosystems and regulating the access thereto, a market will be created for payment for ecosystem-access entitlements and for ecosystem services. We really need to upgrade our performance metrics. The same is true with respect to human/social capital: also here the metrics, the value of education, culture, social cohesion, etc. should be established and more prominently included in investment/development decisions.

4. Conclusion

Limited land is available globally to grow crops for food and fuel. There are direct and indirect pressures on forests and other lands to be converted from growing food for feedstock to be used for biofuel production. The balance of evidence indicates there will probably be sufficient appropriate land available to meet demands for both food and fuel, but this needs to be confirmed before global supply of biofuel is allowed to increase significantly. There is a future for a sustainable biofuels industry, but feedstock production must avoid encroaching on agricultural land that would otherwise be used for food production. And while advanced technologies offer significant potential for higher greenhouse gas (GHG) savings through biofuels, these will be offset if feedstock production uses existing agricultural land and prevents land-use change. GHG savings can be achieved by using feedstock grown mainly on marginal land or that does not use land, such as wastes and residues (although this may compete with other uses of these materials). To ensure that biofuels deliver net GHG benefits, governments should amend, but not abandon, their biofuel policies in recognition of the dangers from indirect effects of land-use changes. Large areas of uncertainty remain in the overall impacts and benefits of biofuels. International action is needed in order to improve data, models and controls, and to understand and to manage effects. These challenges are aggravated by global irresponsibility, regarding water and environmental sustainability. Finally, there is the challenge of who will pay for agricultural public services provided by land managers that the market does not pay for, such as rural landscape maintenance, environmental protection, biodiversity and animal welfare.

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LEGAL-ECONOMIC BARRIERS TO PRICE TRANSFERS IN FOOD SUPPLY CHAINS[1]

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Abstract: Recent price movements have put food supply chains under pressure. On the one side, upward price tendencies on commodity markets result in higher costs to processing firms. On the other side, these firms are confronted with a strong retail sector that is able to prevent compensation to protect consumers' and own economic interests. Regulatory impediments of European law, especially with respect to foodstuffs, can adversely be utilized as barriers to protect the interest downstream the supply chain. The problem is that legal-economic instruments which can serve to smooth price volatility in supply markets can also opportunistically be used at the expense of the middle-section in food supply chains (i.e., mainly small and medium sized producers). The aim of this article is to identify the legal-economic mechanisms that effect price transfers in food supply chains in the European Union and define policy adjustments to improve pricing mechanisms, while safeguarding the interests of the processing industry. Policy alternatives to improve the smooth functioning of notably intermediate markets in food supply chains are the restructuring of competition law, improved processor information management and creating transparency of value added in the supply chain by means of labelling devices.

Keywords: supply chain, price movements, legal system, food supply

Introduction and objective

Effective price transfers within a supply chain are of key importance for the functioning of a competitive European food processing and procurement system (*cf Ben-Kaabia and Gil,* 2007). Recent volatility in fuel and connected food prices has shown that such transfers encounter barriers within food supply chains. Some of the price movements can be absorbed within the food supply chain, for instance by shrinking profit margins, accounting anomalies, or the exercise of market power invoking a redistribution of costs and benefits over the supply chain actors. Ideally, using economic reasoning, price movements of commodities which serve as input for food production should, depending on price elasticities and with the absence of market imperfections, be translated in changed selling prices. Downward moves of food prices are not only induced by price decreases on world markets for inputs (like of soymeal which is used as feed), but also by increased productivity (*Pelleyni,* 2007), economies of scale, and process or product innovation. Higher wages and profits can be expected if the benefits of such efforts are fully transferred to final markets. The practice, however, is that smooth price adjustments are hindered. As we will argue this is among other factors caused by the legal environment. In this article we focus on legal-economic impediments which hinder pricing flexibility from a supply-chain perspective. In effect we focus on the squeeze of producers in the middle section of the supply chain, (to be understood as producers, not being primary or feed producers). A lot of these producers are small to medium-sized (i.e., maximally 250 personnel).

This paper aims to investigate the legal-economic barriers which are vested in the institutional (i.e. legal) environment which determines the transfer of price movements along food supply chains. Specifically, does the EU food law affect pricing flexibility? If yes, what legal-economic measures could be taken to improve price transfers in food supply chains?

We first define a theoretical framework which enables us to identify the factors affecting price movements in food supply chains. Next we categorize the different barriers which impede on flexible pricing, and provide empirical

[1] This paper is among others based on contributions to EU-projects of the authors. The main source has been the Study on the Competitiveness of the Meat Processing Industry (European Commission, 2011), especially § 2.5, of which the primary text has been supplied by the main author of this contribution. However, the content of this article is a responsibility of the mentioned authors only.

evidence of the adverse effects of the legal system on the smooth functioning of food production, procurement and marketing. Finally we define policy alternatives for improving the pricing of food products along the supply chain and will point at ways to improve the food law system.

Theoretical Framework

Williamson (2000) has pointed out that social phenomena are influenced by and can be studied at different levels: cultural embeddedness, institutions, governance and resource allocation.

At the highest level of analysis, the 'right to food' at reasonable prices stands in moral competition with the prime objective of the European Union of realizing a competitive internal market (*cf Stigler,* 1992).

At the institutional level, neo-institutional economics has pointed out that market imperfections obstruct the smooth transfer of costs and benefits from one actor in the market to another. Market imperfections obstruct the reflection of the real costs and benefits in market prices (*Traill and Konig,* 2010, p. 1612; *cf Kuosamen and Niemi,* 2009). From a neo-classical point of view, conditions to realize effective price movements are not met in practice. Markets conditions would have to be transparent, an abundant supply homogeneous product would have to be available and the market would have to provide free entrance, while un-priced hidden externalities should be absent and property rights well defined and protected. If reality would be constituted like this, the market would generate maximum benefits for society, given the income distribution (*Traill and Konig,* 2010, p. 1612). The role of government would be limited under these circumstances. Perfect market conditions are not met in practice, which makes price volatility not to reflect economic changes. It is not even the aim of European authorities to reach such a situation.

At the governance level transaction costs can impede price transfers from on stage in the supply chain to another. Transaction costs are the costs for acquiring the appropriate information, as well as bargaining and enforcement expenditures which have to be made in the market exchange (*Coase,* 1960). It takes into account contractual in-completeness, contracting costs, and adverse (irresponsible, opportunistic or irrational) human behaviour in explanatory economic models (*cf Doyle,* 2007). The legal system, as a major source of transaction costs in the institutional environment (*Ogus,* 1992) should be addressed to be able to predict market irregularities like incomplete price transfers (see on the structure of the food law system: *Van der Meulen and Van der Velde, 2008; Cacic et al.*, 2007).

At the level of resource allocation, price movements are signals for the (re)allocation of business resources. Full price transfers are defined as follow-up prices in food supply chains that represent the relative weights of the inputs in semi-finished and finished products.

In this article we mainly focus on the effects of European public and private food law on price transfers. The regulatory system is viewed as influenced by cultural norms and standards and to affect contractual arrangements, the functioning of markets and the allocation of resources. As such, it forms the central regulatory system to affect the playing field for businesses. So the regulatory system is a part of the institutional environment that frames the transfer of goods from one actor in food supply chains to another. Legal requirements, rules and regulations can cause market failure, as well as counteract it. The potential of market failure is an intrinsic element of food supply markets, since foodstuffs are credence goods. This means that by ex-ante inspection the intrinsic quality of the food and its marginal contribution to personal utility cannot be assessed. Often the consumer has no idea of the road a foodstuff has taken until it reaches his or her plate. It is a task of the European legislator to oppose the imperfect and or asymmetrically distributed information in supply chains, as information distortions can provoke opportunistic behaviour.

Legal requirements (or their absence) in the food supply chain can increase transaction costs at different stages for all participants. Rules and regulations can have a positive as well as a negative effect on the functioning of food markets. On the one side, rules and regulations provide clearness and a 'level playing field', on the other side the monitoring of compliance and the implementation of rules and regulations contribute to the operational and administrative burdens of actors on the in the food chains (*Heyder et al.*, 2010). Specific legal impediments to market flexibility are addressed in the next sub-paragraph.

Legal Impediments to Pricing Mechanisms

This section addresses the impact on price distortions of: food safety and quality preservation, product liability, competition policy, labelling requirements, impact of food regulation on innovation and cost structure in-transparencies.

The Problem of Food Safety and Quality

Nowadays, the European system of food law is largely designed to protect consumers from unsafe food. The ban of unsafe food from the European market is well within the range of goals set out in the Treaty on the (Functioning of the) European Union and proclaimed in Article 14 of the General Food Law (Regulation [EC] 178/2002; GFL). The GFL is a direct result of food safety incidents which occurred at the end of the 20th Century. The GFL makes part of an effort to redesign the legal system with the intention to regain consumer trust (*Knowles and Moody,* 2007; White Paper on Food Safety, 2000). Several incidents provided a wake-up call for the European food regulators and induced a turnaround in policy: from producer to consumer's focus, and from a single business unit to a holistic approach

covering all stages of the supply chain ("from farm to fork"). Hygiene of food is controlled –among other- by means of the implementation of Regulation (EC) 852/2004, which is best known is the HACCP-requirement (cf. Hobbs, 2010). This set of rules is nowadays mandatory in the meat & poultry industry (cf *Unnevehr and Jensen,* 1999; *Maldonado et al.*, 2005). However, it is also costly to the industry (*Bremmers et al.*, 2010; *Hobbs,* 2010).

Quality and risk management serve as instruments to come up to the requirements of the consumer in increasingly complex global markets. They reduce the consumer's transaction costs in assessing the status of the products he/she buys. However, while systems like ISO, HACCP, Global-GAP reduce transaction costs to customers, they represent a significant cost factor for processors upward the supply chain (*Loader and Hobbs,* 1999; *Sredojevi et al*., 2008). Moreover, while on the one hand public agencies proclaim standards for risk management systems and minimal levels of contamination, on the other hand in practice food companies – especially those that operate on a global scale – even surpass public requirements by setting private standards and adhering to strict contractual requirements. An obvious reason for this is to avoid the adoption of a multitude of control systems, each one coming up to different national requirements, as well as avoidance of negative publicity and liability. The costs of food safety and quality systems are not easily to be measured in isolation, apart from adjacent business functions. It is the complementarity and integration at a system level (for instance with social and environmental protection management) with similar functionalities that diffuses the boundaries of costs and benefits. This diffusion provides a 'pricing slack', which can be used to absorb short term input price volatilities. In other words: the effect of sudden price changes in other cost categories (like input of raw material – soy, maize, meat etc.) can be flattened out by under- or overstating the tacit costs of risk control and management systems. We assert that the character of the cost structure in food firms – including the costs of safety & quality systems - is one of the explanatory factors for the discerned smoothening and/or absorption of price shocks along the supply chain.

The Problem of Product Liability

Product liability is a legal instrument to empower the consumer to claim damages to his personal health from the producer, in case of product deficiencies. The food and feed producer is primarily responsible for guaranteeing safety and compliance (*Dwinger et al.*, 2009; *Cumbers et al*., 1995). However, if the original producer cannot be identified (which can be the case if a product is sold under 'private label') the retailer can be made to pay and will be considered as the 'producer'. Via contracting the retailer can shift the burden to the processor again. This practice becomes distorting in a situation of bilateral information asymmetry. If players are dependent on each other to provide the consumer with safe food, and the measures which are taken by one actor are not visible and/or controllable to the other, one party opportunistically could economise on prevention costs to the expense of the other (similar to the moral hazard risk under collective insurance).

As a side-consequence, the liability of chain actors upward the supply chain has a positive impact on the power of the consumer and notably the retailer,[2] who provides the gateway to the consumer market. Increased efforts to reduce the chance of liability at the processor's stage of the supply chain are likely to be harvested at the retailer's stage (*Dobson,* 2003; *Dobson et al*., 2003). So risk control measures reduce transaction costs for some actors (retail, consumer) in the supply chain (*Hobbs,* 2010; *Heyder et al*., 2010), while they boost these costs for other. Or stated more specifically: the costs of system implementation can change the cost structure at the processor's stage, without guaranteeing a compensation in the form of a bigger portion of value added.

The problem of competition regulation

The Treaty provisions relating to competition intend to safeguard 'effective' (not 'full') competition within the European Union. While Article 101 of the Treaty on the Functioning of the European Union (TFEU) addresses the incompatibility of agreements between undertakings and concerted practices, Article 102 TFEU opposes the abuse of a dominant position (Berry and Hargreaves, 2007, p. 262 and next). However, legally as well as in practice, exemptions are made to the prohibition of agreements and concerted practices. Article 101(3) TFEU provides as motivations for exemptions the improvement of production as well as prospected economic progress which benefits the consumers. No safeguard is provided to protect small and medium sized companies against adverse business practices of the retail sector. However, SMEs are considered by the European Commission as of viable importance to the European food industry. In fact, more than 95% of all food firms can be categorized within the SME-range (CIAA, 2006). Contractual dependencies are also created by means of private labelling. As large retailers hold the access key to the consumer, SMEs will be dependent on them for market entrance and/or sales. This dependency relationship constantly gains in strength and induces economies of scale, as well as loss of traditional production (*Dobson,* 2003). Notably, retailers in general prefer homogenized produce because of food safety and risk management reasons as well as desired flexibility in procurement (inter-changeability of

[2]But not in all cases. See for instance case C-315/05 Lidl Italia Srl v Comune di Arcole (liability of distributor for incorrect alcoholic strength on the label).

processors). It opens the opportunity to force SMEs to absorb price movements on commodity markets, at the expense of their profit margin. In the short run the consumer will possibly benefit, but in the long run he will lose as the ability to choose becomes narrower. If the hypothesis holds that there exists a power disequilibrium between a heavily concentrated retail sector and a diversified and abundant amount of SMEs (*Weldegebriel,* 2004), which rely mainly on large retailers to reach the consumer (*Gronden and Hertog,* 2008), the idea might be projected to arrange for a 'countervailing power' in the contractual negotiations with retailers. However, competition law would not allow this. It could be expected that the consumer will be confronted with higher prices. Evidently, it would not only lead to a redistribution of value added over the supply chain, but also to price increases and loss of purchasing power at the customer's stage. As it is, retail companies can limit the access to consumer markets via contractual arrangements or even by denying access at all. Refusal of access to shelf space for sale of branded products can easily be motivated by pointing at the shelf space's opportunity costs. So the retailers choose for suppliers that provide the highest contribution to their goals, such as profit maximization. Abuse of market dominance is therefore not easily proven, unless clear-cut refusals or pressure is exerted (*c.f. Berry and Hargreaves,* 2007, p. 301).

The problem of Labelling Intransparency

Food labels serve to inform the consumer about – among other – the compositional and nutritional characteristics of a foodstuff, so that he/she can base his/her choice on solid information. More than 100 directives and regulations are applicable to food labelling, advertisement and consumer information of foodstuffs, the main of which is Directive 2000/13/EC, which is replaced by a Regulation on the basis of Proposal COM(2008)40, but is still applicable in a transitional period. The transfer of price movements along a supply chain can be monitored with more ease if the relative proportion of an ingredient is revealed on the package. However, this is only legally required in specific and exceptional cases (for instance if an ingredient is depicted -in a picture or in words- on a package. So on the one hand detailed quantitative information in the form of the weights of all ingredients could be useful to detect pricing anomalies. On the other hand, the publication of all ingredients in weight would certainly conflict with the firms' strategic (competition) interests (like would be the case with the brand and foodstuff 'Coca Cola', the real composition of which has remained secret over decades, until now). Labelling requirements are by themselves – because of their complexity and scattered nature – sources for transaction costs, and do not help to analyse the transfer of price changes along the supply chain. In defence it should be added that this is also not the primary aim of labelling (compare in this respect: *Gellinck and Kühne,* 2007; *Verbeke and Roosen,* 2009).

The Problem of Innovation Compensation

It is generally acknowledged – by European policy makers (Lisbon Summit, 2000) and other food network actors – that innovation provides the key to competitive advantage (as was already the case in the seminal work of Schumpeter). Traditionally, many retailers leave the effort of product innovation to the processing stage of the supply chain. However, such innovation expenditures have to be recovered by increased consumer's willingness to pay. Given the disequilibrium in power structure of supply chains, the benefits of innovation can more easily be harvested by actors near to the consumers' markets. Pressures on profit margins through input price movements may therefore be forced to be absorbed by delaying the recovery of costs of product innovation, or postponing innovation investments in firms upward the supply chain. Such effects will possibly be positive for the consumers in the short run, but detrimental in the long run (see in this respect: *Poppe et al.*, 2008).

The system of European food law – by its very nature and structure – contains barriers to price transmission due to long-lasting, in-transparent and costly procedures for market admittance of novel foods (that is foods which have not been introduced to the European market before May 1997), food with health claims, and for food generated through genetic modification. In some cases, total bans or zero tolerance policies make entrance to the EU market virtually impossible. Innovative firms to be found in the middle section of the supply chain have no choice than to homogenize their produce and focus on short term benefits through process innovations as well as organizational restructuring and integration (i.e., by means of mergers and/or submitting to dominant players by adjusting to generic product and processing schemes, like is the case with Global-GAP).

The problem of Cost Structure Intransparency

Cost structures of food firms are intransparent (Roberts et al., 1997) while at the same time they influence price transmission (*Vermeulen* et al., 2007; *Ollinger and Müller,* 2003; *Gellinck and Kühne,* 2007). There are property rights reasons which prevent the revelation of the real composition of cost prices of single products in the food industry. As a consequence, any price effects on the distribution of value added in the supply chain is therefore hidden also (cf *Crutchfield et al.,* 1997; *Ragona and Mazzocchi,* 2008). The present European law system on external financial reporting does not help in this respect. Based on Directive 78/660 on the annual accounts of certain types of companies, it is aggregate, retrospective, firm- instead of product-oriented and diversified, and also in comparison to alternative reporting systems, like in the USA. While the continental reporting system is based on positive law, the Anglo-Saxon rules reflect the aim of providing information that comes up to the principle of "substance over form" (as is the case in the GAAPs). The character of present EU financial reporting

guidelines does not facilitate the tracking and tracing of price changes along food supply chains, especially if production is heterogeneous (i.e., composed of multiple ingredients) and/or purchase of inputs is organized globally. The main obstructing factor in monitoring price transmission is secrecy and centrality of the consumer. It appears that the ultimate positive effect to the consumer is regarded as more important than the distribution of value added over the supply chain actors. Possibly the absence of criteria for a fair distribution of value added and measurement problems with respect to the attribution of costs have added to this tendency.

The previous exposure has basically been based on logic and deductive reasoning. In the next paragraph we provide empirical evidence on the impediments of the regulatory system of the European Union.

Empirical evidence

In this section we provide empirical evidence on the adverse consequences of the European food law system from the perspective the food firms. We focus on the consequences of adverse quality of food law with as dimensions content and ``the context of a competitiveness study for the European Union in 2007 (*Wijnands et al*., 2007) data were gathered and analysed on the factors affecting the competitiveness of the food industry. More specifically, data on the effect of the legal system on exports of the EU were gathered and analysed.

We performed a regression analysis on the 2007-data using Partial Least Squares to assess the relationship between the content of the legal system (CON), its Predictability and Clearness (PREDCL), the innovativeness of the food sector (INN), the level of administrative burdens (ADM) and the introduction of safety and private systems for enhancing quality (SAFPRIV). The dependent variable was the exporting capabilities to countries outside the EU (EXPO), while size was used as a control variable (SZ). The results are depicted in figure 1.

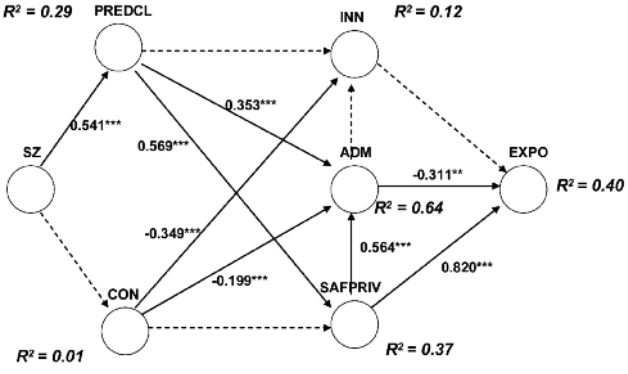

Figure 1: Explaining exporting capabilities outside the EU with PLS (figures represent standardized betas). * = P< 0.10; ** = P < 0.05; *** = P < 0.01 (two-tailed). Non-significant relationships p > 0.10) represented by bracketed lines. N = 44. (also in: Bremmers et al., 2010).

It appeared that Predictability and Clearness (PREDCL) of legal requirements were positively linked with the availability of FSQS (SAVPRIV). In other words, those companies that indicated the legal requirements to be clear and predictable appeared to have invested more in food safety and quality systems.

For companies with a bigger size (SZ), predictability and clearness of European legal obligations appeared to be better than for SMEs. In complementary semi-structured interviews the factual knowledge on the food law system was checked. Surprisingly the impression from the survey questionnaire was not validated: companies were only to a limited extend aware of the state and dynamics of the food law system. The research outcomes, as depicted in figure 1, also show the dissatisfaction on the content of food law, its negative impact on innovation, and adversely, its positive impact on the level of administrative burdens.

In this respect it appeared to be necessary to strengthen the position of processors/SMEs (*Wijnands et al.*, 2007; *Poppe et al.*, 2008). How can this be accomplished?

Policy alternatives

What possible policy alternatives can be proposed to enable effective price transfers from one stage in the food supply chain to another? Three feasible opportunities are mentioned here. The formulation of policy alternatives can be performed on logic grounds as well as on the basis of data analysis.

Competition Law

A first possibility would be the change of competition law to allow the organisation of a countervailing power, for as far as the actual power relations prevent the compensation for price volatility on commodity and intermediate markets. The European food law system has developed from 'market-oriented' to 'consumer-oriented' at the end of the last century. A new empowerment of processing industry is necessary to prevent SMEs from being squeezed between commodity & primary markets on the one side and retail markets on the other. Traditional production provides the innovation backbone for our European heritage of diversified food. It is a capacity which is not easily imitated, and therefore a source for continuous renewal and competitive advantage. However, in many food supply chains traditional SMEs are doomed to disappear as a consequence of up-scaling. The rigidness and consumer orientation of competition laws and policies contribute further to this tendency.

Information provision improvement

A second possibility is the installment of an information policy to address the actual lack of knowledge on rules and

procedures in the European food sector. For instance, SMEs appear not to be aware of the opportunities that HACCP-regulations provide for means to soften requirements which are burdensome and counterproductive to traditional production. An effective processor information policy is required, while at the same time efforts are to be made to simplify the rules and regulations themselves. This policy could be supplemented with pinpointed subsidies to alleviate barriers to compliance, or even lowering them. Zero-tolerance levels ban products from the market altogether at the cost of the producers/importers. An effective processor information policy could alleviate the transaction cost burdens in the exchange of information with governmental agencies (i.e., in monitoring present and new legislation, compliance to administrative procedures, adjusting reporting structures to come up to (new) requirements etc.). Especially for SMEs these burdens are disproportionally high.

Transparency of value added

A third policy alternative is the improvement of transparency of value added in the supply chain. In an extensive research for the Commission DG Enterprise (reported in *Poppe et al*. 2008), the benefits and pitfalls of creating transparency through the labelling of the origin of foodstuffs was investigated. It turned out, that the creation of a 'made in Europe'-label is perceived to have minor contributions to the competitive power of the middle-segment of food supply chains. It should be noted, that the more downstream a company operates, the less proficient it is to allow for transparency of value added of previous stages in the supply chain. However, the total lack of exposure which can be observed with products that are sold under private label should be reduced so that SMEs are granted opportunities to benefit from improved product quality, safety, as well as their innovation efforts. At present, retailers are to a certain degree 'free riders' on product innovation upward the supply chain.

Improving the logic of food law

As this article shows, the institutional environment of food procurement and production is strongly influenced by the system of food law. This system shows sincere shortcomings (*cf. Van der Meulen,* 2009). It is dynamic of nature. It changes constantly and becomes more and more complex. The more complex the system becomes, the easier it is to use it in an opportunistic way. This is a cause for pressure on profit margins in the middle section of food supply chains. If the basic premise would be accepted that premiums should fall where they are caused, this would implicate that the increase in contribution to the margin of a food firm would be: Innovation Premium + Productivity Premium + Market premium. Unfortunately, this is not the case for many small and medium sized companies in the European food industry. They could get squeezed between rising commodity price pressures at their supply side and price rigidity at the retailer/consumer side. To protect the innovativeness of companies upstream, a redistribution of bargaining power has to be accomplished.

Finally it should be noted that the choice for a diverse and viable processing industry is a political one, just like the system of food law is a result of political deliberations. So it's out of the hands of science to change the system. This article may contribute to accelerate the pace of institutional renewal, in the European Union and beyond.

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DISENTANGLING THE COMPLEXITY OF INDIA'S AGRICULTURAL SECTOR

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Abstract: Agricultural policies in India directly impact the livelihoods of close to two thirds of India's population. Through policies, the government manages food security, urban and rural poverty, energy, and infrastructure, among others. Given the current state of India's governance, the connection between policy making and its results in society becomes a key issue for research. This paper presents a game for use as a research instrument. The game can facilitate research into the policy making process at various levels of the government in India. The design is intended to understand the complexity of the institutional arrangement that defines and implements agricultural policies. The game integrates with other games that simulate other aspects of the agricultural system in India. The paper presents the verification and validation cycles followed, and identifies further steps for field validation.

Keywords: India, supply chain, governance, policy, game

Introduction

The agricultural sector in India is highly dependent on policy makers for regulating tariffs and trade, credit, market access, subsidies and services. The government tries to open markets, establish and run food supply programs for the poor and maintain stocks for draughts and floods. Scandals about food prices that triple over months and tens of thousands farmer suicides because of credit issues, along with the contrasts but prevalence of starving people while food is rotting in other parts of the country dominate the daily national news.

The Indian government works through five year central planning. This period matches the appointment of the central government. Typically the five-year plans constitute numerous schemes to be effectuated through a multitude of institutions at the federal, state and regional level. This system has grown to a size and complexity that is unmanageable, with high transaction costs and results that are hard to predict. Following New Institutional Economics frameworks [*Williamson*, 2000; *Menard and Shirley*, 2003] there must be reasons for this complex system to exist. In the literature, studies can be found on the institutional structures of India and some explorative work on the relation between scheme effectiveness and policy making [*Kapur and Mehta*, 2005], however the reasoning and expectations of policy makers are largely uncharted territory in this country.

This paper will present a new approach to disentangle the complexity of agricultural policy making and its complex effects on the agricultural sector using a gaming simulation approach. In an earlier paper [*Meijer et al*, 2010] the authors explored why the successful Western games do not fit the Indian context. In this paper we present a new module aimed at the ministry and secretary level with a focus on waste, credit and production factors. The paper contains results obtained from test groups validating the module.

1. The Indian agricultural sector

Central role and major problems

Agriculture remains one of India's primary occupations, employing close to two-thirds of India's population. Despite employing a large majority of the population, agriculture contributes only one fifth of India's GDP, creating a situation where large numbers of people earn very low incomes and work at low productivity levels. Efforts to improve rural conditions on a sustainable basis hinge to a large extent on increasing agricultural income. These efforts will have to come in the form of policies improving the production, marketing, and distribution of agricultural products.

Increasing population and urbanization has led to concerns about adequate food supplies worldwide and in India. The recent price fluctuations in world markets have led to spikes in commodity food prices like onions and tomatoes. While a 50 to 100 percent increase in prices may not be a problem to consumers in the sections of the society with higher resources, it is a problem for about 2/3 of India's population of 1.15 billion people. The Green Revolution of the 1960s increased yields in the North of India applying scientific knowledge [*Arunachalam and King*, 2004], and

now new approaches are being applied to provide additional insight. The attention is not only geared towards production techniques, but also on the institutional arrangements and economic incentive system, as India has faced scandals with rotting food and hunger existing simultaneously. Recent studies show that waste in agricultural production in India reaches as high as 20 percent while the perception reflected in government pronouncements and the media often extends to 40% [*Mattoo et.al.*, 2007; *India Today*, 2009). The Asian Development Bank also notes the problems with getting produce in acceptable conditions in a timely fashion to consumers, and the need to upgrade transport, irrigation, marketing and financial sector infrastructure to address them [*ADB*, 2009].

Governance

The national agricultural policy stated in the year 2007 [National Policy for Farmers] has 12 major goals, which cover land reforms for farmers, improving economic viability and productivity, developing support services, food and water security and providing non-farm employment among others. This policy is implemented by the Ministry of Agriculture, and one its primary departments, the Department of Agriculture and Co-operation.

The Department of Agriculture and Cooperation is one of the three constituent departments of the Ministry of Agriculture. The other two Departments of the Ministry are the Department of Animal Husbandry, Dairying and Fisheries and the Department of Agricultural Research and Education. The Agriculture Minister, who is assisted by a Minister of State, heads the Department of Agriculture and Cooperation. The Secretary (Agriculture and Cooperation) is the administrative head of the Department and Principal Adviser to the Minister on all matters of policy and administration within the Department. The Secretary (Agriculture and Cooperation) is assisted by a Principal Advisor, four Additional Secretaries, one Financial Adviser, the Agriculture Commissioner, nine Joint Secretaries, one Horticulture Commissioner, one Agricultural Marketing Adviser and one Economic Advisor.

The Department is organized into 24 divisions and a Technology Mission on Oilseeds, Pulses and Maize. In addition, it has 4 attached offices and 21 subordinate offices spread all over India for coordination with state-level agencies and implementation of central sector schemes in their respective fields. There are in all 2 Public Sector Units (PSU)s, 7 autonomous bodies and 11 national-level cooperative organizations under the administrative control of the Department. In addition, two authorities, namely, the Protection of Plant Varieties and Farmers' Rights Authority and the National Rain-fed Area Authority (NRAA) have been set up [*AGRICOOP*].

The organizational structure of the Department of Agriculture and Cooperation (AGRICOOP) is shown in Figure 1[1]. This excludes the Public Sector Units, autonomous bodies, co-operatives and other authorities that come under its purview. This department is only one of three that the Ministry of Agriculture operates, and functions at the National level.

2. Gaming simulation for research in supply chain policy

The late 1990's and start of the 21th century showed an increasing popularity of supply chain gaming simulations in the domain of supply chains and networks. Gaming simulations (games, in short) in this domain are becoming a standard component of business school curricula [*Corsi et al*, 2006], and researchers use them as a research method for both quantitative and qualitative research [*Meijer*, 2009]. Supply chains and networks are considered complex adaptive systems, as they meet all the aspects in the definition by Holland (1995). Bekebrede and Meijer (2009) demonstrated that complex adaptive systems could be simulated in a gaming simulation. The latest development in gaming simulation is the integration of more and better simulators as technical backbone and more detailed representation of the aspect system under study in the game.

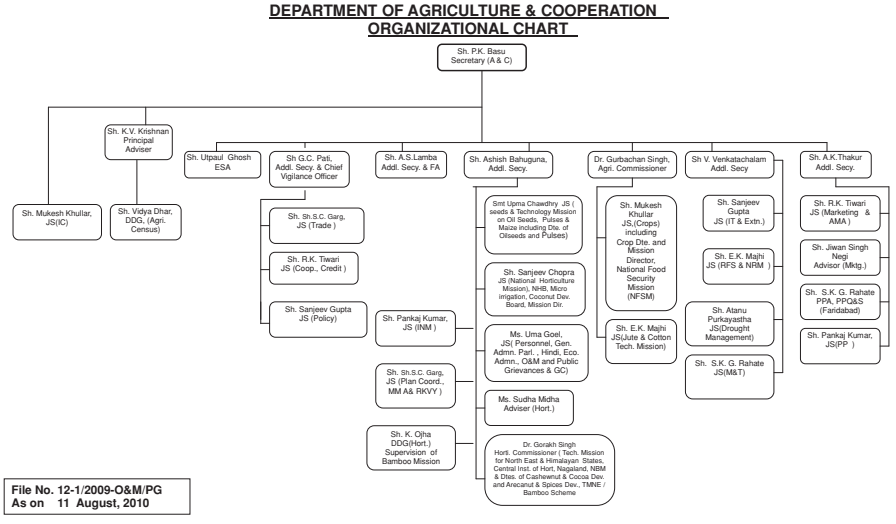

Figure 1: AGRICOOP Organizational Structure (Source: Department of Agriculture and Cooperation)

[1]The image has been modified to exclude the names of officials. The original can be accessed from the source, available on the departments website: http://agricoop.nic.in/orgchart11810.pdf

Using gaming for policy development and testing is certainly not new, and well documented in the work of for instance Duke (1974), Duke and Geurts (2004) and others. Mayer (2009) provides an overview of the development of this field and proves that gaming for policy issues is widely accepted and matured. The use of gaming as a more experimental surrogate environment is less common [*Peters et al*, 1998] and provides methodological challenges [*Klabbers*, 2008]. Recent activities however have shown that it can be done successfully [*Meijer*, 2009; *Zuniga et al*, 2007].

3. A suite for Indian supply chain games

In a previous publication [*Meijer et al*, 2010], the authors showed that no existing gaming simulation currently addresses the specific Indian issues, mainly because most work done has been on Western contexts where seven constraining variables the authors identified do not apply. The seven key elements of the Indian supply chains that must be addressed are:

1. heterogeneous producers, especially small-scale;
2. heterogeneous production methods;
3. segmented markets across geography, time, cultivar, and quality;
4. severe credit constraints, with informal credit often provided by middlemen;
5. inadequate transportation support services;
6. inadequate cold storage and warehouse facilities; and
7. incomplete information across the supply chain, worsening the closer one gets to the farmer/producer.

Not all of these issues can be tackled in one game. Therefore CSTEP works on an integrated suite of supply chain games fitted to the Indian context. The games and game modules developed should all connect to each other to gradually include more aspects in the scope of a playable gaming simulation. In an earlier paper [*Meijer et al*, 2010] we have described the design of a gaming simulation that attempts to track the problems in mango supply chains in India, focusing on wastage, credit and infrastructural/institutional issues. The so-called Mango Mandi Simulation Game (MMGS) models the various roles that exist in the supply networks. Human players can 'take over' each of the roles that are in the model. The simulation part of the MMGS can be isolated and run as a stand-alone supply chain simulation, with software agents playing the roles that exist in the network. The MMGS operates at the level of the markets, which are regulated by a complex machinery of legislations and institutions.

We have chosen to study the agricultural policy making process by using a gaming simulation called the Agricultural Policy Game, as a research tool. The design models the various policy-making roles that exist in the Ministry of Agriculture and its associated departments in the Indian government. Players take on various roles and try to implement an agricultural policy, and the various implements of the policy are fed into the MMGS, which gives the players some feedback on the efficacy of their actions in the game.

4. Agricultural Policy Game

The design of the game is based on the four level framework proposed by Williamson (2000) (Figure 2). Each of the levels changes about ten times as fast as the level above. The top level lists customs, traditions, norms and informal institutions and is usually called 'culture'. Culture is acquired in the early years of a person's life and changes over centuries. Culture influences the institutional environment, which is at the second level. The rules of the "game" or the formal rules governing a community appear, and is often formalized as the legislative environment of the country. This level changes in terms of tens or hundreds of years.

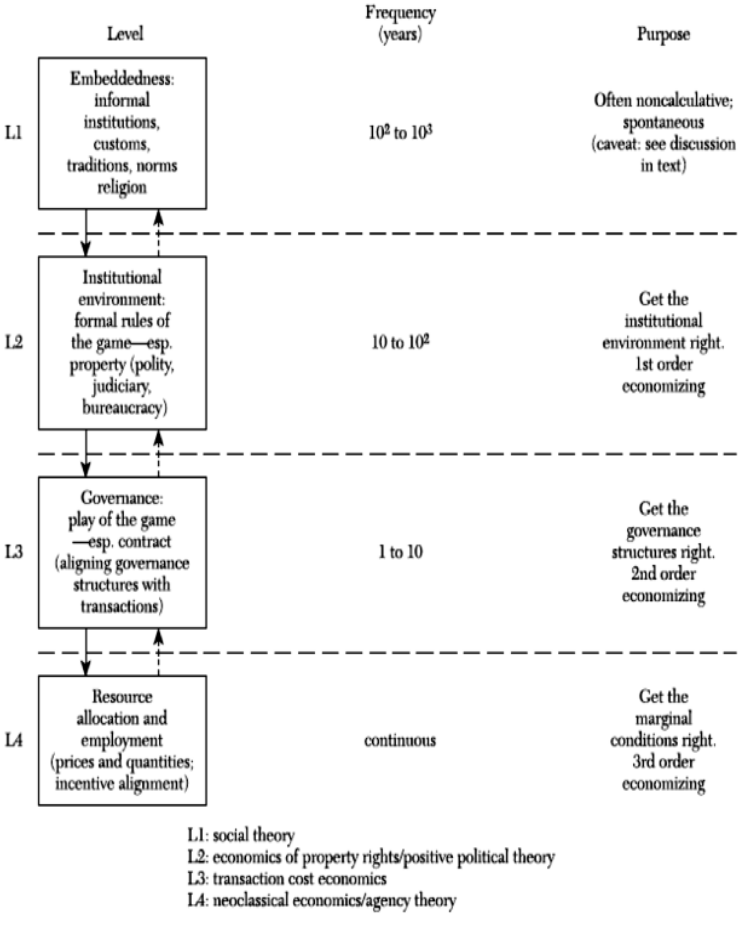

Figure 2: Four-level model of Williamson (2000)

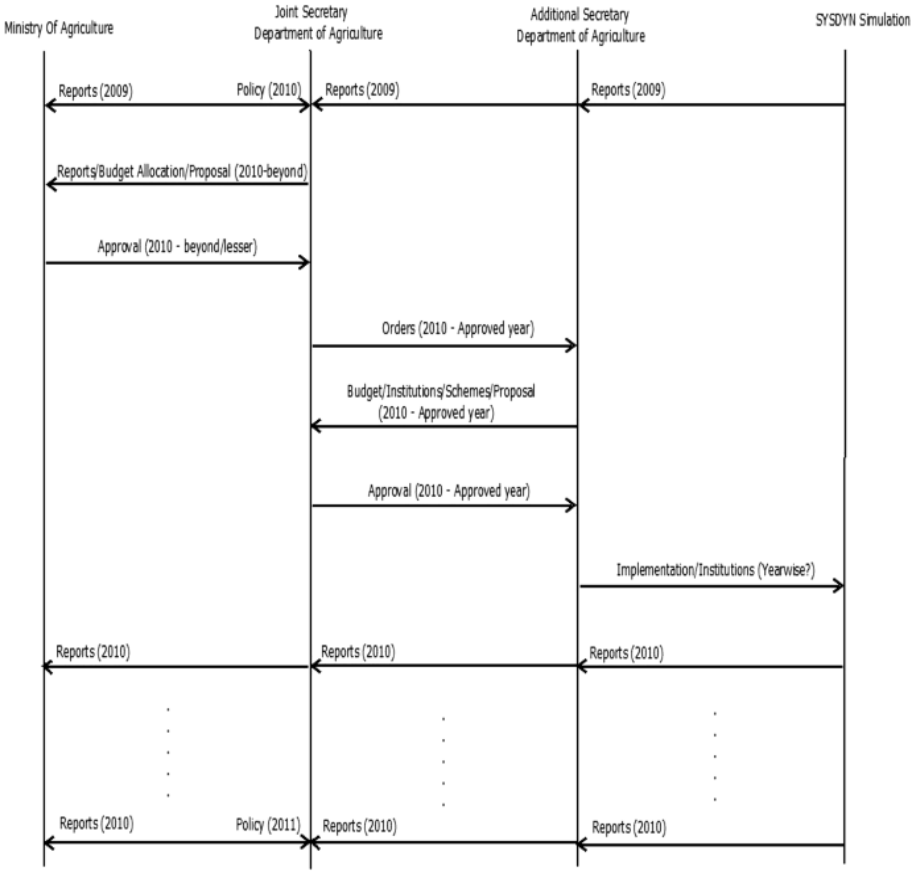

Figure 3: Game Flow

Level 3 consists of the governance structure. Governance structures are ways to implement the rules of the game, and means to resolve conflicts. Level 4 is where the actual business happens, the contracting, negotiations and transactions. The actual transaction costs occur here, as constant negotiations for contracts, both medium and long term happen at this level. For the purposes of this game, this level is currently simulated by a systems dynamics model, but can be replaced by any simulation as relevant to the problem.

The game tries to understand the processes and structures that exist at Level 1 of the four level model, as related to the field of agriculture. All the roles of the game are at levels 2 and 3, and are picked among the roles mentioned in the institutional structure above. The game tries to understand the negotiation processes at the policy making levels (2,3), and on the influence of these policies on the fourth level.

5. Game Description

The APG is a game for 10 to 20 people, and runs in one main room, with optional break-out rooms. The intended play-time is between 2 and 4 hours, depending on the complexity that the game leader wants to put in. The game leader can influence the complexity through interventions.

The game flow is shown in Figure 2. As shown in the figure, there are four roles in the game, three of which can be played by one or more players. The fourth role is simulated, and can be interchanged with alternative simulations based on the context. The game flow shown in the figure is for one round of the game, which represents one year in real time and is repeatable for multiple rounds. The reports at the beginning of every round are generated by the game facilitator, and serve initially as background information on agriculture in India, and as reports on the performance of the players in later rounds.

The game includes a set of roles that players play, and various artifacts that the players use to play the game. These are:

Minister of Agriculture

The minister of agriculture is responsible for defining the agricultural policy, and using the apparatus given to him to implement the policy. At the beginning of every round, he is given a national policy to implement. He can change this policy. He is also given a list of schemes that his Ministry is operating currently. This list contains associated information such as the Department/person in charge, budget, timelines and so on. The minister is also given a list of institutions that the ministry can use to implement various programs; he can also create new institutions as and when necessary. Additional constraints such as a yearly budget are given to the minister. The minister is expected to approve/ disapprove/modify proposals for schemes presented to him, including the ones currently in operation. The approved proposals will become schemes in operation and implemented by officials of the ministry. At the end of every round, the minister receives a report by the officials.

Joint Secretary

The Joint Secretary is one of the senior officials of the Ministry of Agriculture. At the beginning of every round, the Joint Secretary is given a national policy to implement by the Minister. He is also given a list of schemes the ministry is currently operating, along with associated information such as budget, timelines and so on. He is also given a list of institutions that the ministry can use to implement various programs. For every year, the Joint Secretary must propose new schemes, all of which put together will implement the national policy. If approved, the Additional Secretary will implement these schemes. The Joint Secretary must also seek

approval for the continuation of schemes already in operation. At the end of every round, the Additional Secretary gives him a report on the round.

Additional Secretary

The Additional Secretary is also one of the senior officers in the Ministry of Agriculture. There are four Additional Secretaries, each of whom is in-charge of one field. The four fields are Marketing and Trade; Crops and Education; Mechanization and Technology; Credit and Insurance. This classification is based on the programs currently run by the Govt of India, each of which broadly falls under one of these categories. At the beginning of the game each Additional Secretary is given four schemes to manage, two of which he is solely responsible for and two for which he shares responsibility with two other secretaries. Each Additional Secretary is given a list of institutions that they may use to manage one of their schemes, and a budget within which they should operate.

At the beginning of every round, each additional secretary should propose either a new scheme, or seek continuation of schemes he is already operating. The scheme may be run completely by him, or shared with another. Once approved, they are responsible for detailing the scheme and running it. They run the scheme by feeding it into a simulation, which currently is a Systems Dynamics model.

Schemes

Each scheme is detailed by filling out a form given to all the players. The form has the following fields:

- Name of the Scheme
- Implementing Agency (which can be one of the many institutions from a list given to all players, or a new one)
- Type (which is one of the four areas for which the additional secretaries are in-charge, or another type which needs to be specified)
- Year of Commencement
- Duration (number of years for which it will be operational)
- Area of Operation (Geographical area, players can specify that this scheme will be operational only certain select states)
- Funding (Method of funding. For example, whether this scheme will be shared between central, state governments or privately funded and so on)
- Objectives
- Structure
- Budget

The schemes that are already in operation are based on the programs currently being run by the Ministry of Agriculture [*Compendium of Schemes*, 20XX]. Uncertainties and unforeseen events such as droughts, floods and technological advancements and so on can be introduced in the game in the form of messages given to certain players. Apart from the negotiations about the schemes, this adds an extra dimension of complexity as the players can choose to use the messages to their advantage.

Systems Dynamics Model

The players in the game make decisions on the implementation of agricultural policies. We propose to feed their decisions into the Mango Mandi Gaming Simulation, where their decisions will influence a dynamic environment of software agents and/or human players interacting in a market for agricultural goods. For ease of testing the Agricultural Policy Module though, we have chosen to replace the MMGS with a systems dynamics model, illustrated in Figure 3.

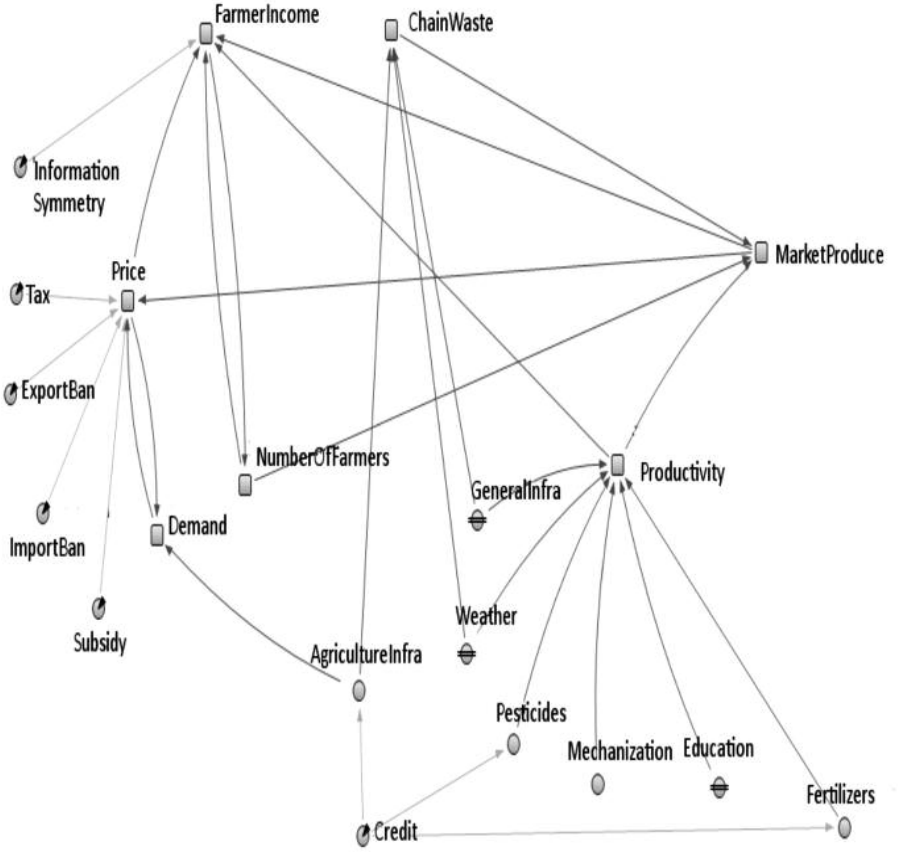

Figure 4: Systems Dynamics Model

The systems dynamics model is simple, intended mainly to illustrate the relationships between various elements in the system and to provide feedback to the players on their policies. A directional arrow between two entities indicates a direct relation between them, either positive or negative. The weight of the relationship is configurable, and the value of the element may be a function of the value of several other elements. The model is configured with initial settings that match the initial report that all players are given. The model can be run as many times as necessary. The value of an element (after a particular run) relative to its earlier values gives the participants an indication of how their policies are influencing the system.

At the end of every round, all the players give their policy measures to the game facilitator. The facilitator then goes through all the schemes and tries to map the schemes to the elements in the model. The values of the elements are changed to suit the new policies that have been implemented, and the model run. Comparisons of results from various models will give participants and indication of the efficacy of their decisions.

6. Verification, Validation and Test Results

In line with the test approach of Duke and Geurts (2004), and the iterative agile design method of Triadic Game Design [*Harteveld*, 2011], we followed a sequence of test sessions. The projected research methodology is analogous to the one used by Meijer et al (2008) in Figure 5.

For the current paper we focus on the left side of Figure 5, where iterative cycles lead to a gaming simulation prototype, later to be used as research tool in the empirical cycle, as well as induced hypotheses from test sessions with projected participants in the later empirical cycles.

We tested the AGP in five cycles of which the last two were fully playable sessions. Both sessions included participants from within CSTEP, so the maximum level obtainable was a working prototype, but no induced hypotheses, as these should come from play-testing with policy officers.

The cycles followed the traditional sequence of testing a simulation:

1. Verification whether all the built-in mechanisms work. In terms of a game this means whether everything is clear to the participants, and understood in the way meant by the designers, whether the Game Flow (Figure 3) really happens, and does not leave people sitting idle for a while, or short on essential information. This took 3 cycles to get everything working as described above in the paper.
2. Validation. We needed one cycle (the 4th) to improve the design here. The last cycle (game session) is described below in more detail. In addition to the 7 key elements of Indian supply chains mentioned earlier, we formulated four patterns that were not directly built into the design of the game, but needed to emerge from the game play. The patterns could not be obtained from literature directly, as little has been written on how the individual officers have their place in the Indian system, but were obtained from interviews with some ex-government officials and from tendencies observed over several years of newspaper reports. They can be used as hypotheses to check in the empirical cycle later in the process. For now the patterns are:
   a) A dominant behavior of the Minister who has a pull to centralize
   b) Joint secretaries will have trouble managing the overview of schemes between the Minister and the Additional Secretaries.
   c) A tendency to invent new schemes instead of changing existing ones
   d) A tendency to bring in funds from central budgets only, and not involving the local or domain agencies in the budget.

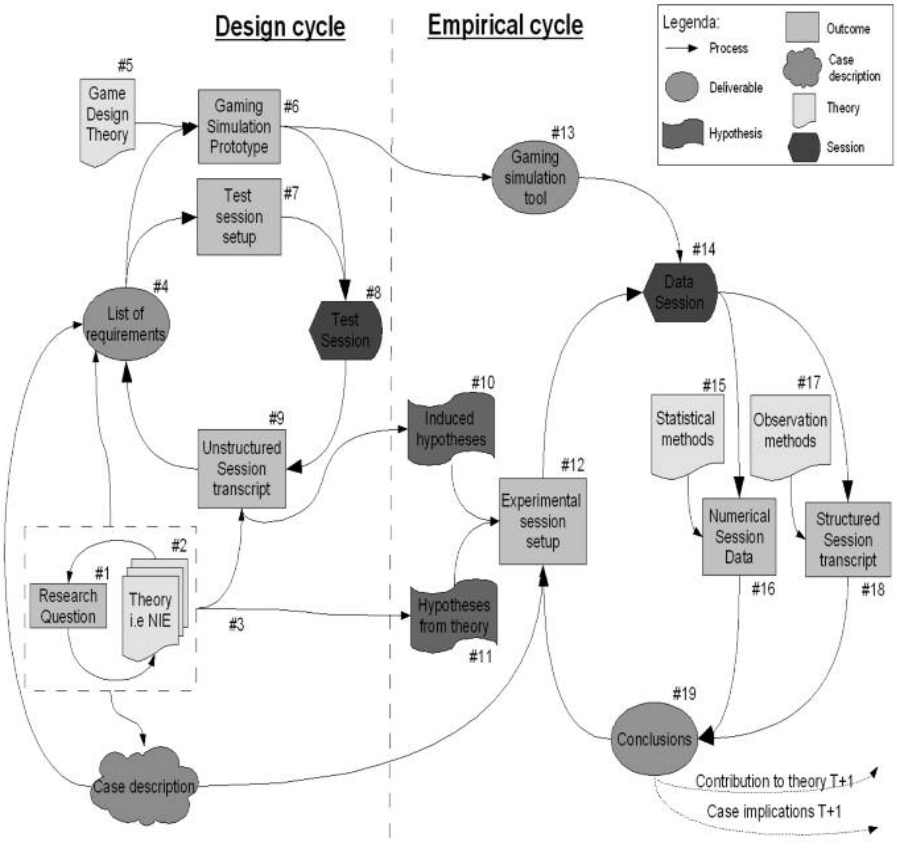

Figure 5: Research methodology for supply chain game [Meijer et al, 2008]

Out of the seven key elements, six could be brought into the game through the information provided on the current state of agribusiness. And through the existing schemes at the game start. This information was based on real numbers, abstract from the latest official online source made public. Only the segmented markets could not be represented, as this is not really apparent on levels 2 and 3 of the Williamson framework used.

The fifth cycle session lasted approximately three hours, including briefing, game play and debriefing. The session included a total of eight participants, one playing the role of the Minister, three playing the role of Joint Secretary, and four playing the role of Additional Secretary. As mentioned earlier, the Additional Secretaries were given two schemes to manage individually, and two schemes to jointly manage with two other Additional Secretaries.

The session was played for two rounds, each of which lasted for approximately thirty minutes and represented a year. In the first round, the participants added 8 new schemes to the existing 12. The original twelve were all renewed, bringing the total number of schemes managed by the participants to 20. In the second round, the participants added 6 new schemes to the now existing 20, making the total 26. None of the schemes started earlier were stopped. The overhead of continuing existing schemes could potentially account for the fall in the number of schemes created in each additional round.

Since every scheme must be approved at the beginning of every round, participants had the freedom to revise existing schemes. Very few schemes were modified, with only three out of twelve modified in the first round and four out of twenty in the second round. In all these schemes, only the budget was modified, while other attributes of the scheme were left intact. The participants were given twelve pre-existing schemes, which they also had to manage. Of these, 50% (6) of the schemes were shared. At the end of the first round, this had reduced slightly to 45% (9 of 20 schemes were shared). At the second round, this percentage had reduced to approximately 42% (11 out of 16 were shared). This proves emergent pattern 3.

While defining a scheme, the participants had to decide on the funding structure as well, i.e they had to decide whether the scheme would be funded completely by the central government, shared between central and state governments, private investment or other sources. A majority of the schemes created were all funded completely by the central government. Only one scheme was funded without any central government funding, and four other schemes were shared between the central government and other agencies. This proves emergent pattern 4.

Over the game play the Minister became more dominant as he got fed-up with the Joint Secretaries. The latter were having major trouble coordinating amongst them and keeping an overview of what the Additional Secretaries were doing. In the hierarchical Indian culture (large power distance in terms of the Hofstede culture dimensions), they could not think of delegating to the additional secretaries, while they had the actual information on their schemes and on what happens in their field. This is very analog to the real situation according to our information. The Minister taking over the control and effectively bypassing the joint secretaries was a matter of time. This proves emergent patterns 1 and 2.

Now that the game has been verified and validated with a test group from outside the governmental institutes, now it is time to plan on the last cycles in the design, being test sessions with policy makers. This last validation part is planned for summer / fall 2011, after which the Agricultural Policy Game can be used as a research instrument in the Indian agricultural sector.

7. Conclusions and Discussion

This paper introduced a gaming simulation for research into the agricultural policy making process in India. The game is intended to be part of a larger stack of games, and parts of the game can be replaced with parts from other games in the stack. The design is faithful to the structure and processes of the official Indian agriculture governance. While the game can be very broad in its scope, special attention is paid to six out of seven key elements of Indian supply chains identified earlier. This makes the game different from other supply chain games, as are popular in the Western world. Verification and validation have been completed insofar can be done without involving real policy makers. Further validation using the targeted participants of later empirical sessions need to be done before the game can be used as a research instrument.

The game can be used to better understand the decision making process at various levels of the government. It is useful in articulating the tradeoffs and concerns of actors in the agricultural governance sector, their power relationships and so on. Coupled with a simulation, it can also be used to help policy makers understand the consequences of their decisions. Depending on the simulation model used, the game brings together actors from both the regulatory institutions and the markets, allowing for feedback and dialogue between the various actors.

The complexities and the scope of the agricultural sector make development of the game challenging. Given the sensitive nature of the sector in India, and the societal issues surrounding it, approaches like the Agricultural Policy Game have potential in disentangling the complexities in regulating this vast sector.

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GREEN NETWORKS: INNOVATIVE CAPACITY OF SMES IN THE DUTCH GREENHOUSE HORTICULTURE INDUSTRY

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Abstract: The Dutch greenhouse horticulture industry is characterized by world leadership in high-tech innovation. The dynamics of this playing field are innovation in production systems and automation, reduction in energy consumption and sharing limited space. However, international competitive advantage of the industry is under pressure and sustainable growth of individual enterprises is no longer a certainty. The sector's ambition is to innovate better and grow faster than the competition in the rest of the world. Realizing this ambition requires strengthening the knowledge base, stimulating entrepreneurship, innovation (not just technological, but especially business process innovation). It also requires educating and professionalizing people. However, knowledge transfer in this industry is often fragmented and innovation through horizontal and vertical collaboration throughout the value chain is limited. This paper focuses on the question: how can the grower and the supplier in the greenhouse horticulture chain gain competitive advantage through radical product and process innovation. The challenge lies in time- to-market, in customer relationship, in developing new product/market combinations and in innovative entrepreneurship. In this paper an innovation and entrepreneurial educational and research programme is introduced. The programme aims at strengthening multidisciplinary collaboration between enterprise, education and research. Using best practice examples, the paper illustrates how companies can realize growth and improve the innovative capacity of the organization as well as the individual by linking economic and social sustainability. The paper continues to show how participants of the program develop competencies by means of going through a learning cycle of single-loop, double-loop and triple loop learning: reduction of mistakes, change towards new concepts and improvement of the ability to learn. Finally, the paper illustrates the importance of combining enterprise, education and research in regional networks, with examples from the greenhouse horticulture sector. These networks generate economic growth and international competitiveness by acting as business accelerators.

Keywords: entrepreneurship, innovation, greenhouse horticulture, knowledge transfer network, growth

Greenhouse horticulture dynamics

If we consider the greenhouse horticulture industry in a wider perspective, a distinction can be made between Food and Flowers, where Flowers represent the production end of the value chain – from seed to produce – and where Food indicates the processing element of the value and supply chain; from harvested product to consumer. Food cannot be seen independently from Flowers, therefore both should be considered as one value chain. Throughout this chain we find (technology) suppliers of resources, equipment and services (*Krebbekx,* 2008). Both growers and suppliers manifest themselves mostly as small scale organizations. Together, growers and suppliers constitute a solid beginning (Flowers) of the value chain. The Food end of the chain, however, is characterized by companies that operate on a much larger and often multinational scale. This holds true for both producers and suppliers. It makes linking both ends of the value chain complicated (*Scheepbouwer,* 2009).

The fact that export is growing in absolute terms suggests continuing success in the greenhouse horticulture industry. This should not be confused with economic strength. On the contrary, it could prove a weakness, as the processing industry related to greenhouse horticulture is relatively small in The Netherlands, export might be the only option (*Snijders* 2007). The growing European market and favourable economic developments in Asian countries such as China present market opportunities, for instance for cut-flowers and plants. In emerging markets with fast growing wealth, local population can afford more and more luxury food and flower items from the greenhouse horticulture industry. Food shortages strengthen these dynamics (*Krebbekx,* 2008). Yet, international competitive advantage of the Dutch greenhouse horticultural industry is under pressure – as is the case in other countries – such as the US and Japan. Also China and India recognize the importance of innovation and invest in it. More and more serious competition is felt from non-EU, low-wage countries (*Kleijn,* 2006). However, when comparing the Dutch greenhouse horticulture industry's added value to that of other countries, the sector out-performs the international average by more than 50% (*Krebbekx,* 2008).

The dynamics of the greenhouse horticulture playing field focus on innovations in production systems and automation, in sharing limited space, in reducing energy consumption and finding alternative sources and in finding solutions for the fragmented value chain and time-to-market. The sector's ambition is to innovate better and faster than the competition in the rest of the world. Internationally speaking, The Netherlands rank among the top 3 countries as far as the ability to innovate is concerned. This is especially apparent in large and multinational companies. However, many companies fail to valorise opportunities and strengthen their ability to compete (*Volberda et al.,* 2011). To complement this trend, innovation programmes that are specifically geared to getting SMEs to innovate or to raise the level of their innovative capacity are particularly encouraged by Dutch national and regional governments (SenterNovem, 2008). However, research shows that knowledge transfer is often fragmented and innovation through collaboration takes up a mere 25-30% of the opportunities (*Krebbekx,* 2008).

The Dutch greenhouse horticulture sector is generally characterized by small scale, often family-run businesses. Growers have historically depended on the Dutch auction system for their revenues and (technology) suppliers operate mainly independently. Horizontal and vertical collaboration throughout the value chain is relatively limited. Traditionally companies were established around the physical marketplace of the Dutch auctions, resulting in concentrated greenhouse horticultural areas. This type of concentration was never managed or planned; growers opted for a place close to their point of sale. Greenhouse horticulture concentration hence resulted from individual entrepreneurship decisions.

Branch organizations play a limited role in innovation, with a notable exception in the cut-flower business, where separate clusters have been formed and with the Productschap Tuinbouw serving as an umbrella organization, especially where joint or collective research is concerned. Furthermore, fragmentation can be observed in horticultural vocational training and education at applied sciences level; which infrequently interacts with other sectors (*Snijders,* 2007).

The innovation playing field

Considering the above dynamics of increasing complexity and global dependency, the need for innovation and entrepreneurship is becoming more and more important (*Harkema,* 2004). This requires true flexibility and adaptability of people and organisations. Recognising opportunities and translating these into new products, processes and services is as essential as integrating these in innovative organisations.

Andrew et al. (2009) find that the most widely tracked components of innovation are overall company profitability, overall customer satisfaction and incremental revenue from innovation. Companies consider themselves most effective at measuring innovation *outputs* (such as revenue growth, shareholder returns and brand impact). They consider themselves far less successful at tracking innovation *inputs* (for example dedicated resources, such as people and funds invested) and the quality of their innovation *processes*. This suggests that organizations can truly influence their profitability and incremental revenue from innovation as well as influence customer satisfaction. For the greenhouse horticulture industry this appears not to apply to the same extent, considering the Dutch auction system prevents the grower from meeting his consumer. Also considering that it is extremely difficult for the grower to match his supply to the demand and the difficulty the individual grower experiences with brand positioning.

Ultimately, improving a company's innovation performance boils down to leadership and leaders' willingness to put in place the necessary processes and tools to help employees deliver on the targeted objectives (*Andrew et al.,* 2009). In this respect innovation is no different from any other company priority. And, like other things that matter, innovation can and must be measured and linked to both financial and non-financial incentives to ensure that it receives the attention and focus it requires. Here the greenhouse horticulture industry appears to conform to generally applicable findings in the sense that greenhouse horticulture is a production industry, struggling with international competition, problems relating to economies of scale and a considerable reduction in product range. The impact of leadership on process and product innovation in the greenhouse horticulture industry might be of a different nature compared to other industries, considering the fragmented value and supply chain. Subsequently, Lans (2009) suggests that for leaders in an agricultural environment to be successful three domains constitute the heart of entrepreneurship competence: analysing occupational challenges, pursuing new opportunities as well as management practices and networking. *Lans* (2009) defines networking not only as the social competence to relate to others in an entrepreneurial context, but also as the ability to cooperate with other entrepreneurs and being open to suggestions and feedback from others.

In The Netherlands the various actors in the innovation playing field are mostly 'stuck in self-created institutions' (*Scheepbouwer,* 2009), so there is an urgent need for more knowledge management and knowledge circulation within the greenhouse horticulture sector. Great value may be added to innovation networks by innovation brokers, especially when the innovation broker takes the lead in innovation initiation, network composition and innovation process management (*Batterink et al.,* 2008). Within the greenhouse horticulture industry several players are active, such as Productschap Tuinbouw, LTO Glaskracht, Syntens or SIGN, often operating within their own associated networks.

In times of negative economic growth it is essential for entrepreneurs to take difficult decisions and to boldly tread unexplored, innovative paths. Maintaining the status quo is generally not the road to sustainable business development.

It is furthermore suggested that relatively few people have a clear image of what goes on in the greenhouse

horticulture industry, resulting in limited interest among school leavers and graduates to work in this industry. It is expected that in ten years' time the sector will experience a lack of qualified employees. Closely related to this aspect of negative image is the difficulty experienced by current owners of greenhouse horticulture companies in finding adequate succession. Equally crucial to a sustainable business are the problem of fragmentation and the lack of space for growth; not only in literal terms of square footage but also in a figurative sense: restrictive regulations. Another important challenge facing the horticultural greenhouse industry is internal greenhouse climate management. The use of (alternative) energy sources for lighting, electricity, heat, water and CO_2 require innovative strategic thinking.

Many growers realize the key to innovative entrepreneurship lies not only in knowledge of the produce they grow. They indicate that knowledge of shortening time-to-market, improved customer relationship management, developing new product/market combinations, using less (alternative) energy sources and state-of-the art production automation are just as vital to innovative entrepreneurship. Managers and owners of companies in this industry suggest that they are able to make choices at a strategic level, but not quite able to translate these into new products or processes (*Volberda et al.,* 2011). Neither are they able to implement their strategy satisfactorily. One of the more important issues in the horticultural greenhouse industry is what Nooteboom (2000) characterizes as the 'cognitive discrepancy' with SMEs between the (lack of) knowledge of end-users' demands and the (in-)ability to recognise opportunities and implement viable business proposals. *Klerkx* (2008) suggests that contractual research planning may be well-designed for operationalising end-user demand steering. Following Lans (2009), who indicates that the networking domain represents social competence in relation to the entrepreneurial task, we hope to contribute to the notion that in the horticultural greenhouse industry knowledge of end-user demand should be used for research steering.

The KITE120 research programme

Against this background we are interested to learn how the grower and the supplier in the greenhouse horticulture industry can gain sustainable competitive advantage through product and process innovation. Our main research objective is to arrive at an understanding which interventions in leadership, organisational structure and culture contribute to a more innovative capacity. This is visualised in Fig.1.

The answers to these questions illustrate how companies can realize growth and improve innovative capacity of both the organization and the individual in that organization by linking economic and social sustainability. Resulting from these answers we hope to find support for two hypotheses:

– The bigger the innovative capacity in the greenhouse horticulture industry, the stronger regional development.
– The stronger regional development, the bigger the innovative capacities in the greenhouse horticulture industry.

Starting from the research questions, the current programme aims at strengthening multidisciplinary collaboration between enterprise, education and research. Using an analysis of a group of 30 companies in the greenhouse horticulture industry based in the western part of The Netherlands, a model is developed that might serve as a driving mechanism for process and product innovation and that fits the nature and characteristics of the companies in this industry. The research in progress is longitudinal and explorative and aims to gain a practical insight in the day-to-day operations of the participating companies and to elicit claims that prove valid for the entire greenhouse horticulture industry and possibly for other industries as well. In short, it is a way of looking at current operations and combining them with entrepreneurs' ambitions in order to arrive at generally applicable theories.

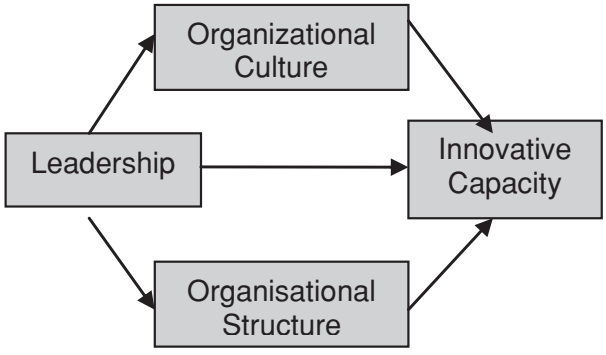

Figure 1: Research model visualised

The activities in the greenhouse horticulture industry are embedded in a wider research programme that is partly funded by a grant from the European Fund for Regional Development (EFRO) and encompasses three other sectors that are of importance to the regional economy in and around the town of The Hague in The Netherlands: the service industry, the legal and paralegal cluster, and the ICT/multimedia industry. The programme is known by the name of KITE120, which is an acronym for Knowledge and Innovation Towards Entrepreneurship. 120 Companies in the four clusters serve as research objects for the research programme. Its aim is to stimulate innovative capacity within organisations and to stimulate regional economic growth.

This research programme fits into the tradition of post-modernism that, as opposed to positivism, is not based on traditional scientific thinking but acknowledges the context related nature of knowledge following from experiences (*Harkema,* 2004). We believe that the behaviour of complex phenomena, such as innovation processes, confronts academics with particular insights that tear at the foundations of what till recently has been regarded as the mainstream academic tradition: the Newtonian equilibrium theory and the linear behaviour of systems. This implies that the future

can be predicted on the basis of experiences that occurred in the past. If we analyse and understand these occurrences we will be able to fathom the future. Especially companies are interested in predicting the future since it can give them certainty about something which within reason seems uncertain. Complex phenomena show that behaviour is dynamic and non-linear and that order emerges bottom-up through a process of self-regulation. This is contrary to how most companies operate and innovation processes are managed.

Besides the main research objectives, a number of enterprise objectives were formulated. These enterprise objectives primarily focus on the formation of networks and dissemination of knowledge, aimed at embedding sustainable results in the industry on completion of the programme. The main aim is to support enterprises and assist them in making an important step forward with their organisation by guiding them through the process from ambition to action. In KITE-terminology, we help them make a metaphorical 'Amazing Jump'.

Apart from the enterprise objectives, goals were formulated for students and faculty, who participate in the programme. These concern professionalizing and raising the quality of education and knowledge circulation. The latter aspect deserves separate attention as it is characteristic to research in the applied sciences. Professionalizing faculty should be seen in the light of the commitment of universities of applied sciences to stimulate knowledge circulation through practice-based research. Apart from knowledge of facts and figures and practical expertise, explanatory and conceptual knowledge are important to the professional.

Professionalizing staff is characterized by the development of knowledge and skills that allow faculty to better reflect on, define and conceptualize professional practice. Undertaking research is an important part of this. During that process lecturers apply knowledge and in so doing bring it up to date it. Subsequently, it is embedded in their teaching modules and curricula. It is vital for faculty and students to be critical consumers of scientific texts as well as to learn to apply practical and scientific knowledge for the purpose of developing new knowledge. In this way they not only improve their own capacities and capabilities as a lecturer, coach and student but also contribute to improving industry. Simultaneously, a process of knowledge circulation is created that is conditional to improved links between education and industry.

In the pursuit of these aims we contribute to the Lisbon agenda of the European Union in which entrepreneurship is considered a fundamental requirement for creativity and innovation (e.g. *Onstenk,* 2003 and *EU,* 2010).

Methodology

Considering these aims, we had to find a way of linking entrepreneurs, students and faculty. Our method consists of three elements:

1. a process model in which entrepreneurs, undergraduate students and faculty are brought together and collaborate,
2. a research model addressing several methods of data collection,
3. a theoretical model that provides a framework for companies.

The process model

The process model (see fig. 2) was developed to ensure that students are linked to entrepreneurs within a fairly rigid system of the academic timetable in universities of applied sciences. Periods of 20 weeks provide the basis for this model. In each of which one or two students are matched with one of the entrepreneurs in the greenhouse horticulture industry, following an intake by one of the faculty members.

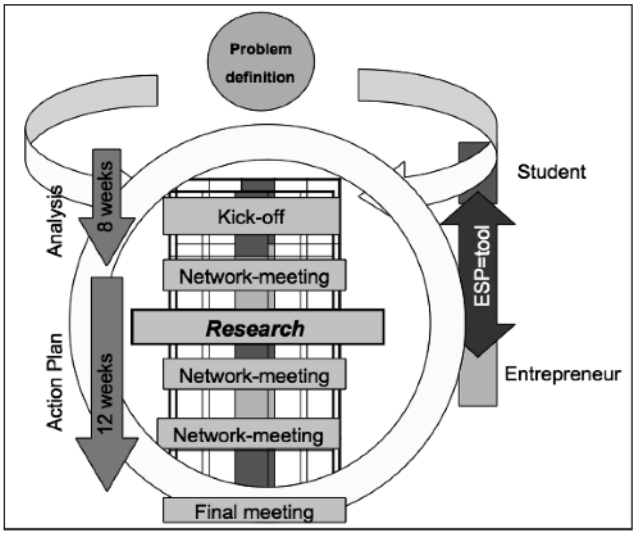

Figure 2: process model for innovation programmes linking universities and SMEs

In network meetings entrepreneurs, students and faculty gather to address topics that are relevant to more than one company or that can serve as best practice models to others. Preferably these meetings take place on location, i.e. at one of the participating organisations, rather than at the institute of higher education. Topics vary from leadership and innovation through lean production to multi-functional and multi-level use of space.

The research model and theoretical framework

The research model is complementary to the process model. To determine the strategic themes and problems in the sector, key-players and stakeholders were interviewed. Knowledgeable people with proven expertise and experience within the greenhouse horticulture industry were interviewed by the research team to elicit key issues in the sector. A semi-

structured questionnaire was used to confirm (or reject) published sources or popular opinion. The strategic topics and trends were subsequently clustered into four research themes: internal greenhouse climate management, organisational growth, knowledge of entrepreneurship, and time-to-market.

The next step is to define problems and research questions related to the research themes. In general terms we are interested in establishing how SMEs in this sector innovate and what are barriers for innovation. For the theoretical model we used the broader definition of innovation put forward by *De Jong* (2006) that innovation is purposefully innovating products, processes and work methods. This definition fits in well with the one brought forward by Tidd and Bessant (2009), who speak of the innovation space within an organisation. Four types of innovation can be distinguished: paradigm, position, process and product innovation. These innovations can be incremental or radical and according to their contribution to organisational growth and continuity can be classified as more or rather less successful. Innovation according to them is directly linked to the entrepreneurial skills of the owner / managing director who needs to recognise opportunities and assess their innovation value.

After having defined the research question, data collection takes place through the inductive approach. Data triangulation is leading in the approach, as it contributes to the robustness and reliability of the data. We have selected several ways of collecting data. In spite of the inductive approach we decided to build a theoretical framework through desk research. Not so much as to validate that theory, nor geared at the development of a new theory, according to the method developed by Glaser and Strauss (1967), but to bring focus to the research and serving as 'a pair of glasses' through which to look at our study object. The innovation model of *Tidd and Bessant* (2009) acts as a framework for that purpose. They describe phases that an organisation should go through from strategic innovation to implementation. Four aspects are important according to the authors:

- looking for opportunities and recognising them
- selecting opportunities and formulating a strategy
- implementing the strategy
- learning from that implementation

We use a modified version of their model (see fig. 3) as we introduce reflection and learning stages after each of the steps in the model, thus introducing a continuous learning experience.

Innovation is seen as a continuous process supported by routines and methods that contribute to a successful process and outcome. Against the background of the research question this has proved to be a valuable method to observe reality in similar research projects we have undertaken in the manufacturing and construction industries. The aim of the research is to establish whether the findings of our research and the model developed for that purpose, are also useful within the greenhouse horticulture industry.

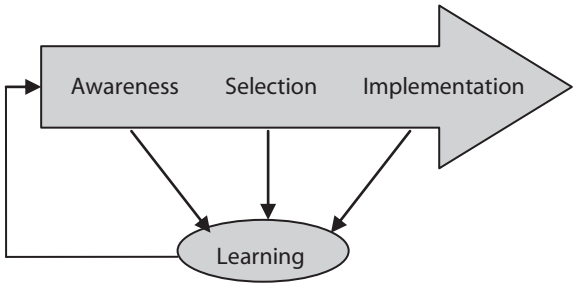

Figure 3: modified innovation management model based on Tidd and Bessant

It may prove equally useful in the greenhouse horticulture industry. Observations of interventions in organisational structure and/or culture are complemented with data collected from in-depth interviews based on a semi-structured questionnaire. This should lead to an understanding of what works and what does not.

From the data collected, the entrepreneur, the student and the member of faculty involved collectively select one or two aspects within the enterprise that can be formulated into an innovation action plan. Studying the implementation results, the entrepreneur can acquire knowledge and insight into radical innovation processes.

To illustrate the scope of our innovation programme, some of the KITE120-projects are given here as examples: They fit the designated problem areas in the greenhouse horticulture industry:

- developing an internal greenhouse climate control simulator. In conjunction with a grower and the installation industry we hope to develop a simulation programme to benefit the grower's climate requirements, unify existing programmes in use in the climate control industry and provide training facility for students and third parties
- promoting the use of direct current in the greenhouse horticulture industry. Together with a hardware producer we are looking for a stable infrastructure in and around the greenhouse to reduce installation cost and operational expenses for the grower.
- finding new business models for branding greenhouse horticulture produce in order to achieve competitive advantage for the grower
- developing new ways of reverse chain management in collaboration with a greenhouse horticulture consultant. Growers should benefit from this scheme through increased product demand
- finding a business model for innovative water reservoirs that solve problems deriving from the impending restrictions on reverse osmosis and waste brine disposal.

Discussion

If we observe changes and improvements within the industries of similar research programmes we have

undertaken, our findings show (*Van der Woude,* 2008, *De Pagter,* 2009 and *Boost et al.,* 2010) that innovation is both product and process innovation and in most cases incremental. Rather: what we do, we do a little better and / or faster. This is a recognizable pattern with entrepreneurs who develop their products to the demand of customers or end-users. Innovation here is re-active. The results so far suggest that the greenhouse horticultural industry does not innovate in this fashion, simply because there is a notable lack of knowledge of customer / end-user demand in comparison to the other sectors mentioned. Whether this means that this industry innovates pro-actively remains a matter for further research. Pro-active research in other sectors frequently goes together with larger companies having R&D departments. In the greenhouse horticulture industry this type of organisation is rare. Here the individual entrepreneur plays a crucial part, because it is the individual entrepreneur who started the company and consequently has an enormous impact on its development.

Although almost all companies innovate, our first observations show that there is no conclusive opinion on definition and importance of innovation for business growth among entrepreneurs. Most of them focus on product innovation. This is interesting, as it appears to be contradictory to Tidd and Bessant's finding that process and product innovation are closely interlinked, especially where the step form strategic innovation to implementation is concerned. Considering the model of *Tidd and Bessant* (2009) as the 'looking glass' and framework through which we research and analyse the sector the following observations can be made.

To most entrepreneurs in the greenhouse horticulture industry scanning external developments and looking for opportunities is not an integrated part of everyday entrepreneurship. And if it is, entrepreneurs have difficulty in adapting and applying their findings to their own situations. The question is why so little attention is paid to external influences, knowing that they are an important source of information and are the basis for recognising opportunities. There are several reasons for this attitude: it is not considered important enough, entrepreneurs pretend or presume to know developments, it is too great a burden on the entrepreneur due to lack of time, and competencies and interests of the entrepreneur quite often do not lie in the field of research or strategy.

During the next phase in the innovation process, that of selecting opportunities and formulating strategies, the entrepreneur should select opportunities and translate them into a strategy that fits his organisation. This requires not only looking at people's competencies, at financial feasibility, but also at processes that offer the best chance to realise the formulated strategy. Within smaller organisations it is the entrepreneur who is crucial to decisions taken and to the culture in the organisation that influences the innovation process. The smaller the organisation, the bigger the influence of the entrepreneur appears to be.

Klerkx (2008) suggests that innovation intermediaries assist agricultural entrepreneurs with innovation processes, bridging the managerial knowledge gap (*Bessant and Rush,* 1995). This is on the assumption that innovation is within the focus of the entrepreneur; that the entrepreneur is the "agent of change", who has sufficient absorptive capacity (*Cohen and Levinthal,* 1990) to learn how to innovate and be able to influence the innovative capacity of his organisation. *Klerkx* (2008) also shows the fragmentation in (types of) innovation intermediaries, from public to private, from for-profit to not-for-profit organisations. Klerkx does not focus on the role universities and colleges of higher education can play as both sources of knowledge and innovation intermediaries. Recent developments of this are the Green Knowledge Cooperative and the Greenport Campus Initiative.

Our research (*Van der Woude,* 2008, *De Pagter,* 2009 and *Boost et al.,* 2010) shows that in spite of an independent analysis or external advice, the entrepreneur easily disregards the outcome of the analysis or advice if it does not fit his own perspective. This would seem to reduce some of the added value of innovation brokers in the agri-food business as advocated by *Batterink et al.* (2008).

When implementing product innovation strategies, the entrepreneur should realise that process and people management play an equally important part. Through a clear implementation plan, such as the stage-gate model introduced by *Cooper* (1987) it is decided in advance which restrictions apply during product development stages and how to monitor progress. The process has built-in 'go' and 'no go' moments that should lead to successful market introduction of the new product of service. In fact this is the moment where ambition turns into action. This is quite a step where radical innovation is concerned, because there is a high degree of uncertainty about the success rate. In the case of incremental innovations the risk involved is considerably less.

However, earlier research (*Van der Woude,* 2008, *De Pagter,* 2009 and *Boost et al.,* 2010) also shows that in innovation processes in smaller enterprises a structured approach appears to be the exception to the rule. It is the entrepreneur who plays a pivotal role, at the expense of learning lessons and embedding experiences for future projects. It is our aim to develop the entrepreneur's competencies by means of going through a learning cycle of single-loop, double-loop and triple loop learning: reduction of mistakes, change towards new concepts and improvement of the ability to learn. This can more easily be effected when an entrepreneur withdraws from the daily routines and takes time to develop processes to professionalize his organisation and his employees.

Implications

In this paper we have described a model through which we aim to contribute towards regional development and improve the innovative capacity of SMEs in the greenhouse horticulture industry. The programme we developed to that end is aimed at gaining insight in the way SMEs in this sector innovate, and simultaneously professionalize

lecturers and involve students in research. The objective of our KITE120-programme is to try and eliminate innovation barriers among SMEs in the greenhouse horticulture industry and to develop instruments that are beneficial to organizations and individual entrepreneurs. A secondary aim is to help them make the step from ambition to action and from incremental to radical innovation. Metaphorically speaking we want entrepreneurs to make an 'Amazing Jump'.

Realizing this ambition requires strengthening the knowledge base, stimulating innovation, entrepreneurship and education. It also requires professionalizing people. It appears equally important to bridge the gap between the sub-sectors of Flowers and Food by developing and strengthening elements in the value chain, or conversely, by shortening the value chain. More interaction with sectors outside the glasshouse horticultural industry is welcome. This will bring on the need for more and better knowledge management and knowledge circulation.

We have illustrated the importance of combining enterprise, education and research in networks with a regional scope, with examples from the greenhouse horticulture industry. These networks generate economic regional and national growth and international competitiveness by acting as business accelerators. Subsequently, the need arises for programmes that focus on improving the image of the sector, if the sector is to remain attractive for entrepreneurs and their employees to work in. For the near and distant future most is to be gained from flexibly managing expectations and predictions and by reacting quickly to changing circumstances. Including organisational culture in times of innovation and including employees in the process are critical success factors. According to *McGuire and Rhodes* (2009) it is clear that effective innovation management starts at the top. Managers should never delegate innovation processes. Moreover, it is essential they themselves are committed to the change, if not success is highly unlikely. By changing first and setting an example, management itself becomes the instrument of change. It helps if teams and individuals are open to more than one opinion, set great store by collaboration with others and opt for experiment and growth.

An economy's ability to innovate is decided by a combination of the component parts of a national innovation system: its market, knowledge infrastructure, intermediary organisations and the collaborative interplay between these parts (*Hufen,* 2009). What we need are visionary entrepreneurs; people who are prepared to think out of the box and who can come up with radical alternatives, charismatic leaders, who inspire and help their organisation forward. Ongoing research is necessary to provide a better insight into the ways innovation processes can be organised, considering the size of the greenhouse horticulture enterprises, considering the limitations in human and financial resources and considering the options for collaboration across the value chain.

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ECONOMIC ASPECTS OF AN AGRICULTURAL INNOVATION – PRECISION CROP PRODUCTION

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Abstract: Innovation in agriculture ensures the wide-spread use of the latest, up-to-date technology. Such new technology is precision farming in crop production, which serves as a validation of the criteria of environmental and economic sustainability.
The economic applicability of precision crop production depends on several factors. Among them the following aspects must be emphasized: the size of the farm, the characteristics of the production structure, the current input-output prices and their tendencies, the investment needed for transitioning to precision technology and its capital source, the level of professional knowledge and the managerial attitudes of the farm.
I have examined the economic relations between potential savings in chemicals on EU level. It has been found that after switching to precision farming, the active ingredient use for fertilizers can be reduced by 340 thousand tons at the same expected yield level in an optimistic scenario in the EU-27, while the savings in pesticide use can be 30 thousand tons (calculating with the current dose-level). If approximately 30% of the crop producing and mixed farms over 16 ESU adopt this new technology, this will diminish environmental loads by up to 10-35%.
The majority of farms characterized by greater output and size can be based on their own equipment but it might as well be presumed that smaller farms can turn to precision farming not based on their own investment. They can buy the technical service from providers, they can establish producer cooperation, for example in the frame of machinery rings.
At a certain farm size and farming intensity precision crop production is a real, environmentally friendly farming strategy, with the help of which the farm can reach earnings that cover at least the economic conditions of simple reproduction.

Keywords: farming, technology push, low speed of diffusion

1. Introduction

It was over two decades ago when the technological foundations for precision farming became available in practice. Yet, it has not become as wide-spread as it was expected. Other technological innovations, such as nozzles suitable for spraying micro-drops of pesticides etc, rapidly became widely-used, regardless of the extra costs or sometimes even the investments they required.

Precision farming is a new farming strategy in crop production which enables farmers to implement variable rate applications, primarily in using chemicals. It provides farmers with a possibility to grow crops more economically, while the environmental load is also reduced. According to *Moore et al* (1993), site-specific crop management is an information- and technology-based farming system which is aimed at identifying, analysing and handling the soil, spatial and temporal variability for the purpose of reaching optimum yield and agricultural sustainability and to protect the environment. (*Moore et al.* 1993)

Precision farming makes it possible to treat the different parts of the field separately with targeted active ingredients, which results in a more rational and reduced application of chemicals. It is based on the facts that the data of soil examination enable farmers to plan variable rate fertiliser application, while the data about pest presence, the level of infection and its estimated development dynamics enable them to make decisions regarding crop protection and the dose of the active ingredient in the different lots. The computer-operated agricultural machinery can release fertilisers or pesticides in different amounts, while it can measure the yield of each lot during harvest, which assists the following planning period. It must be added, however, that the technology can be used to its full potential only if each participant of the system can and is willing to use it in an appropriate way.

According to *Wolf* and *Buttel* (1996), in the ensuing decades, precision farming will be a reforming tool for agricultural production, the key to increasing its efficiency as well as an abiotic factor that can reduce the extent of environmental pollution. They highlight the duality of the significance of this technology. It is not only the reforming tool of people's approach to agricultural production with its chemical reducing ability, but also one of the basic factors of efficient agriculture, retaining the present industry-like farming structure, investments and certain managerial structures and operational mechanisms. Furthermore, precision farming is a real means of reducing environmental damage, and it is a means of reducing risks on the level of farmers. During crop production, yield uncertainty can be

reduced and the security of farmers' incomes can be increased if the technological elements are used and combined properly, but not the incomes at every case (*Auernhammer* 2001; *Gandonou et al.* 2004; *Takács-György* 2006; *Hejmann – Lazányi,* 2007; *Chavas*, 2008).

Neményi et al (2001) emphasise that site-specific farming research goes far beyond the development of agricultural activities. They reveal the general tendency aimed at combining artificial (technological) and natural (biological, ecological, etc.) information systems.

In what follows, I intend to look at the issue from the point of view of innovation. For that reason, it is important to clarify the notion of innovation. Innovation refers to the process of applying knowledge (*Oslo Manual* 2006) The process is not for itself, it is important to use its result in practice – applied research. An innovation can be regarded implemented when it has been launched (product innovation) or when it has been applied during a production process (process innovation). The process of the innovation basis model is linear. Applied science (applied research) produces new ideas and products by using basic scientific results (basic research) called as science push line, which is followed by the launch of the innovation, when market forces take the leading role (market pull). (*Arnold – Bell* 2001) In this respect, precision crop production as an agricultural innovation belongs to the 'science push' category. Other authors call this type a demand-creating model (technology push). (*Pakucs – Papanek* 2010).

Precision farming technology became part of crop production in the United States of America in the 1990's. In 1992, 3% of American farmers used yield mapping combined with GPS (*Lowenberg-DeBoer* 1999), while in 1998, only 5% of them used some kind of a precision technology device (*McBride – Daberkow* 2003). However, precision soil sampling techniques and variable rate fertiliser applicators spread rapidly. In 1996, 29%, in 1997 33%, while in 1999 43% of American farmers used GPS-based soil sampling methods. While in 1996, only 13% of the farmers combined precision fertiliser release with variable rate applicators, this ratio was estimated to be 37% in 1999 (*Akridge – Whipker* 1997). In EU-member states, the spreading process started later and its extent also remained below the level of proliferation in the United States. Presumably, one of the reasons is the difference in farm size. According to a survey carried out in 2002, slightly more than 1% of Danish farms (400) apply this technology, on an average of 200 hectares, and only 10 farms reported to apply more than one precision element. (*Pedersen et al.* 2010)

Adaptation refers to the diffusion and proliferation of the innovation. Despite its 20 years, precision technology can still be categorised as being in the early stage of launch. Although it has already left the stage of innovations, its development is still being carried out, i.e. there are still R&D activities connected to that technology. Lack of capital as one of the main elements hindering innovation and its diffusion cannot be disregarded (*Pakucs – Papanek* 2010). Otherwise innovation is a tool for being adaptive to the new challenges. *(Marselek et al. 2008; Buday-Sántha, 2009)* Another important factor in spreading innovations is the role of mass communication channels since potential appliers can primarily be informed about the presence and details of an innovation through these channels. After the initial phase, however, the role of interpersonal communication channels increases (e.g. discussions between experts) as individuals base their decisions mainly on the information coming through these channels (*Csizmadia* 2009). We must also bear in mind the IT skills, however basic they are, required from the appliers of this technology. It must be underlined the important role of extension services and communications, the communication of economic and other usefulness of novelty in the diffusion of precision technology. (*Griffin et al.,* 2004; *Kalmár* 2010; *Kutter et al.,* 2011) The causes of the slow spreading process also include lack of education and expertise (*Attanandana et al., 2007; Pecze* 2008; *Takács* 2008; *Magda et al.* 2008; *Kalmár* 2010; *Nábrádi* 2010). Moreover, the new technology requires high-level managerial skills, accuracy as well as relatively high extra investment costs and the lack of proof for the cost-efficiency of the technology (*Lencsés – Takácsné* 2010). Accuracy is needed during proper application of precision technology, but often this becomes one obstructive factor of using it in farms. (*Arnholt et al.,* 2001; *Sinka*, 2009)

The amount of chemicals saved by precision technology can be regarded as chemicals not required and not taken by crops and also not released into the environment, thus playing an important role in reducing environmental load. The positive impacts of the technology are unarguable both on the level of farms and on the level of the national economy as several earlier studies found cost-effectiveness in farms, however, their detailed discussion cannot be included in this paper. (*Goldwin et al.* 2003; *Swinton* 2005; *Dillon – Gandonou* 2007; *Chavas* 2008; *Takács-György* 2008; *Lencsés* 2009; *Lencsés – Takács-György* 2009) The reduction of environmental burden can be considered as other positive impact. (Chilinsky et al., 1998; Pretty et al., 2000; Szűcs et al., 2004; Jongeneel et al., 2008; Takács et al., 2008; Magda et al., 2009)

The objectives of this paper are as follows:

- examination of the macroeconomic relations of precision crop production as an agricultural innovation and the modelling of active ingredient savings in case of applying this technology;
- revealing the causes of its slow proliferation.

2. Material and methods

During my research, I had the following presumption: in EU-25 countries, the transition of a certain number of farms to precision crop production would result in saving a significant amount of active ingredients, particularly in the field of crop protection, which would reduce the environmental load as well. Using scenarios, I modelled the changes in the amount of the fertiliser and pesticide applied

presuming crop producing and mixed farms adopt the new technology to different extents. The statistical data concerning farm structure were collected by EUROSTAT and the Central Statistical Office of Hungary, while those concerning chemical use were collected by the OECD (Table 1).

Table 1. Fertiliser and Pesticide-Herbicide Application, 2007

Country	Total arable land	Fertiliser	Pesticides
	thousand ha	kg/ha arable land	
OECD	350,960	22	0.70
EU-15	324,300	60	2.3
Hungary	9,300	58	1.7
Netherlands	4,200	134	4.1
Germany	35,700	105	1.7

Source: OECD in Figures 2008

The European Size Unit, which categorises farms according to their profitability (SGM output) and distinguishes 6 categories, served as a basis for identifying the farm size where the extra investment of adopting precision farming technologies pays off. Based on their size and farming standards, crop producing farms (cereals and other field crops, as well as fodder production) over 100 ESU were presumed to be able to adopt precision farming with the help of their own financial resources. I also presumed that farms of 16-40 and 40-100 ESU would be able to adopt precision crop production with the help of machinery rings (*Takács* 2000). In the EU, there are 240 thousand farms of 16-40 ESU, accounting for 4.2 million hectares of land. The number of farms of 40-100 ESU is 139 thousand, accounting for 5.9 million hectares, whereas the number of farms over 100 ESU is 77 thousand, and they account for 11.3 million hectares of land. The basis of the calculations at national level was also the above categorisation.

The ratio of farms deciding on adopting the new technology is 15, 25 and 40%, in case of pessimistic, indifferent and optimistic scenarios, respectively.

Savings for fertilisers are 5, 10 and 20%, while for pesticides they are 25, 35 and 50%.

3. Results and discussion

3.1. The diffusion of precision crop production – how it looks like and the reasons for its slow speed

Based on Rogers' (1960) typology of the diffusion of innovations, precision crop production as an agricultural innovation can be described as follows, including some of the reasons for its slow diffusion in practice:

1. In the launch phase, it had an advantage over the technological elements widely used in farming, which could have made rapid diffusion possible.
2. Precision technology is less compatible, as farmers greatly vary in knowledge, skills and attitude to innovations, as well as in farm size and financial background. Due to lack of counselling support, the process of proliferation of the new technology is slower. In this respect, the Hungarian practice has several positive features, such as the successors of the production systems set up several decades ago, and the counselling networks.
3. The application of precision crop production must be considered from two points of view. Although the adoption of the element of the technology is not complex, it requires far more attention, a wider information base and also more accurate work.
4. The key figures of letting farmers learn more and test the new technology are the participants of agriculture and providers. (There are several specialist, scientific shows and presentations organised annually in order to achieve wider diffusion.)
5. Some of the benefits of precision technology can be observed directly (material saving, improved cost-effectiveness, yield growth), similarly to extra costs and investments. However, its indirect impacts, such as the reduction of the environmental load and increased food safety, are less obvious. As long as the positive impacts of the new technology are not obvious and measurable for farmers, and the perceived risk of its introduction is high, the technology will diffuse slowly, even when the financial background is sufficient. (This phenomenon can be observed both in the United States of America and in Europe.)

The most important factor that can speed up the diffusion and wider application of the innovation is its profitability (*Samuelson – Nordhaus* 1985). Others emphasise the effects of demand (*van Rosenberg* 1976), the significant role of R&D (Freeman, 1974; Szűcs et al., 2010), or the role of the state (*Nelson* 1982; *Késmárky-Gally* 2008; *Pakucs – Papanek* 2010). According to some economic theories, demand-creating innovations can be expected to diffuse if using the limited resources with the new technology results in economic efficiency. The diffusion of precision crop production and its wide-spread application in practice is an economic decision from farmers side when they have to invest their capital. Thus, it is not sufficient to examine the changes in the variable costs incurred by production but it is also important to consider the changes in product prices as well as the rate of interest of credits so that farmers can make a reasonable decision (*Swinton – Lowenberg-deBoer* 2001). The dynamic spreading of the technology can be expected in countries where there is a scarcity of human labour, the amount of arable land is not limited, the selling prices are high, while the rate of credit interest is low.

Husti (2008) states that innovation is not generated by farmers in Hungarian agriculture, which results from the polarised and highly fragmented farm structure, the shortage

of capital and the lack of entrepreneurial affinity. The majority of agricultural businesses are characterised by a survival or sometimes consolidation strategy, which does not contribute to investment in the future of production. From technical size to implement all the necessary machines and other facilities the farmers can buy the technical service from providers, they can establish producer cooperation, for example in the frame of machinery rings. *(Takács 2000; Baranyai – Takács 2007; Baranyai – Takács 2008)*

In my opinion, it is of great importance to provide information for farmers, particularly information on the economic benefits of the technology.

3.2 The environmental and economic benefits of precision crop production

Modelling the savings of active ingredients of fertilisers and those of costs in case of switching to precision technology showed the following results: on the level of EU-25 states, the widespread application of precision farming in crop production may save 959-10082 t of fertiliser active ingredient, amounting to €327.1-1308.3m, while the costs of pesticides saved may range between €1674.1-3348.1m (using 2006 price levels) (Tables 2 and 3).

Primarily, precision nutrient supply may be the method of using the yield potential of the field, thus it is not a constant amount, and can even mean higher fertiliser application in certain cases. Naturally, there is considerable fertiliser saving when planning the consolidated field-level yield. Precision farming has an even greater significance in reducing the amount of pesticide used.

One of the main advantages of precision crop production is that site-specific treatment of lands with pesticides or herbicides may save a considerable amount of chemicals when only a small proportion of the land is infected. The estimated amount of pesticides saved in this way on the level of EU-25 countries is 5.7-11.4 thousand tons in case 15% of farms apply precision farming, 9.5-13.1 thousand tons in case 25% of them introduce it, while in the most favourable case it is 15.2-30.4 thousand tons (Table 4).

Considering the role of agricultural production in ensuring food safety, this

Table 2. Estimated savings in fertiliser application of farms introducing precision farming (EU-25)

Category			Farms applying precision technology		
			15%	**25%**	**40%**
16-100 ESU	Land using precision technology (ha)		103,559	172,598	276,157
	Savings in fertiliser active ingredient (t)	5%	535	892	1,426
		10%	1,070	1,783	2,853
		20%	2,140	3,566	5,706
>= 100	Land using precision technology (ha)		132,353	220,588	352,941
	Savings in fertiliser active ingredient (t)	5%	424	1,136	1,094
		10%	821	2,272	2,188
		20%	1,641	4,543	4,376
Total	Total size of land using precision technology (ha)		235,912	393,186	629,098
	Total savings in fertiliser active ingredient (t)	5%	959	2,027	2,521
		10%	1,890	4,055	5,041
		20%	3,781	8,109	10,082

Source: Author's calculations

Table 3. Savings in fertiliser costs

(million euros)

Country	16-100 ESU farm group			>100 ESU farm group		
	5%	**10%**	**20%**	**5%**	**10%**	**20%**
Denmark	2.398	4.796	9.592	3.654	7.309	14.617
United Kingdom	9.982	19.964	39.928	25.585	51.169	102.338
France	48.870	97.739	195.478	50.547	101.094	202.189
Netherlands	1.349	2.698	5.397	2.052	4.105	8.210
Poland	12.927	25.855	51.709	9.185	18.369	36.738
Hungary	3.641	7.282	14.563	4.913	9.826	19.652
Germany	19.362	38.724	77.448	40.025	80.049	160.099
EU-25	156.259	312.519	625.037	170.815	341.629	683.258

Source: FADN data base, edited by author

Table 4. Estimated savings in pesticide application of farms introducing precision farming (EU-25)

Category			Farms applying precision technology		
			15%	**25%**	**40%**
16-100 ESU	Land using precision technology (ha)		5,086,330	8,477,217	13,563,547
	Savings in pesticide (t)	25%	2,925	3,574	7,799
		30%	4,095	3,950	10,919
		50%	5,849	4,900	15,598
>= 100	Land using precision technology (ha)		4,818,598	8,030,997	12,849,595
	Savings in pesticide (t)	25%	2,771	4,618	7,389
		30%	4,095	6,465	10,344
		50%	8,190	9,235	14,777
Total	Total land using precision technology (ha)		9,904,928	16,508,214	26,413,142
	Total savings in pesticide (t)	25%	5,695	8,192	15,188
		30%	8,190	10,415	21,263
		50%	11,391	14,135	30,375

Source: Author's calculations

Table 5. Savings in pesticide costs

(million euros)

Country	16-100 ESU farm group			>100 ESU farm group		
	25%	35%	50%	25%	35%	50%
Denmark	18.272	25.580	36.543	19.127	26.778	38.254
United Kingdom	127.923	179.092	255.845	139.921	195.889	279.841
France	252.736	353.830	505.471	239.276	334.987	478.552
Netherlands	10.262	14.367	20.524	26.884	37.637	53.767
Poland	45.923	64.292	91.846	31.010	43.414	62.020
Hungary	24.565	34.392	49.131	22.043	30.860	44.085
Germany	200.123	280.173	400.247	191.189	267.665	382.379
EU-25	854.073	1 195.702	1 708.146	820.023	1 148.032	1 640.046

Source: FADN data base, edited by author

amount cannot be ignored. It has great importance since the same effects of crop protection can be achieved with a significantly lower level of environmental load if precision crop production is applied (Table 5).

As macro-level modelling calculations support, precision crop production plays an determining role in reducing the environmental load, along with the other agricultural technological innovations. However, precision farming has a greater importance in the reduction of the amount of pesticides used. On the level of farms, site-specific crop production leads to the reduction of material costs, as the necessary pesticide amount is 8-10% lower (calculated in active ingredient) than in case of traditional treatment Savings in pesticide use affect not only costs but also competitiveness, and have great importance in environmental protection as well.

In the above situation, individual and societal benefits coincide, thus serving sustainability. In agriculture, the diffusion of every technological procedure that has a positive impact on conserving or re-producing natural resources and can be implemented in a profitable way on the level of farms (economic efficiency) supports sustainability. Furthermore, the proliferation of precision crop production promotes societal sustainability, together with the reduction of environmental pollution and the production of foods, industrial raw materials and energy plantations.

Apart from economic arguments, precision technology can be supported by other factors as well. First and foremost, we must refer to its role in the reduction of the environmental load. However, it is not an important motivating factor for farmers, unlike for those who consider the transition to organic farming. Nevertheless, precision farming must be given outstanding attention in sustainable agriculture in developed countries. It must, however, be examined how it can be a real alternative in an economic respect. As it requires extra investment, expertise and accuracy, and its risks depend on a lot of unknown factors, farmers will not apply precision farming exclusively for 'philosophical' reasons.

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THE GLOBAL FINANCIAL CRISIS: IMPLICATIONS FOR CAPITAL TO AGRIBUSINESS

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***Abstract*:** The global economy has continued to experience lingering effects of the global financial crisis that began in 2007. Although attention was initially given to the liquidity crisis and survival of some the world's largest corporations and institutions, the financial crisis is likely to have long-lasting implications for agribusiness. As the world slowly recovers from the crisis, another round of problems are emerging as governments and international institutions attempt to unwind the positions they took in an effort to prevent the global economic bubble from bursting. Perhaps the most problematic factor for businesses is access to capital in sufficient amounts and at affordable rates. Governments and institutions, particularly in the United States (U.S.) and the European Union, have increased their financial obligations as the result of activities taken to curtail the economic crisis. These financial obligations and the associated financial risks place pressure on financial markets and tend to restrain the availability of capital and increase the cost of capital for businesses. However, the U.S. agricultural credit market has not experienced problems to the same extent as general business (commercial and industrial) and real estate credit markets have. In general, U.S. farm businesses have a strong balance sheet, adequate repayment capacity, sufficient amount of assets to offer collateral for loans, and reasonable profits. Thus, U.S. farm businesses have had an ample supply of credit at relatively low interest rates.

Keywords: financial crisis, capital, credit, agribusiness, liquidity

1. Introduction

The global economy has continued to experience lingering effects of the global financial crisis that began in 2007. Although attention was initially given to the liquidity crisis and survival of some the world's largest corporations and institutions, the financial crisis is likely to have long-lasting implications for agribusiness. As the world slowly recovers from the crisis, another round of problems are emerging as governments and international institutions attempt to unwind the positions they took in an effort to prevent the global economic bubble from bursting.

2. Central Bank Action

Early during the financial crisis, the United States (U.S.) Federal Reserve System (Fed) took the traditional step to stabilize the financial system by lowering the federal funds rate target from 5.25% in September 2007 (*Figure 1*). However, liquidity concerns remained. As the Fed continued to lower the federal funds rate, it took another step to assist the liquidity situation by creating the Term Auction Credit Facility in December 2007, which allowed institutions to purchase funds in the open market without going to the discount window (*Blinder* 2010). The Fed also began lending to nonbank dealers after the rescue of Bear Stearns in March 2008. With the failure of Lehman Brothers in September 2008, solvency as well as liquidity concerns were heightened. The Fed created the Commercial Paper Funding Facility, initiated Maiden Lane Facilities to provide Support for Specific Institutions (i.e., rescued American Insurance Group), announced the Mortgage Backed Security program, and accelerated cuts to the federal funds rate to near zero, all by December 2008. As a result, total reserves at depository institutions skyrocketed, but also did the Fed's assets leaping from $907 billion on 3 September to $2,256 billion on 17 December 2008 (*Figure 2*). Although additional programs would be created, for example, the Term Asset-Backed Securities Loan Facility, the dye had been set. In exchange for pushing and holding down liquidity risk and solvency risk premiums for financial institutions and businesses in the short run, the Fed's balance sheet had expanded and its leverage (assets:capital ratio) had multiplied more than two fold from 22:1 to 51:1. These short run actions may have long run consequences as the Fed downsizes its balance sheet by unwinding its positions. Although this only outlines the actions taken in the United States, similar actions and monetary expansions have occurred in other countries, such as the United Kingdom, Switzerland, and Sweden (*Anderson* et al., 2010).

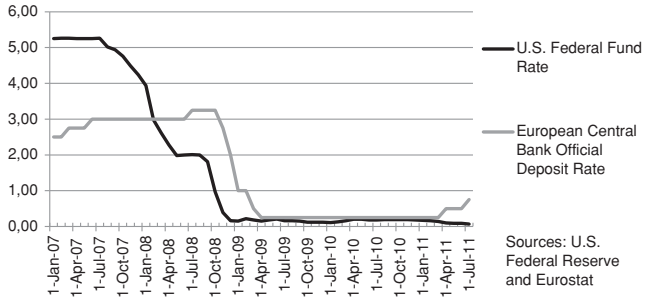

Figure 1. U.S. and European interest rates (%)

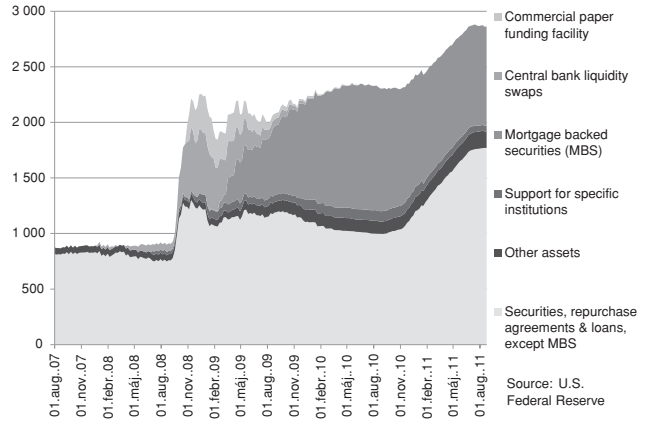

Figure 2. Composition of the U.S. Federal Reserve balance sheet: Assets side ($Billions)

Like individuals and businesses before them, governments and institutions in the United States and in many areas of Europe have increased their financial obligations as the result of financing activities taken to curtail the economic crisis and avert an economic meltdown. As this was occurring, financial institutions were reassessing their appetite for risk and their willingness to extend credit. Later came calls from the public for regulatory reform that have led to added financial market oversight, which in turn have driven credit institutions to draw back further.

3. Impacts

U.S. commercial banks and other financial institutions were beneficiaries of the Fed's liquidity and solvency programs. The first program addressed the liquidity crisis by providing ample amounts of reserves. The second program, the Capital Purchase Program, addressed the solvency crisis by making capital infusions in financial institutions. Of the more than 8000 eligible U.S. financial institutions, 707 received a total of $205 billion beginning in October 2008. By end of 2010 approximately 80% of these funds had been repaid and very few of the beneficiaries had failed (*Contessi* and *El-Ghazaly*, 2011).

Although the vast majority of banks have returned to a sound liquidity and solvency status, particularly banks in rural areas that had not piled on residential mortgage, commercial real estate, and non-agricultural business (commercial and industrial) loans, there have still been 380 U.S. bank failures since the beginning of 2008 through 19 August 2011 (*Federal Deposit Insurance Corporation*, 2011). Although 380 bank failures is a large number, they account for less than 5% of the 8534 U.S. banks that began the period.

Banks continue to be under pressure from both sides of the loan-making debate. On one side is the pressure from politicians for banks to make loans in support of growing the economy. On the other side is the pressure from regulators for banks to improve overall credit quality and increase the safety and soundness of their assets. Although the pressure from politicians to make loans has been long and on-going since well before the financial crisis and, in fact may have contributed to the crisis, the regulatory pressure has been in reaction to the crisis.

Prior to the crisis, many banks and other financial institutions had relaxed credit standards, particularly for real estate and commercial and industrial lending. This included a general relaxing of the five C's of credit for loan evaluation purposes. The five C's are: 1) character, 2) capital, 3) capacity, 4) collateral, and 5) conditions (*Gustafson*, 1989). Correspondingly there was less attention given to assessing loan applicant: 1) credit history, 2) balance sheet, 3) cash flow/repayment capacity, 4) asset valuation, and 5) profitability given the general economic trends. And even if attention was given, the minimum levels necessary to meet loan qualifications had been lowered. However, the lowering of loan eligibility criteria had not occurred to the same extent for agricultural lending.

Most financial institutions are quite familiar with their farm customers since they often serve them for many years and are very much aware of their character/credit history. Farm businesses have also maintained strong capital/balance sheet positions. In fact, U.S. farm sector equity is forecast to increase to $2,082 billion at year-end 2011 from $1,782 billion at year-end 2008, a 17% increase (*U.S. Department of Agriculture*, 2011). The $300 billion increase in equity is the result of farm asset values increasing by the same amount over the time period while farm debt remained the same. Of the $2,324 billion of farm assets, $1,973 billion (85%) is farm real estate. Moreover, farm real estate has been the leading contributor to the increase in asset values with an increase of $270 billion (16%) since 2008. Given the increase in U.S. farm asset values, there should be adequate assets available to serve as collateral for financial institutions to make farm loans.

Even though the overall U.S. economy has been slow to improve the past several years, the repayment capacity/cash flow situation for U.S. agriculture has improved. Farm net cash income is forecast to increase $26 billion (30%) from $89 billion in 2008 to $115 billion in 2011 (*U.S. Department of Agriculture*, 2011). Since interest rates have remained low and farm debt has been relatively constant, there has been adequate repayment capacity in the U.S. farm sector.

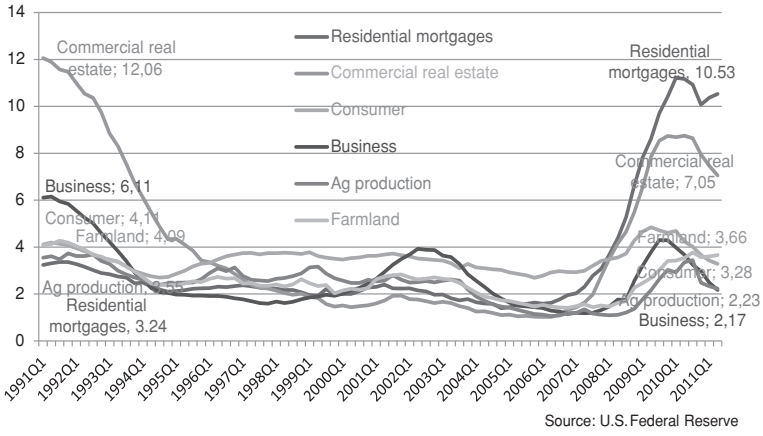

Figure 3. Loan delinquency rates at U.S. commercial banks (%)

However, this does not mean that repayment capacity is uniform across the country. Certain farm businesses, such as dairy farms, those with a large amount of debt, or those that lost non-farm income as the result of the weak U.S. economy, may be experiencing repayment difficulties.

Loan delinquency rates can be used as an indicator of credit problems occurring in various sectors of the economy. In general, the agricultural credit market has not experienced problems to the same extent as general business (commercial and industrial) and real estate credit markets have.

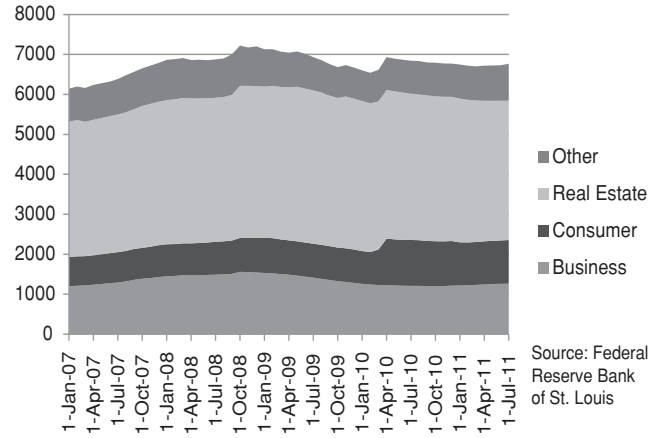

Figure 4. Total loans and leases at U.S. commercial banks ($Billions, seasonally adjusted)

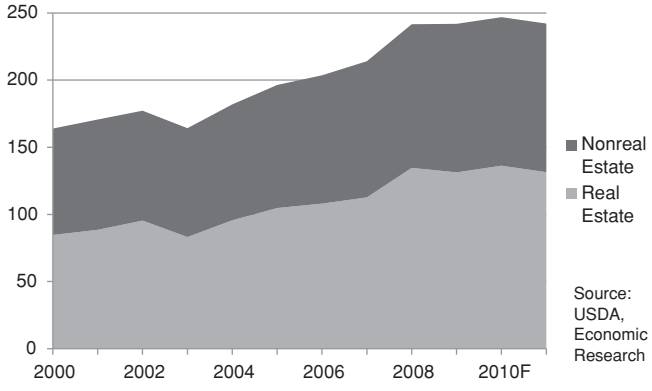

Figure 5. U.S. farm debt ($Billions)

The recent rise in loan delinquency rates at U.S. commercial banks began in 2007 when rates were between 1% and 3%, some of the lowest rates seen in the last 20 years (*Figure 3*). Delinquency rates had increased during previous recessions in the early 1990s and 2002, but not as quickly as they did in 2007 through much of 2009. The rise was particularly steep for residential mortgage and commercial real estate loans with delinquency rates peaking at 11.22% and 8.75% in 2010. Delinquency rates for agricultural production and farmland loans have risen as well, but not nearly to the same levels as residential and commercial loans. With current delinquency rates of 2.23% and 3.66% for agricultural production and farmland loans, they are similar to those for business and consumer loans (2.17% and 3.28%). As was the case for delinquency rates, commercial business and real estate loan volumes have been more problematic than agricultural production and farmland real estate loan volumes. After rising for a number of years, general business and real estate loan volumes have fallen 19% and 10% from their peaks of October 2008 and May 2009 (*Figure 4*). However, agricultural farm non-real estate and farm real estate debt volumes have changed relatively little the past four years, averaging $110 billion and $133 billion, respectively (*Figure 5*).

Although the agricultural credit market is relatively strong, the regulatory pendulum has swung from lax to tight. Moreover, many lenders have decided to switch their focus from growth and profit to safety and soundness. This has led to less emphasis on making loans of all types and more emphasis on investing in government securities. And even though agricultural credit remains available, loan eligibility criteria have been strengthened making qualifying for loans more difficult.

4. Looking Forward

Perhaps the most problematic factor for businesses is access to capital in sufficient amounts and at affordable rates. Certain things are beyond the control of individual businesses. As the result of governments and institutions increasing their financial obligations to restrain the economic crisis, the credit environment has changed. These financial obligations and the associated financial risks have placed pressure on raising taxes, more agency and bankruptcy costs, greater likelihood of credit and liquidity constraints, increasing credit reserves, baring additional regulatory costs, more inflation, higher interest rates, and more conservative behavior. If these changes occur, they will be the impetus for more restricted availability of capital and, for those agribusinesses that are able to attract capital, a higher cost.

However in this new environment of regulatory oversight and conservative lending, agribusinesses still have some control in their ability to attract capital. They must be ever more cognitive of the importance of attracting capital by

having their five C's of credit—character, capital, capacity, collateral, and conditions—in the best possible position in order to attract credit. Therefore, as businesses compete for capital, they must have a clean credit history, a strong balance sheet, superior repayment capacity, an ample supply of assets to offer as collateral, and be in position to operate profitably even in a weak, but slowly recovering economic environment.

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EXTERNALITY EFFECTS OF HONEY PRODUCTION

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Abstract: Bee-keeping and honey production has a long history in Hungary. Honey is an important and healthy food of people and it can be consumed without any human processing.
The honey production has important role, too. Some researchers say that if honey bee will extinct the humanity in the world would also extinct. It is true since plant pollination by honey bees is very important. It is confirmed by researchers' studies that plant pollination by honey bees has significant positive external impacts on potential yields in orchards.
Although the contribution of honey production to the GDP in Hungary is only a few per cent, other benefits play more important role. One of them is the positive external effect – mentioned above – and the other is the contribution to the biodiversity of the nature.
This paper focuses on secondary research methods, gathering and evaluating data regarding the positive external impacts of plant pollination by honey bees as well as finding possible solution for the problem that bee-keepers have a lot of costs in connection with carrying honey bees to orchards, while farmers "only" benefit from the positive externality of plant pollination of their fields. To evaluate its economic effects a numerical HEEM-model was developed and applied for the Hungarian situation.

Keywords: Honey production, bee-keeping, positive external impacts, HEEM model

Introduction

Honey is one of the most important foods of our modern world taking into account the current trend in food consumption. In addition to it, honey has an important role in the so-called "healthy lifestyle", since it can be consumed without any further processing. While honey has been used for thousands of years to treat wounds and ailments, scientists have only recently begun to explain the precise effects of the natural sweetener's antiseptic and antibacterial qualities on human health (*Heller,* 2008).

Worldwide production of honey amounts to around 1.4 million tonnes. The EU is an important producer of honey, in terms of production volume. In 2006, EU production of honey amounted to almost 200 thousand tonnes, accounting for approximately 14% of the global production. Other leading producers according to their production shares are China (22%), the USA (6%), Argentina (6%) and Turkey (5%) (*Faostat*, 2010).

Nowadays bee-keeping – as one of the activities can provide alternative income for small businesses in rural areas – has become more and more important topic in Hungary and in several part of the world. It takes important role in the preservation of rural landscape, traditions and their regional values. Rural development has become more and more important issue in Hungary since rural areas also contribute to the efficiency of the national economy. Development of rural areas also very important issue in the European Union, which could contribute to the improvement of profitability of small family businesses, higher employment rate in rural areas as well as slow down the migration of people from rural into urban areas. Nowadays bee-keeping sector provides income roughly 15 thousands families in Hungary. Hungary is one of the largest EU producers of natural honey, with production amounting to 19.7 thousand tonnes in 2006.

The contribution of honey production to the GDP in Hungary is only 1 per cent and to the animal husbandry is approximately 3 per cent. Bee-keeping has incontestable role in plant pollination too, hereby gives positive externality to plant production sector. In addition to it, contributes to the biodiversity of the nature directly. Classic micro economical example of positive externality is the contact between the apiary and the neighbouring orchard (*Kopányi,* 1993).

Research method

The main objective of this paper to show the relevant literature that contributes to the benefits and effects of pollination by insects with special regard to honey bees.

Secondary research methods were used for data gathering and evaluation, as the most internationally accepted one. Within the framework of the secondary research the restructuring and evaluation of the available data have been carried out.

For estimating the positive external impact in EUR, a model (HEEM – Honey-bee Economic Evaluation Model) has been created for evaluating different development

scenarios. For creation of the numerical model the method suggested by ZIMÁNYI (2006) was taken into account.

Evaluation of the most important literature regarding to the benefits of the pollination by honey-bees

The agronomic and economic value of honey-bee effected pollination has been an internationally contentious issue since at least the turn of the century (*Gill,* 1991). Unfortunately the recognition of the value of honeybees as pollinating agents has not always been unanimous. While the technical literature pertaining to the pollination of cultivated plants is relatively big and well-founded, that pertaining to the economic or social valuation of the pollination benefit is not.

Ecosystem services, defined as the benefits to human welfare provided by organisms interacting in ecosystems, are considered to be at risk (*Daily,* 1997; *Palmer et al,* 2004). Pollination by wild animals and honeybees is a key ecosystem service. Insect pollination is an ecosystem service with high economic value that is mainly provided by bees.

Honeybees, mainly Apis mellifera, remain the most economically valuable pollinators of crop monocultures worldwide (McGregor, 1976), and yields of some fruit, seed and nut crops decrease by more than 90 % without these pollinators (*Southwick* and *Southwick,* 1992). When wild bees do not visit agricultural fields, managed honeybee hives are often the solution farmers to ensure crop pollination.

An economic evaluation of the contribution of bee pollination to the production of 30 insect-pollinated crops was published more than two decade ago (*Borneck* and *Bricout* 1989). These authors attributed to each crop a value, 'the coefficient of incidence', based on its dependence on insect pollination and attributed 85% of insect pollination to honey bees. They calculated that the crops had a combined annual market value of 65,000 million ecus, that insect pollination contributed 5000 million ecus and that pollination by honey bees contributed 4250 million ecus (1 ecu = *ca.* 1$). There is a need to update this evaluation and include more than 30 of the 177 crops grown in the EU that benefit from bee pollination. More recently, the value of honey bees and bumble bees as pollinators of major selected UK crops for which market statistics are available, has been estimated to be £172 million for outdoor crops (rape, beans, tree and soft fruit) and £30 million for glasshouse crops (tomatoes and sweet peppers) (*Carreck* and *Williams* 1998).

Kevan et al. (1990) stated that underestimation of the pivotal role played by managed and native insect pollinators is a key constraint to the sustainability of contemporary agricultural practices. The economic value of such insects to pollination, seed set, and fruit formation greatly outweighs that suggested by more conventional indices, such as the value of honey and wax produced by honey bees.

Allsopp et al (2008) presented in their study replacement costs as a more accurate value estimate of insect pollination as an ecosystem service. In their opinion the importance of insect pollination to agriculture is unequivocal. Insect pollination is not only a critical ecosystem function, but also an essential input in the production of a host of agricultural crops grown world-wide. Of the approximately 300 commercial crops (*Richards,* 1993) about 84% are insect pollinated (*Williams,* 1996). Modern commercial crop production is increasingly dependent on managed pollinators (e.g. the introduction of honeybee colonies into orchards or fields to improve crop production), and less on wild insects living on the periphery of crop fields (Richards, 2001).

The "value" of managed honeybee pollination has been used to justify honey price support schemes (ROBINSON et al, 1989); funding for honeybee research and extension programmes (*Richards,* 1993; *Cook* et al, 2007); invasive weeds as necessary bee forage (*Gill et al,* 1985; *Allsopp et al,* 2004); and for the preservation of indigenous vegetation (*Turpie et al,* 2003). In turn the "value" of the wild pollination services (pollination ecosystem service) forms part of a case for the conservation of natural biodiversity.

We take a different approach to valuation by estimating industry-wide replacement costs for wild and managed insect pollination services (Table 1). We adopt an approach where the value of wild and managed insect pollination services are equivalent to the amount of income lost if these components were to be replaced by alternative (non-insect) means of pollination *(Table 1).* Consequently the replacement cost is proposed as an estimate of the relative value of these services.

French scientists from INRA and the CNRS, in collaboration with a German scientist, found that the worldwide economic value of the pollination service provided by insect pollinators, mainly bees, was €153 billion in 2005 for the main crops that feed the world. In terms of weight, 35% of the world food production comes from crops which depend on insect pollination, 60% come from crops which do not (such as cereals) and 5% come from crops on which the impact of insect pollination is still unknown. The total

Table 1. Current approach to calculate pollination service value

Approach	Formula to calculate "Pollination service value"	Reference
Total production value	Annual production value	n/a.
Proportion of total production value attributed to insect pollination	Annual production x insect dependence factor	MORSE et al., 2000; LOSEY et al., 2006.
Replacement value	(Annual production attributed to insect pollination) – (Annual production value using pollinator replacement)	ALLSOPP, 2008

Source: ALLSOPP, 2008.

economic value of pollination worldwide amounted to €153 billion in 2005, which represented 9.5% of the value of the world agricultural production used for human food that year.

The scientists also found that the average value of crops that depend on insect pollinators for their production was on average much higher than that of the crops not pollinated by insects, such as cereals or sugar cane (€760 and €150 per metric ton, respectively). The vulnerability ratio was defined as the ratio of the economic value of insect pollination divided by the total crop production value. This ratio varied considerably among crop categories with a maximum of 39% for stimulants (coffee and cocoa), 31% for nuts and 23% for fruits. There was a positive correlation between the value of a crop category per production unit and its ratio of vulnerability; the higher the dependence on insect pollinators, the higher the price per metric ton (*Klein et. al.,* 2006).

Their results highlighted that the complete loss of insect pollinators, particularly that of honey bees and wild bees which are the main crop pollinators, would not lead to the catastrophic disappearance of agriculture throughout the world, but would nevertheless result in substantial economic losses even though these figures take into consideration only the crops which are directly used for human food.

According to the study of the European Committee on the Status of Pollinators in North America honeybees is the most widely, carefully monitored, and commercially distributed pollinator, are used for the fruit and seed production of more than 100 crops in the United States. Estimates of their economic value in the United States range from $150 milllion (at 2007, the total annual cost of bee-colony rental) to almost $19 billion (the estimated value that farmers would pay if pollinators weren't freely available in nature) (Mazer, 2007).

The European Perspective

Although the European Commission recognises the need for more environmentally-friendly agricultural policies, it does not appear to appreciate the crucial role of pollinator diversity to the functioning of agricultural production systems to ensure continuity of supply of high quality and varied food for Europe or the dangers of over-dependence on the services of a single pollinator, the honey bee.

Crop production in Europe is highly dependent on pollination by insects. At least 264 crop species from 60 plant families are grown in the EU, nothing has been published about the pollination requirements of a third of these species but of the remainder, 84 % depend on, or benefit from, insect pollination (Williams, 1994).

The botanical diversity of morphology, degree of self-compatibility and sexuality of the flowers of crops grown requires a diversity of insect vectors for efficient pollination (*Williams,* 1994). The flowers of most outdoor crops are visited by an assemblage of insects, typically including the honey bee, several species of bumble bee, a few species of solitary bee, and on more open flowers species of flies, beetles, butterflies, or thrips.

The native European honey bee (*Apis mellifera*) is undoubtedly the insect species that contributes most to crop pollination (Williams, 1994). It is abundant and readily available; in the EU there are estimated to be *ca.*7.5 million colonies managed by *ca.*500.000 beekeepers. It is the only pollinator available for supplementary pollination of field crops.

After reviewing the relevant literature, our paper focuses on the model, created by the authors. **HEEM** – Honey-bee Economic Evaluation Model, as a possible solution for evaluating the positive external impact of honey-bee pollination. The main structure of the HEEM (Honey-bee Economic Evaluation Model) is seen below:

Table 2. Basic structure of the HEEM-model

TCCHP=CCCP+CCHK+SSCC+OC		**EUR**	**%**
TCCHP	Total Cash Contribution of Honey-bee Pollination	59.724.735	100
CCCP1	Cash Contribution for Crop Producer	14.880.000	24,9
CCCP2	Cash Contribution for Fruit Producer	28.080.000	47,0
CCHK	Cash Contribution for Honey-bee Keepers	288.000	0,5
SSCC	Saved State (social) Cash Contribution	16.476.735	27,6
OC	Other Contribution, such „intangible values" as value of biodiversity, healthy lifestyle, etc.	0*	0*

*not calculated at the present scenario.
Source: own research

The final figure of this calculation can be found in Table 2, that is about 60 million EUR for Hungary per year that is considerable higher than the sales value of the honey produced.

Based on primary and secondary research data the following input figures were taken into account *(Table 1.).*

Conclusions

It can be stated by the most important pertaining literature that benefits of honey pollinating are incontestable in many respects. In this paper we would like to show the relevant literature regarding to this topic and after that we made a model to calculate the economic benefits of the pollination.

Considering that the agrarian market is in a special situation in Hungary (*Kozár,* 2010) and based on these information and other calculated figures the value for country of Hungary is close to 60 million EUR in 2010. Since this figure touches about 16000 families the total figure is close to 4000 EUR per family. Other factors is not involved in these figures, like preserving biodiversity and healthy lifestyle, etc. we did not take them into account, so the actual figure can even be higher. Input data of the model will be recalculated based on further research in the near future.

Table 3. Input figures of the recent HEEM-scenario

Symbol	Description	Unit	Value
CCCP1	Cash Contribution of Crop Producer	EUR	14880000
CA1	Cropping Area of the country involved honey-bee pollination	ha	480000
TBF	Total Number of Honey-bee families in the Country	hive	800000
RORHF	Ratio of Relocated Honey-bee families in the Country	%	60
TBFPC	Total Number of Relocated Honey-bee families in the country	hive	480000
BF	Honey-bee families per ha	hive/ha	2
ANAR	Average Number of Annual Relocations	Occasion/year	2
YH1	Average Yield of the crop pollinated by honey-bees	t/ha	3
PRH1	average price of pollinated crop	EUR/t	200
Y01	average yield of the non-pollinated crop	t/ha	2,7
PR01	average price of non-pollinated crop	EUR/t	200
HMC1	harvesting and marketing cost of the crop	EUR/t	30
SCCP1	surplus chemical cost incurred at the crop producer	EUR/ha	15
SCO1	surplus other cost of the crop producer due to the relocation	EUR/ha	5
CCCP2	Cash Contribution of fruit producer	EUR	28080000
CA2	Cropping Area of the country involved honey-bee pollination	ha	24000
TBFPC	Total Number of Honey-bee families in the Country	hive	800000
RORHF	Ratio of Relocated Honey-bee families in the Country	%	3
TBF	Total Number of Relocated Honey-bee families in the country	hive	24000
BF	Honey-bee families per ha	hive/ha	4
ANAR	Average number of annual relocations	occasion	4
YH2	Average yield of the fruit pollinated by honey-bees	t/ha	25
PRH2	average price of pollinated fruit	EUR/t	250
Y02	average yield of the non-pollinated fruit	t/ha	22
PR02	average prie of non-pollinated fruit	EUR/t	220
HMC2	harvesting and marketing cost of the fruit	EUR/t	40
SCCP2	surplus chemical cost incurred at the fruit producer	EUR/t	100
SCO2	surplus other cost of the fruit producer due to the relocation	EUR/ha	20
CCCP	CCCP1+CCCP2	EUR	42960000
CCCHK	Cash Contribution of Honey-Bee Keepers	EUR	288000
HYH	yearly honey yield of the (relocated) honey	kg/hive/year	50
HPRH	average honey price of the (relocated) honey	EUR/kg	3
HY0	yearly honey yield without relocation	kg/hive/year	30
HPR0	average honey price without relocation	EUR/kg	3
ACR	average cost of a one-time relocation	EUR/hive	12
SSCC	Saved state cash contribution	EUR	16476735
ROSPDN	Social contribution recipients	person	3200
SSPPP	Social security payment per person	EUR/person	4000
TSSP	Total saved security payment	EUR	3840000
TBFPC	Total bee families per country	hive	800000
ABFPP	average bee family per person	Hive/person (bee-keeper)	50
SSC	average state social contribution	EUR	1200
ROSPD	Rate of social payment demanders	%	20
CCHK	average actual Cash Cost of Honey-bee keepers, the labour cost is not included in the figure.	EUR	70
LCPH	labour cost/hive/year	EUR	15
MCPH	material cost/hive/year	EUR	55
VAT	VAT	%	25
MCWVAT	Material cost without VAT	EUR	44
VATC	Vat cost	EUR	11
PIVAT	Pay in VAT	EUR	8800000
LCPIRAT	labour cost pay in ratio	%	47
LCREM	Labour cost remained	EUR	10,2
LCPI	Labour cost paid in	EUR	4,8
TLCPI	Total labour cost pain in	EUR	3836734,7
NPPH	Net profit /hive	EUR	4000,0
SSCM1	if NPPH > SSC, then SSCM = 0		0,0

Source: own research

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COMPETETIVENESS OF THE MONTENEGRIN FRUIT AND VEGETABLES SECTOR AND RECOMMENDTATIONS FOR IMPOVEMENT

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Abstract: A number of facts, primarily including high fragmentation at all levels, weak vertical integration, limited dimensions in comparison to competitors poor technological level and unbalanced quality/price ratio make the sector weak, low competitive and exposed to international competition, reducing its capacity to capture any existing market potential. Almost all opportunities are frozen by prevailing weaknesses and threat impacts are exacerbated by a largely prevailing number of weaknesses. High production unit cost appears to be a major constraint to local supply market competitiveness. This situation appears to be mainly caused by general low levels of productivity – provoked by not adequate and up-to-date cultivation practices, reduced levels of input use, utilisation of old and, therefore, less performing varieties, and also farm management shortcomings. High losses from reduced availability of post-harvest facilities and equipment add up to the problem. The improvement of the sector is not easy. In other words, there is a lot to do for the Montenegrin sector operators to increase sales: tackle imports and increase market shares in the domestic market and abroad. Based on our research, we suggest that the Montenegrin fruit and vegetable sector should primarily aim at substituting imports, increasing domestic consumption and developing exports to the region (CEFTA countries) primarily via promising market opportunities. Based on our analyses of the state of affairs of the sector, the competitiveness and the market potentials, the recommendations for improvement competitiveness are outlined.

Keywords: fruit, vegetables, competitiveness, strategy, sector improvement

1. Introduction

Montenegro is a small country (13,812 km² and 620,000 inhabitants) with one of the lowest population density in Europe (44.9 inhabitants/km²). The climate is Mediterranean, with more continental influences in the inner part of the country. Today Montenegro is at stage 2 of development out of the three stages (plus two transition stages) identified by the WEF and is positioned 49 in the Global Competitiveness Index 2010-2011, with significant weaknesses in infra-structures, market size and business sophistication that may have a negative impact on agriculture and the sector. Agriculture account for 10% of the GDP, almost 12,000 labor force and 49,000 rural households. Food production and agriculture still play an important role in the economic development of the Republic of Montenegro. Food production and agriculture play an important role in Montenegro's economy, with the primary sector alone providing (source: EUROSTAT) more than 10% of total GDP (GDP (EUR 2.95 Billion in 2009), with respect to 2% in the EU27, together with processing industry shares around 20% of GDP, and 4.9% of total exports (Source: MONSTAT).

The place agriculture takes in the economy is hard to evaluate due to obvious flaws in the sector statistics. The discrepancy between the share of agriculture in GDP and the share of employed people in agriculture is evident, since statistics monitor movements of employees in agricultural enterprises, but not in agricultural households. Some tendencies of labour market movement and structure of the active population are presented through data on the share of active agricultural population in total number of active population. According to these data in period between 1961 and 2003, the share of the active agricultural population in the total number of active population has been reduced from 53,6% to 8,8%. There are also considerable changes in labour force structure, as well as large-scale migrations of population from rural to urban areas of Montenegro, economically motivated, above all.

Surveys reveal an agricultural labour force of 11,902 (World Bank – Montenegro Institutional Development and Agriculture Strengthening – MIDAS), while official estimates point to a total of around 55,000 rural households in Montenegro (now 49,000 – Agri-Census preliminary data). Agriculture has been growing steadily at an average 2.4% annually from 2002 to 2006, with certain sub-sectors generating significantly higher growth, such as fruit at over 10%.

2. Sector structure

The sector benefits from natural gifted conditions (good climatic and soil conditions, sufficient water resources to grow high quality fruit and vegetables and vines) that give fruit and vegetable production and viticulture a long tradition for cultivation of a wide assortment of produce and make it possible that a significant number of the Montenegrin households deal with horticultural and wine production, although at a small-scale.

Table 1. Volumes and Values of the Fruit and Vegetable (including Wine) Sector in Montenegro. Farm prices

	Ha	Gross Output (t)	Wine (l)	Euro
Potatoes	6.800	130.000	–	39.000.000
Vegetables	5.500	130.000	–	58.500.000
Fruit	6.100	30.000	–	19.500.000
Horticultural sub-sectors	*18.400*	*290.000*	–-	*117.000.000*
Vinegrape Small-scale Farmers	1.750	15.600	1.200.000	4.000.000
Vinegrape "13 jul Plantaze" (Factory price)	2.150	23.100	14.000.000	30.000.000
Grape and wine sub-sector	*3.900*	*38.700*	*15.200.000*	*34.000.000*
TOTAL	22.300	328.700	15.200.000	151.000.000

Source: MONSTAT, author's estimations, 2011

The domestic horticultural production is on the rise, nowadays estimated at an overall 290,000 t/year: 160,000 t/year of fruit and vegetables and 130,000 t/year of potatoes. Looking at the key production area of Malesija and Zeta plans, it can be observed that after 10 year of decreasing, the production of vegetables has recovered and today this region has many active producers.

The domestic production of grapes is estimated (2008) in 43,989 tons (MONSTAT, 2008). The domestic production of wine is estimated (2009) at over 15 million litres (16,9 million litres in 2008, MONSTAT), out of which 1,2 million produced by small-scale wineries and the majority by "13 jul Plantaze", the largest wine producer in the country. The processing yields in private farms are limited as a result of the low technology: 50% for wine and 18% for brandy. The production of grape brandy is significant, as in 2008 it was reported by MONSTAT at over 1.1 million litres, with strong declining trend after variable productions in the past years and a stable contribution of the private farms just below 1 million litres/year. According to MONSTAT, potato area is stable, orchards and vineyards are on the rise, vegetable area is recovering after years of decline of the cultivated area (Chart 1).

The available data sets are not always consistent; hence estimations were required to design the sector structure. We estimate the sector value (farm prices) at approximately 155 million Euro/year according to the break-down of sub-sectors included in table 1.

The structure of the sector is highly fragmented, as the production area is divided into thousands of rural households, always not specialised as they are producing several kinds of produce, often for self-consumption, in addition to other crops such as cereals and feed for animals. We estimate that approximately 44,000 rural households and private farms are involved in the sector (90% of total rural households according to Agri-Census preliminary data), with a small average dimension that we estimate, for the rural households, at 0.20 Ha/each of horticultural/vine area, often in combination with other cultivations (livestock, dairy, etc.), particularly in the inner regions of the country. Rural families often have other sources of incoming, thus farming is a secondary economic activity aimed at self-consumption and at preserving the land property in an economy where the real estate market and trade of land are rather limited.

The average dimensions of the cultivations operated by private farmers are larger than the above estimated average, although the majority of them are included in the smallest dimension category (< 2.00 Ha). As in the pure rural families, also the small-scale farmers are not specialised, usually cultivating all products: potatoes, vegetables and fruit/vines in small areas (estimated mode: 0.40 Ha for fruit, 0.70 Ha for vegetables and 0.85 Ha for potatoes), often scattered in different plots (Table 2).

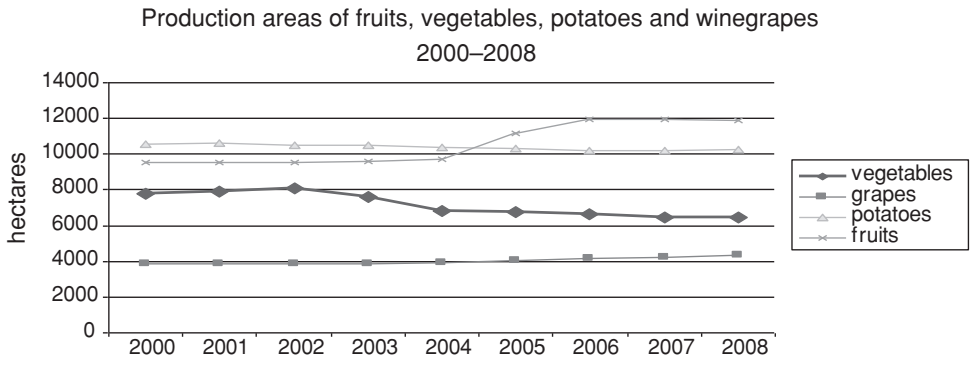

Chart 1. Production areas of horticultural products and vineyards
Source: MONSTAT

Table 2. Dimension categories of private farmers active in the Fruit and Vegetable (including Wine) Sector in Montenegro (estimated number of farmers per size category)

	< 2 Ha	2 - 5 Ha	> 5 Ha	Total
Potatoes	1,500 – 1,700	80 – 120	20 – 30	1,600 – 1,850
Vegetables	1,900 – 2,200	350 – 400	200 – 250	2,450 – 2.850
Fruit	1.000 – 1,300	350 – 400	25 – 30	1.375 – 1,730
Vine grape	600 – 800	120 – 150	25 – 30	745 – 980
TOTAL	5,000 – 6,000	900 – 1,070	270 – 340	6,170 – 7.410

Source: Author's calculations

The expected trend is for an increase in size of potato and largest horticultural producers, while grape producers should also grow in number due to the increasing interest in the profits the sub-sector may provide.

The registered grape and wine producers are 122. However, we estimate their number at almost 1,000. The majority of the grape producers also process grapes into wine: we estimate that the number of family wineries is over 500 in the country with the largest part making use of rudimental technology and producing less than 4,000 litres per year from an estimated mode acreage of 0,35 Ha each. Additionally, production of brandy is very popular across grape producers.

Table 3. Horticultural processing and wine sector in Montenegro

	< 200,000 Euro/year	> 200,000 Euro/year	(> 1 mil Euro/year)
Processing factories	55%	45%	(35%)

Source: author's calculations

In the horticultural sector we have approximately 100 processing factories in the country, with 10 of them having significant dimensions and market role and the others, mostly active in production of low quality fruit juices, without a strong market presence. Only 35 % of processing factories achieve year income more than 1 million (table 3). In fact, the domestic market of processed fruit and vegetables and fruit juice is still dominated by imported goods. It is difficult to estimate the number of traders that might venture into supply chain agreements with primary producers: we calculate them in not more than 10 at a national level, with Plodovi, Red Commerce and Mont-Valery topping this list.

3. Competitiveness of the sector

With the exception of "31 jul Plantaze", a number of facts, primarily including high fragmentation at all levels, weak vertical integration, limited dimensions in comparison to competitors poor technological level and unbalanced quality/price ratio make the sector weak, low competitive and exposed to international competition, reducing its capacity to capture any existing market potential. In fact, as confirmed by our SWOT Analysis, almost all opportunities are frozen by prevailing weaknesses and threat impacts are exacerbated by a largely prevailing number of weaknesses. As highlighted by the findings of the various investigations carried out to prepare this strategy and the collected documents on the subject, high production unit cost appears to be a major constraint to local supply market competitiveness. As already mentioned, this situation appears to be mainly caused by general low levels of productivity -provoked by not adequate and up-to-date cultivation practices, reduced levels of input use, utilisation of old and, therefore, less performing varieties, and also farm management shortcomings. High losses from reduced availability of post-harvest facilities and equipment add up to the problem.

Montenegro has a significant and increasing trade deficit in agricultural products with the EU. For instance, EU imports from Montenegro (Average 2006/08) about €1,1 millions (mio) of fruits, €2,1 mio of vegetables and €0.5 mio of wine. On the other hand, EU export to Montenegro (Average 2006/08 in 1000 Euro) about €0,3 mio of fruits, € 38,8 mio of vegetables and € 3,8 mio of wine. However, while vegetables shows an increasing trend in export, fruit show a decreasing trend in export and increasing import from EU countries. This represents a sign of better competitiveness of the vegetable sub-sector while the fruit sub-sector in suffering in a broad market like EU. Wine sector is gradually increasing export to EU, meaning a quite good competitiveness, primarily achieved thanks to the organisation of Plantaze.

These limits should be considered seriously as competition at an international level is increasing fast and significantly and the market is more and more segmented, comprising several market segments and niches that need to be carefully considered, also because the consumption will likely grow more in value than in volume and a consequence the markets will require more added-value and quality products rather than mass-products. Supply concentration and consistency are crucial factors for an adequate response to these market challenges along with innovation of product and process, a necessary tool to compete in the global market.

If we consider the European Union, the internal market of fruit and vegetables shows signs of saturation with increasing imports from major producers such as Egypt, Morocco and Turkey. The global wine sub-sector is undergoing a number of significant changes, too. New World producers like USA, Chile, Australia, South Africa and Argentina have expanded very dynamically and the share of Europe within the global production and exports has declined. World consumption and especially exports have been growing continuously. Among the biggest markets, USA, China and Russia are expanding, while Germany and the UK are stagnating. The key drivers of change for the international wine sub-sector are the growing impact of brands, shifting demand from bulk to premium wines and growing competition between wine countries and firms.

Distribution of wine and horticultural produce has become dominated by retail chains in developed countries and this trend is likely to appear soon in Montenegro, too. Supermarket chains retain extremely strong positions and bargaining power against suppliers. Their more and more global sourcing system creates a great challenge, but also opportunities, for growers. Major retailers prefer working with a limited number of big suppliers, thus increasing competition at a primary production level and on the other hand stimulating impetus to concentration and size of suppliers increase.

Because of the above reasons, the improvement of the sector is not easy. In other words, there is a lot to do for the Montenegrin sector operators to increase sales: tackle imports and increase market shares in the domestic market and abroad.

Considering the above state of affairs, the major weaknesses of the sector that should be addressed by any investment programme are the following:

- High fragmentation at all levels
- Weak vertical integration
- Limited dimensions and reduced economy of scale
- Poor technological level
- Unbalanced quality/price ratio

4. Market potential

Within the next five years, domestic consumption of fruit and wine is expected to increase, while vegetable and potato consumption is likely to maintain the current high level. With the gradual elimination of the remaining Montenegrin border protection and with the foreseen advance of foreign owned retail chains into the country, competitive imports are likely to soar. Domestic demand, particularly for high added-value products will increase following the growing purchase power of Montenegrin households and the lower real prices as a result of increasing competition (hazards for domestic producers: imports, new retail chains) and more efficient logistics. Also regional markets will increase imports and consumption as a result of the increased purchasing power of the domestic consumers.

These expected trends would suggest that the Montenegrin fruit and vegetable (including wine) sector should primarily aim at substituting imports, increasing domestic consumption and developing exports to the region (CEFTA countries) primarily via promising market opportunities.

The total market potential for the next 10 years is estimated at over 45 million Euro/year at farm prices (factory price for fruit juice).

In order to achieve the above sales potential, also benefiting from trade liberalisation and from the process of integration into the EU, the Montenegrin sector has to strengthen its competitiveness by focusing on a limited number of strategic options: high quality of production, market differentiation and strengthening of supply.

5. Recommendations

Based on the analyses of the state of affairs of the sector, the competitiveness and the market potentials, the following recommendations are outlined.

5.1 Strategies

Owing to the above described conditions, several measures should be taken to shift the Montenegrin horticultural sub-sectors from the current status of commodity-oriented supply to more attractive high-value product supply and to improve efficiency and marketing of the Montenegrin wine sub-sector:

Montenegro needs an efficiency strategy, including concentration of supply, strengthening of vertical co-ordination to manage the integration of the supply chain, improved management and increased productivity to reduce costs in order to enhance the efficiency of supply and address the impediments connected to the not adequate price formations schemes. The adoption of integrated supply chain agreements, partnerships among stakeholders and co-ordination and integration at all levels of the chain is necessary for higher efficiency and competitiveness.

At the same time, Montenegro needs to increase the value of the sector outputs through a market differentiation strategy, including market diversification, promotion of sales and improved marketing, better quality and safety of products, development of value-added products, branding and differentiation of products, expansion of additional market opportunities for the rural communities (tourism). The potential of high quality products is explicitly expressed in the Ministry of Agriculture strategic outlines. There is a strong awareness in the Ministry to improve product quality in the fruit and vegetable and wine sector directed towards EU standards. For processors and distributors the HACCP and for farmers the Good Agricultural Practice (Integrated Crop Management) is necessary and government control institutions are in place. Selected investment measures will foster the farmers and processing enterprises to meet the EU-standards. However, it will require efforts to raise the quality levels in production, processing, distribution and sales. The increase of consumer awareness shall play a crucial role in this process of quality improvement and will need investments and care through education and promotional schemes. The consistent conduct of retailers in the domestic market and wholesale traders in export markets will facilitate this process.

As co-ordination at all levels is felt to be crucial for the development of the sector, a Sector National Board with representatives of institutions (Ministry, Biotechnology Institute, etc.) and experts from the agricultural associations and enterprises should be established with the main target to integrate and to address marketing, promotion and the general development of the sector as a co-ordinating and representative body of all the interests co-existing within the

sector market. The National Board should give consistency and co-ordination to the implementation of a national innovation strategy, which needs specific actions (table 5) and investments.

Specific policy recommendation: A sector strategy followed by long-term and well planned export and marketing initiatives is necessary for the successful development of the sector under the guidance provided by a proposed Sector National Board and utilising the domineering position of Plantaze with their international market know-how and contacts for smaller private niche marketers in the wine sub-sector, along with a national policy with focus on small wine producers and the reform of controls and laboratories.

Specific policy recommendation: As innovation is a key issue in the sector development, R&D strategies should be developed and implemented to support long-term initiatives with strong focus on product- process- and packaging development. The domestic Competence Centre in the Biotechnology Faculty and the advisory services should be extended to support farmers and enterprises in a proactive way and via vocational training programmes offered to farmers and the first processing level. Limited resources should likely be shared in co-operation between the Biotechnical Faculty, the Chamber of Commerce, the Municipalities and other organisations.

processing of the products. This component of the interventions should be implemented via national schemes or under other programme. For a balanced development of the chain, investments at both primary production level and post-harvest stage are necessary in this domain. The current absence of a specific measure for Producer Organisations is a constraint that needs to be addressed quickly, as the organisation of primary producers is one of the most urgent actions for the sector development. Thus, the support to the establishment and the operations of producers‘ organisations (PO) is strongly recommended.

Specific policy recommendation: A flexible legal framework for establishing organisations that foster co-operation among farmers needs to be developed.

The implementation of the proposed market differentiation strategy will increase the value of Montenegrin products thanks to improved quality and marketing of the products and market differentiation.

Specific policy recommendation: Initiatives for quality improvements should be proposed in close co-operation with retailers and consumers. These schemes should also address organic farming and geographical indication products. The adoption of a supply chain approach should direct investments subsidies to the suppliers of packaging material, machinery, irrigation and cooling technology, agricultural input material (seed, fertilisers and pesticides) and logistics

Table 5. Marketing strategies for the Montenegrin fruit and vegetable (including wine) sector

Market Components	**Major Strategies**			
	Vegetables	**Potatoes**	**Fruit**	**Wine**
Targeted markets	Modern Domestic Market Regional Market (niche products)	Modern Domestic Market Regional Market (niche products)	Modern Domestic Market	Modern Domestic Market and Ho.Re.Ca Regional Market (niche products)
Distribution	Consolidation of supply at a primary level Vertical co-ordination and integration	Consolidation of supply at a primary level	Consolidation of supply at a primary level Vertical co-ordination and integration	
Promotion	Education of consumer		Co-ordination of promotional activities	Education of consumer and coordination of promotion with tourism
Price	Market integration/co-ordination to improve price formation schemes and positioning at high level	Market integration/co-ordination to improve price formation schemes	Market integration	Market integration/co-ordination to improve price formation schemes and positioning at high level
Product	Product innovation based on biodiversity; Improvement of quality of production; quality certification of origin	Specialise specific cultivar for final uses	Product innovation based on biodiversity; Improvement of quality of production	Product innovation based on biodiversity; Improvement of quality of production; quality certification of origin

As for the proposed “efficiency strategy”, the sector efficiency shall increase through the establishment of Producers’ Organisations, the implementation of supply chain agreements along the value chain, the improvement of primary production and the development of adequate post-harvest practices, including sorting, grading, packing and

suppliers to further improve quality and to reduce prices of the agricultural products. The labelling of wine and horticultural products as „Product of Montenegro” should be strictly implemented and controlled not to mislead the awareness of the consumers by meeting the origin of raw materials and the production location.

Training, technical assistance, R&D and consumer education will be necessary to support the sector development, facilitate the development of a Montenegrin cuisine, target the promising Ho.Re.Ca, channels and increase the level of education of Montenegrin consumers. The development of human resources through technical assistance and training is one of the bases of the proposed strategy of development. This target requires the enhancing of the scientific capability of technical staff and extension specialists through specialised training courses with national and international experts and networking with international scientific communities. Support to entrepreneurs at local level combining training and technical assistance and promoting R&D schemes is recommended.

If we look at the sub-sectors, we see that the wine sub-sector is showing a constant growth during the last years, the export is also increasing (+27% in the triennium 2009–2007 vs. the previous period) and at significant level, the domestic market is growing too, the investments in new machineries and new processing facilities are evident, the overall production is increasing, the number of labour forces that are employed by the sector is increasing. However, some financial constraints in terms of lack of working capital and investment capacity along with serious marketing and technology constraints need to be stressed and addressed through investments that the wine sub-sector should direct to primary production (enlargement of vineyard dimensions and renovation of vines, adoption of integrated crop management principles), to wine making practices (cellar technology, quality standards and HACCP) and marketing (branding, sales, promotion). Considering that tourism and environment are major drivers for the sector development, environmentally sound practices should be promoted at all levels, among market-oriented farmers, micro-scale farmers and rural households.

Thus, an improved competitiveness of the wine sector requires innovation and a better use of natural resources (vocational areas) through new vineyards by using controlled planting material. The production should also be organised by supporting farmers' initiatives for establishing associations and developing joint actions in production and marketing. This would contribute to achieve higher efficiency through vertical integration of agricultural production and processing. On the other hand, the focus of production on specific and traditional products of high quality would contribute to develop the horizontal integration between the wine sub-sector and tourism and make the tourist offer more attractive. This would also help to establish better conditions for developing the sector and for diversifying economic activities in the rural areas. The development of the existing Wine Route and its integration with other food thematic networks is considered crucial for the growth of the sub-sector. In fact, the integration among different product routes / tours (an olive oil route, the upcoming cheese route, honey and ham tours, etc.) will enhance the offer of typical food to tourists, make tourist resorts more attractive and increase the attraction power of the rural communities. These latter will highly benefit from the combination of food with rural heritage, natural parks and other environmentally-featured sites.

Specific actions for the horticultural sub-sectors shall improve the competitiveness by modernising agricultural holdings, through better utilisation of assets and human resources and thanks to the introduction of new technology and innovation, with particular focus on the market-oriented farmers. This requires also a better use of natural resources through setting up modern orchards by using planting material of controlled quality and using quality seeds also based on local biodiversity. This will specialise production aiming at market niches. Competitiveness could benefit from the enlargement of the supply season through greenhouses and plastic tunnels and improving market infrastructure that enables the storage and keeping of fresh produce for the market, thus improving the market quality and reducing the seasonal character of those products. Greater efficiency can be acquired through vertical integration of agricultural production and processing according to quality schemes and farmers' initiatives to establish associations and implement joint actions in production and marketing.

The link between tourism and the sector is a further asset for market development that requires stricter commercial connections with the Ho.Re.Ca. channels and the development of a sustainable and territory-based production consistent with the "Montenegro as an ecological state" project. In addition to the already commented enrichment of the tourist offer with specific and traditional products of

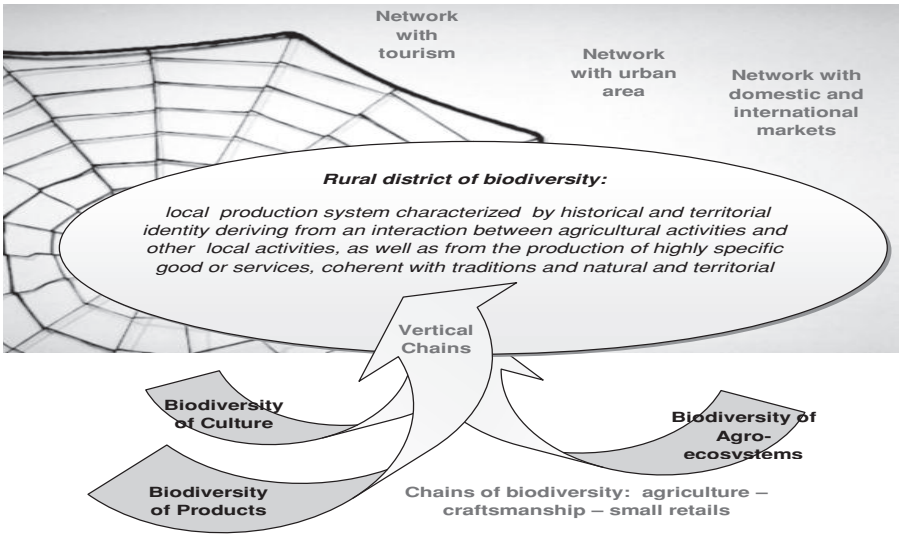

Chart 2 Territory-based networking

high quality, this will include additional assets such as actions for the preservation and sustainable use of biodiversity, the development of the organic production and the consistent land management. Biodiversity, in particular, may become a starting point to differentiate the sector production for niche markets, increase the sector products' attractiveness and support the enhancement of the rural communities ().

Specific policy recommendation: Migration of predominantly young people from the rural areas to the cities is a constraint to the development of the sector and the economy of the rural areas that attractive offers developed by the Rural Development programme might contribute to reduce and make reliable workforce available throughout all seasons. To this end, dissemination and communication initiatives for policy and strategy issues should be elaborated and implemented.

The improvement of sector prodcuts' attractiveness and the enhancement of rural communities are crucial objectives, as an increase in tourist and quality food demand could lead to a growth of imports if the local agri-food system is not properly organised in term of quality of products and services.

To tackle a possible increase in imports, the proposed interventions must primarily refer to the market-oriented farmers through the activated measures and national schemes. The further activation of the measures shall incorporate a wider number of rural households in the programme and give more dedicated focus to the "Montenegro as an ecological State" programme, thus increasing the sector attention to sustainability and territory-based production.

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COMPARISON OF THE PERFORMANCE OF A TRAINED AND AN UNTRAINED SENSORY PANEL ON SWEETCORN VARIETIES WITH THE PANELCHECK SOFTWARE

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Abstract: In this paper the results of trained and untrained sensory panels are compared on five Hungarian commercial sweet corn samples. The two evaluations were carried out in a sensory laboratory (ISO 6658:2005), with the same experimental design, with two replicates, and the panels consisted of 10 panelists. In both cases the panels assembled the profiles of the samples according to the vocabulary chosen by the trained panelists. The results show that the untrained panel has higher standard deviation, weaker repeatability and less significant parameters (ISO/DIS 11132). However 10 of the 17 sensory attributes were significant in the case of the untrained panel, the trained panel has 15 significant parameters with lower standard deviation and good repeatability. During the statistical investigation we focused on the panel performance and used the PanelCheck open source software package to achieve this goal. We followed the workflow suggested by the researchers of the Nofima, the developers of the PanelCheck. According to the examined parameters the trained panel has better discrimination ability (F values) for attributes 'yellow color', 'hue', roughness', 'freshness', 'juiciness', 'tenderness'. There was not an attribute evaluated by the untrained panel where all the panel members reached the line representing the 5% significance level. Furthermore the trained panel has better agreement between its assessors (Tucker-1 plots) and the repeatability is much better according to the MSE plots. This examination confirms that it is necessary to train the panels in order to get reliable and consistent results.

Keywords: Panel performance, PanelCheck, Sweet corn evaluation, Trained and untrained panel monitoring

1. Introduction

The computer aided sensory evaluation has been a topical issue of the past few years in the international industrial and scientific life. Sensory tests conducted by experts or consumers need high level IT support. On one hand the IT support is necessary during the consumer tests because of the high number of the consumers and on the other hand the expert tests need this kind of support to ensure the reliability of the sensory panel. There has been an ever growing need for the monitoring of the sensory panels. The panel leader has to know and follow the performance of the individual assessors and the panel as a whole: individual panelist's discriminating ability, individual panelist's reproducibility, individual panelist's agreement with the panel as a whole, panel discriminating ability, panel reproducibility (*Lawless – Heymann,* 2010; ISO/DIS 11132). Because of these facts have the researchers and scientists implemented two or more way mathematical methods (*Meullenet et al.* 2007, *Tomic et al.* 2007, *Martin and Lengard* 2005, *Pineau et al.* 2007, Kollár-Hunek et al. 2008, Héberger – Kollár-Hunek 2010). These methods, created to ensure the quality control and control of the panels, have been the part of different software (SAS, SensomineR, PanelCheck). The major advantage of this software is – with proper data pre-processing – that the results of the statistical methods are graphically based. In this way the performance of the sensory panels can be evaluated or analyzed rapidly and comprehensively. With this software the uni- and multivariate methods can be well combined. The panel leader gets useful information about the panel. With these important information the panelists can be trained according to their strengths and weaknesses. (*Tormod et al.* 2010, *Tomic et al.,* 2010).

2. Materials and methods

2.1 Materials

In our study five Hungarian commercial sweet corn samples were evaluated by two panels consisting of ten panelists. The members of the untrained panel were students of the Corvinus University of Budapest, Faculty of Food Sciences. The members of the trained panel were the assessors of the Corvinus University of Budapest, Sensory Evaluation Laboratory. These trained individuals got the

training which meets the requirements of the ISO 8586-1 standard (ISO 8586-1). The preparation of the samples was conducted by the same parameters (cooking time, sample quantity, material and brand of the cooking vessels, size and temperature of the hot plate, etc). The recommendations of Beeren (2010) were followed during the sample presentation, so the small amount of samples were prepared by one person to achieve better homogeneity, and reference samples were used to reduce the standard deviation. The samples were labeled, according to the international practice (ISO 6658:2005), by 3-digit random numbers. In the literature numerous types of palate cleansers are recommended depending on the characteristic of the tested products. During our earlier experiments tap water was used, but now the much more constant composition mineral water was chosen which has neutral taste and thus does not modify the sensory properties (Aquarius) (Sipos, 2010).

The sessions were conducted in two different days one for the trained and one for the untrained panels, with two replicates per sessions. The sensory evaluations were conducted in a laboratory which meets the ISO 8589:2007 requirements (ISO 8589:2007). The 17 measured attribute were the following: Yellow color, Hue, Size, Roughness, Freshness, Odor intensity, Cooked corn odor, Sweet odor, Texture, Juiciness, Skin chewiness, Tenderness, Global taste intensity, Sweet taste, Salty taste, Cooked taste and Aftertaste.

2.2 Methods

In our research the performance of a trained and an untrained panel were evaluated according to the workflow offered by the creators of the PanelCheck. The results of the untrained and the trained panels were compared by uni- and multivariate mathematical-statistical methods. The methods will be presented in an order that complies with the suggested data analysis workflow. The sensory test was carried out by the means of profile analysis (ISO 13299:2003). Results of the tests were summarized through spider plots. These figures show the similarities and differences of the tested samples across the attributes.

Multivariate statistical methods

2.2.1 Mixed modell ANOVA

As a first step, mixed model ANOVA was conducted for assessing the importance of the applied sensory attributes in detecting significant differences between the samples. The main reason for using this method is to eliminate the unimportant attributes from the further analysis. The method is based on modeling samples, assessors and their interactions in two-way ANOVA model or samples, assessors, replicates and their interactions in three-way ANOVA model, and then testing for the sample effect by regular F tests (on the vertical axis are represented the F values). In each case, the assessor and interaction effects are considered random. Only attributes that are significant at the chosen significance level (in our case we defined 5%) for product effect are considered as the subjects of further analysis.

2.2.2 Tucker

In the next step, the multivariate analysis method Tucker-1 was applied in order to get an overview over assessor and panel performance using multiple attributes. The essence of Tucker-1 method is that a PCA is applied on an unfolded data matrix. This data matrix consists all individual matrices (Xi,) ordered horizontally. This unfolded matrix then consists of J rows, where each row represents the average across replicates, and IXK columns, where I represents the number of assessors and K represents the number of attributes. This means that the dimension of the unfolded matrix will be J X (I*K). In the case of our data set the dimension would be 5 X (10*17), with J = 5 samples, and K = 17 attributes and I = 10 assessors in both cases.

As a result the method will provide two different types of plots: a common scores plot and a correlation loadings plot. The common scores plot shows how the tested J samples relate to each other, i.e. it visualizes similarities and dissimilarities between the samples along the found PC's. This plot gives no direct information on assessor or panel performance, but it can be used as a useful tool to investigate the discrimination ability of the panel taking the explained variances into account. Based on the high explained variance in the first few PC's (it means that there is a systematic variation in the data set) the discrimination ability of the panel can be considered as good.

The correlation loadings plot provides performance information on individual assessors and the sensory panel as a whole. The plot contains I*K dots, with each dot representing one assessor-attribute combination. The specific dots of one assessor or one attribute are highlighted in order to visualize the performance. The information about the performance comes from the position of the dots. If the attribute or assessor contains a lot of noise the dots will located close to the origo. On the other hand the dots will position around the 100% variance ellipse if there are more systematic variation. The other ellipse represents the 50% explained variance. If the dots of an assessor of an attribute fall under this line the performance will considered as not enough good. For a well-trained and calibrated panel the correlation loadings of the attribute under investigation should be close to the outer ellipse with all panelists clustered closely together.

2.2.3 Manhattan diagram

Manhattan plots in general provide an alternative way to visualize systematic variation in data sets. These plots are easy to look at and provide useful information for screening

purposes. The information visualized by Manhattan plots may be computed with different statistical methods. In this paper, we used PanelCheck to provide these kind of plots. In our study I*K explained variances will be given. The number of the assessors in both panels is I = 10, the number of explained variances is 10*17 with the 17 attributes.

Manhattan plots are easy to understand because it uses the shades of grey to visualize the explained variances and the PC's. The principal components located on the vertical axis. The shades have to endpoints, one is the black which represents the 0% explained variance, and the other is the white which means the 100% explained variance. The lighter the plot of an assessor or attribute, the better the performance is. Typically, the color will be darker for PC1 and then get lighter with each additional PC. In other words, the explained variance at PC3 is the sum of the explained variances of PC1, PC2 and PC3 (Tomic, O et al. 2010). In our case the method is most useful when the explained variances for the different attributes are presented in separate plots. The other option is to sort the explained variances by assessors in order to obtain information about the differences between panelists. The shades help the user to identify these differences and after this one can choose the specific methods to investigate deeper the chosen assessor or attribute. This can shorten the time of analyzing performance. Both of the methods mentioned above are implemented in PanelCheck but we have chosen the plots sorted by attributes because we were interested in the differences between panels according to the measured attributes. For further analysis the other option can be used later in another study to improve the trained panel.

Univariate statistical methods

2.2.4 F plots

F values can be used to check each assessor's ability to detect differences between the samples for a given attribute. F values can be plotted in a bar diagram, giving an overview over the performances of all assessors in the panel. Generally speaking, it can be said that the higher the F value of an individual assessor for a certain attribute, the greater is the ability of this assessor to distinguish between the measured samples. Besides the F values there are two horizontal lines in the F plots. These lines represent the 1% and the 5% significance level. If there are differences between the tested samples one can expect the assessors to obtain higher F values than the level of the 1% and 5% significance level.

2.2.5 MSE plots

The MSE values are the mean square errors (random error variance estimates) from the one-way ANOVA model so they provide a direct measure for the repeatability of the individual assessors. Similar to the F values a total of I*K MSE values are calculated and plotted in a bar chart. If an assessor almost perfectly repeats the results, this MSE value should be close to zero. This means that in contrast to the F values the lower the MSE values mean the perfect performance. Generally speaking, the lower the MSE value, the better the repeatability of the particular assessor. It should be used with the F values to get a realistic overview over the panel's performance. If differences between the samples are given, an assessor should ideally have high F values and low MSE values.

2.2.6 p*MSE plots

In a p*MSE plot the assessor's ability to detect differences between samples (p) is plotted against their repeatability (MSE). A total of I*K pairs of p and MSE values are computed and plotted in a scatter plot. They can be presented together in various ways (for instance all at the same time, only for one attribute at a time or only for one assessor at a time) and with highlighting of the assessors or attributes that one is particularly interested in. The perfect p*MSE plot has low p and MSE values close to the zero and all of the dots are clustered around the origo. However it is true in the case the difference is really present between the tested samples. The p*MSE plot is a valuable tool to quickly and easily detect which assessors perform poorly for a certain attribute. A great advantage of the p*MSE plot is that it displays distinguishing performance and repeatability in a single plot for all assessors and all attributes. That means that with a single plot one can get a quick overview over the performance of the entire panel.

2.3 Preparation of data

There is always a data preparation step before importing data into PanelCheck. The software requires a data structure, so one needs to order the data sets according to this structure. The most obvious way of doing this is the use of the Microsoft Excel, where the assessors should be ordered in the left column (A), and the attributes should be on the first row of the table. During the data import the software asks which columns are the columns of the „assessors", „replicates" and „samples". Furthermore it offers an opportunity to choose attributes or assessors in which one is not interested in so one can leave out these objects. After this the data import is done. During the process the software automatically checks the data sets and gives a „Summary" which contains the parameters of the data set. With this tool one can see that all of the data are OK.

3 Results and discussion

The plots used during the analysis have unique information and can be used independent on the other graphical methods. But it is much more effective to use them as a collection of methods, so they can complete each other. Following these the panel leader can have a more

comprehensive picture over the data set. With this information in hand the weaknesses of strengths of the panel can be analyzed more efficient. The methods and plots used in this paper are based on two replicates. According to the results of the trained panel we used the workflow indicated as gray in Fig. 1 and the results are discussed detailed below.

3.1 Trained and untrained panel, 2-way ANOVA

According to the workflow in Fig.1 a 2-way ANOVA was applied on the data sets of the two panels as the first step of the analysis. The results are visualized on Fig. 2 and 3. The plots have three different colors. The red means the significance level is $p<0.001$, the orange means $p<0.01$, the yellow means $p<0.05$ and the gray means the non-significance. The non-significant attributes were excluded from the further analysis. According to this the trained panel has two non-significant parameters, Roughness and Salty taste, and the untrained has four, Size, Sweet odor, Texture and Aftertaste. So these attributes had been excluded from the further analysis. The untrained panel has twice as many attributes which are non-significant. Although the results of trained panel are not fully satisfying but they can be improved by further training and practice. It is important to mention that the trained panel had no specific product training because they have to work with different kind of products.

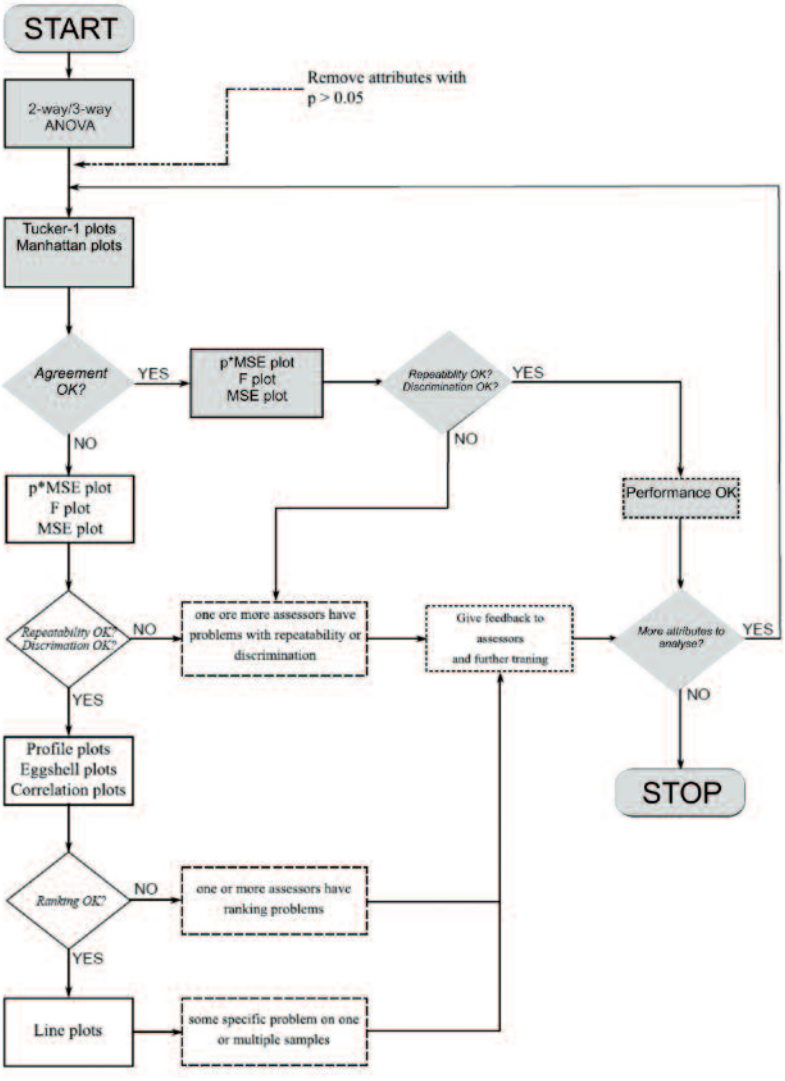

Fig. 1: The applied workflow indicated as gray

3.2 Trained and untrained panel, Tucker-1 plots

The next step is the applying of multivariate statistical methods to get an overview about the performance of the two panels. The panel has good performance if the members of the panel (dots representing them) are close to the outer ellipse (100% explained variance), and to each other (Tormod et al. 2010). Fig. 4 represents the Tucker-1 plots of the untrained panel. It can be seen that the dots are scattered at most of the attributes so the panel has weak performance. There is only one attribute (Sweet taste) where all of the panel members are between the two ellipses, but the assessors are far away from each other so the panel agreement is weak. At the juiciness attribute the assessors are close together but one of them is located under the 50% ellipse so his or her variance is low. If his or her results would be excluded this performance could be considered as good. The results of the trained panel on the Fig 5 show better panel agreement. The assessors have lower variance at the Cooked odor, Odor intensity and Aftertaste attributes. Furthermore there are some assessors who have lower variance at the Size, Sweet odor, Texture and Cooked taste attributes. The lack of agreement is not only because of the panel's weakness, it is possible that there were no differences between the tested samples, or if there was it was only a little difference. As a result it can be said that the trained panel has better agreement; there were more attributes with excellent results. In contrast the untrained panel has no parameter with excellent results.

3.3 Manhattan plots of the trained and untrained panels

Using the Manhattan plots the systematic variance of one specific attribute can be analyzed. The performance of the two panels can be compared according to this. In this case we selected the visualization by attributes because we are interested in the differences of the panels. In the case of seeking the performance differences between the assessors of one specific panel one should select the visualization by assessors. Both panel needed

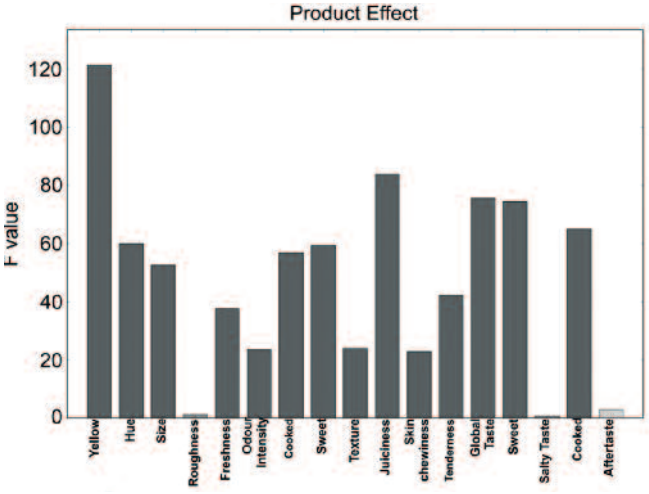

Fig. 2: ANOVA of the trained panel. Two parameters do not reach the p<0.005 significance level (Roughness and Salty taste)

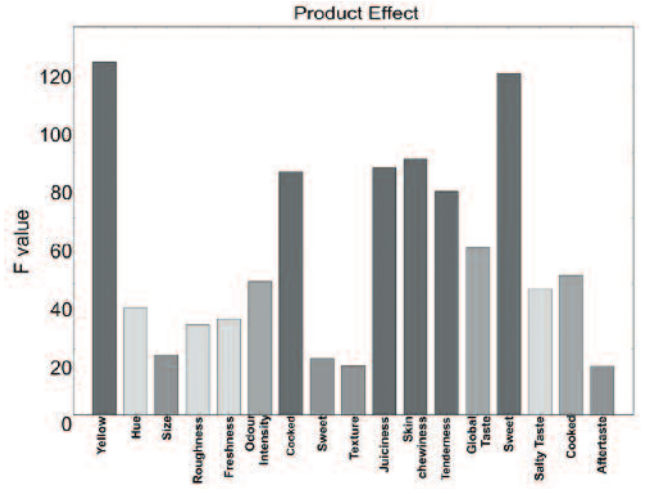

Fig. 3: ANOVA of the untrained panel. Only six parameters reach the p<0.005 significance level and there are four parameters with p<0.001 level (Size, Sweet odor, Texture and Aftertaste)

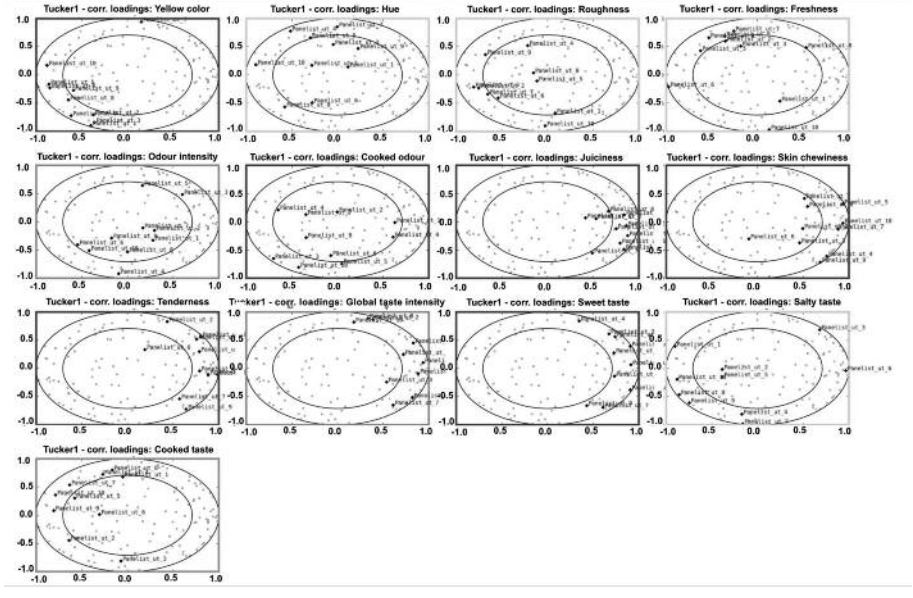

Fig. 4: Tucker-1 plot of the untrained panel

more PC's to reach higher explained variance. The best results of the trained panel were at the Skin chewiness and Tenderness. According to the results the untrained panel has lower explained variance at the attributes as the trained panel. It can be stated that trained assessors used and understood better the attributes as untrained panel (4 out of 17 were nearly the same, and 11 out of the 17 were better understood and used).

3.4 F plots of the trained and untrained panels

When analyzing the F plots it has to be considered that the higher F values mean the better discrimination ability. Furthermore the significance levels are plotted too. More trained as untrained assessor reached the 5% line, as it can be seen in Fig. 6 and 7. Besides this the F values of the trained panelists were higher than that of the untrained panel. Nevertheless there are trained assessors who had weaker performance at specific attributes. With the PanelCheck one can find the reasons of this weaker performance and can suggest further trainings which opportunity could be a good base of a further study.

There are no untrained assessors who could reach the 1% significance level at all of the measured attributes. In contrast there were only four trained assessor who could not reach this 1% significance line at one of all attributes. According to the results of the F plots the trained panel has better discrimination ability than the untrained panel.

3.5 MSE plots of the trained and untrained panel

After analyzing the discrimination ability the next step is to measure the repeatability during our way to explore the performance of the two panels. For this purpose the MSE plots are the best tools. The results of the MSE plots can be summarized in one sentence: the lower the MSE value the better the repeatability. The better the repeatability of the assessor the closer the MSE value will be to zero.

Two panelists out of the untrained panel, panelist 2 and 4, have as low MSE values as the average of the trained panel. They probably have good sensory abilities, or good sensory memory, since they gave results similar to the trained panel with the lack of training. But their F values were weaker than that of the trained panel.

The MSE values of the trained panel were lower than that of the untrained panel but the untrained panel has some better results. It would be efficient to analyze some attributes to

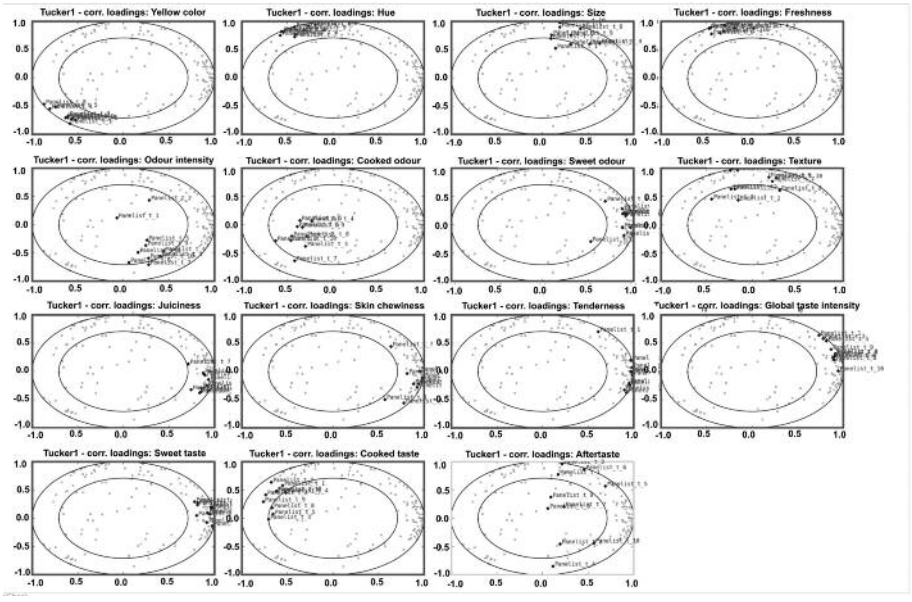

Fig. 5: Tucker-1 plot of the trained panel

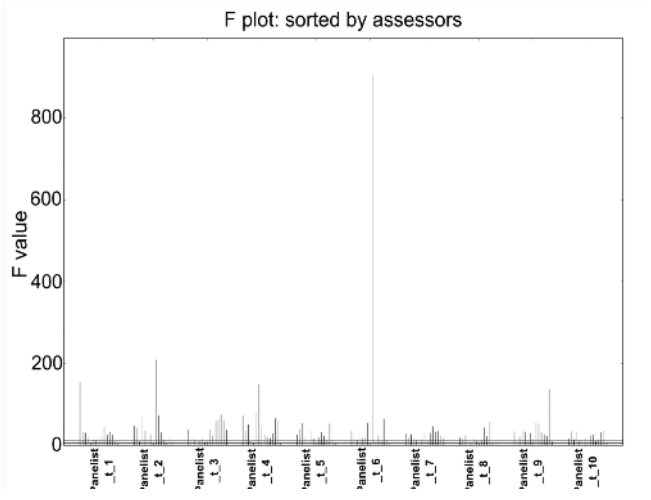

Fig. 6: F plot of the trained panel

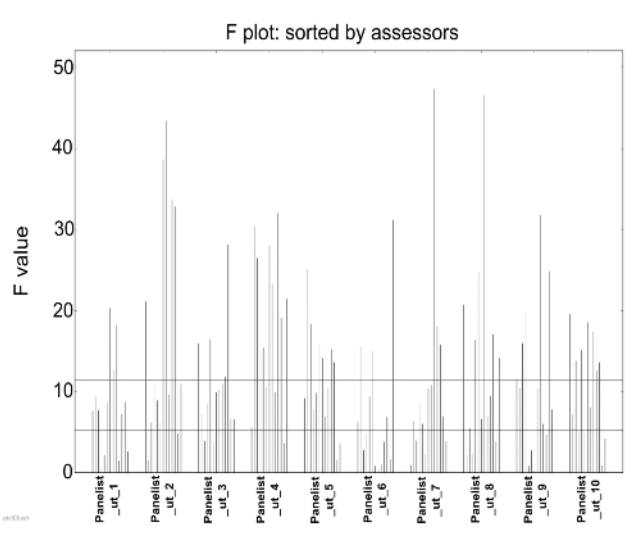

Fig. 7: F plot of the untrained panel

achieve better results, or with other words: to achieve better repeatability.

*3.6 p*MSE plots of the trained and untrained panels*

The p values of the trained panel were lower (the highest of them was p=0.4, in contrast the highest of the untrained panel's p values was p=0.8). The same can be said about the MSE values so the trained assessors have lower results (the MSE values of the trained assessors were around 20 with some around 60, but the untrained panel's results were around 50 with some around 300), which means that the trained panel has better discri-

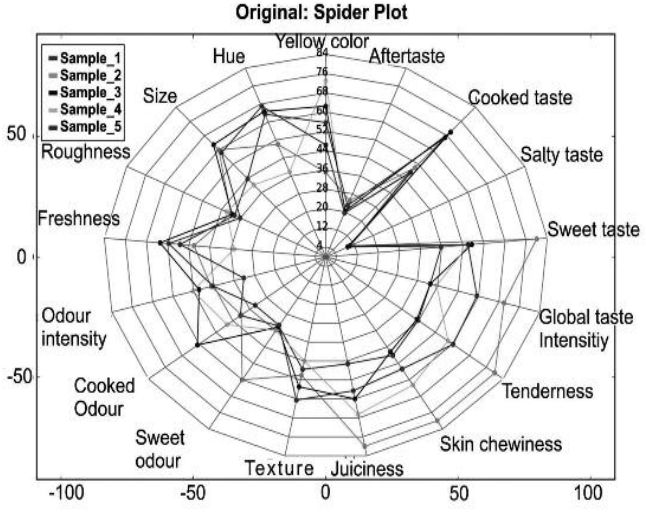

Fig. 8: Spider web plot of the trained panel

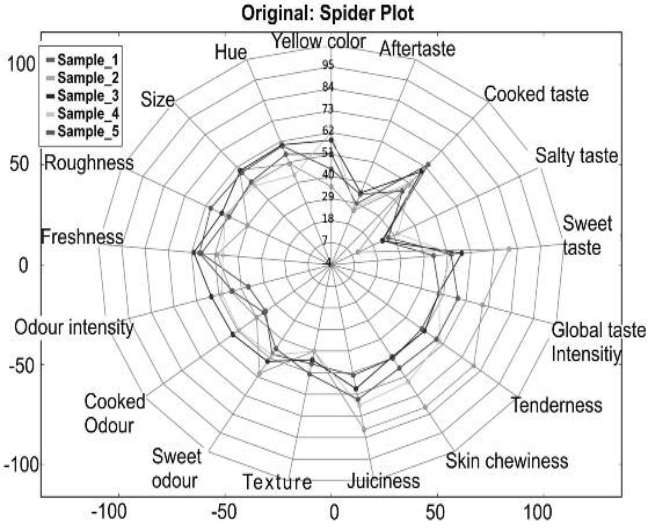

Fig. 9: Spider web plot of the untrained panel

mination ability. According to the results the trained panel has better panel agreement because the standard deviation of their MSE values was lower.

3.7 Spider plots of the panels

In the following we would like to present the profile plots of the two panels. Fig. 8 represents the plot of the trained panel and Fig. 9 is the profile plot of the untrained panel. There are some differences between the two panels.

According to the plots the main differences were the Sweet taste, Global taste intensity, Tenderness, Juiciness and Skin chewiness. On the plot of the trained panel one can identify bigger differences so the trained panel was more sensitive.

4 Conclusions

After the analysis it can be said that according to all of the applied methods the results of the trained panel were better than that of the untrained panel so the training, validation and monitoring of the panels are important during sensory evaluations. For the two panels the most difficult attribute to use were Cooked odor and Odor intensity. These two attributes have the highest variations in the Tucker-1 plots and they required the most PC's in the Manhattan plots to reach higher level of explained variance. Both attributes are based on olfaction so it can be said that it would be useful to train the odor detecting ability of the panels. It could be done using reference samples, and after this training the panels could reach better results.

In general trained panel has a good performance but the F values of panelist 2 do not reach the 5% significance level at 5 out of 15 attributes which is high among the trained assessors. Furthermore the MSE values of the assessor are high among the other trained assessor's MSE values. So the assessor's discrimination ability and repeatability do not match to the average of the trained panel. It would be very useful to analyze deeper the results of panelist 2 or conduct more tests to find out what was the problem. It could be a temporarily or a permanent problem. Having this information about the panelist the panel leader can make a decision about the results of the assessor. They can be excluded or the panelist can trained to get better results.

Among the untrained panel there were panelists having very good performance (panelist 2 and 4). Their F values were not very different from the average of the untrained panel but the MSE values of panelist 2 were absolutely satisfying. Although panelist 4 could not repeat the results of Salty taste but this is the only value which is too high, so it could be the reason of a mistyping and not the weakness of his or her tasting. These two assessors could be the member of the trained panel after adequate results of the proper trainings.

The spider web plots showed that the trained panel discriminated the products more effectively.

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THE ROLE OF AGRIBUSINESS IN STIMULATING ON-FARM INVESTMENTS – CASE-STUDY OF THE ARMENIAN DAIRY SECTOR[1]

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Abstract: This paper analyses the impact on investments of contractual arrangements between farms and agribusiness in the Armenian dairy sector. Our empirical evidence is based on a unique survey of 300 Armenian dairy farms. The dairy sector is of particular importance as it provides vital employment and income, in an environment of weak social security and scarce job opportunities. Furthermore, milk production is predominantly organized in small-scale farms, which are most likely to be affected by adversarial financial conditions and limited in their opportunities to raise resources to invest. The results show that a large share of milk producers in Armenia is actively investing to upgrade their farm business. Furthermore, investment activity is not limited to large dairy farmers as over 30% of respondents with less than eight cows have made dairy-specific investments. We find that the linkages between farms and agribusiness – and more specifically the support programs that agribusiness firms offer to their suppliers – have been crucial in stimulating this restructuring process at the farm level. Interestingly, farmers with a more exclusive relationship to the buyer and farmers that deliver to more internationally oriented buyers are more likely to receive support. On the other hand, buyers that operate in a more competitive market are less likely to provide support to their suppliers. These findings have interesting policy implications. On the one hand, our results point to the gains that can be made from openness to international firms. On the other hand, the negative competition effect indicates that buyers are unable to enforce repayment of the provided farm services in an environment where a lot of buyers are competing for the same supply. Policy makers should look at ways of improving the enforcement capability of dairy companies under these circumstances.

Keywords: Dairy, on-farm investments, vertical coordination, Armenia

1. Introduction

Agricultural credit and rural finance problems are important constraints on restructuring and growth in transition countries. Financial resources can come from own resources and from formal or informal loans. However, cash flow and profitability problems have constrained both types of financing. This has induced political pressure for governments to intervene. In many transition countries this has resulted in the introduction of subsidies and loan guarantee programs. Not only policy reforms but also private companies have contributed to overcoming financial constraints. Agribusiness restructuring and investments up- and downstream from the farms have helped to reduce farm finance constraints.

This paper analyses the impact on investments of contractual arrangements between farms and agribusiness in the Armenian dairy sector. Our empirical evidence is based on a unique survey of 300 Armenian dairy farms. Data were collected in 2006 through a random survey in the main dairy regions. Agriculture remains the backbone of the economy in Armenian rural areas where the sector accounts for over 50 per cent of gainful employment. Rural welfare is therefore inherently linked to the fortunes of agriculture. The dairy sector is of particular importance as it provides vital employment and income, in an environment of weak social security and scarce job opportunities. Furthermore, milk production is predominantly organized in small-scale farms, which are most likely to be affected by adversarial financial conditions and limited in their opportunities to raise resources to invest.

The results show that a large share of milk producers in Armenia is actively investing to upgrade their farm business. Furthermore, investment activity is not limited to large dairy

1 The data used in this paper were collected in the SIDCISA (Supporting the International Development of CIS Agriculture) research project. This project was funded by EU INTAS.

farmers as over 30% of respondents with less than eight cows have made dairy-specific investments. Finally, we find that the linkages between farms and agribusiness have been crucial in stimulating this restructuring process at the farm level.

The remainder of this paper is organized as follows. We first provide information on the dataset and the data collection process. Next, we discuss descriptive statistics on on-farm investments and the sources of agricultural finance that are employed in the Armenian dairy sector. Finally, we introduce a basic investment model and analyze the determinants of on-farm investments. We pay special attention to the role played by the dairy processor in stimulating dairy-specific investments. A discussion of the main results and final remarks conclude the paper.

2. Materials and methods

Data collection was conducted in 2006 and focused on having a better understanding of the supply chain relationships of commercial milk producers, paying particular attention to the linkages between vertical relationships and the potential to influence on-farm decisions. Given this objective, the population of interest was defined as primary producers which sold cows' milk to another supply chain actor. Therefore farmers without dairy cows, those who did not sell any of the milk produced or who processed all milk into cheese or other dairy products (i.e. did not sell any raw milk) were excluded from the study. Given the objective of the study these restrictions are justified but it means that our sample cannot be directly compared to official data on the structure of milk production.

To obtain the sample a quota of 300 responses was set with the intention of including a representative cross-section of commercial dairy farms, including both household producers if they marketed their output and agricultural companies. Respondents were drawn from all regions (*Marzes*) which have significant commercial milk production, based on proportions given from statistical data on milk production. The cross-section of farm respondents was identified from contacts with national statistical agencies, local and regional authorities, village majors, local livestock experts and agricultural agencies. Data were collected concerning: farm growth, prices, yields, investment, collaboration with other farmers, the nature of and satisfaction with relationships with their main buyer and non-price aspects of contracts. The data set by herd size is presented in Table 1. In contrast to other CIS countries – e.g. Ukraine – corporate farms with herds of more than 200 milking cows are absent from Armenia. None of the sampled farms in Armenia were registered entities and all of them are legally classified as individual farmers.[2]

Table 1: Farm size distribution in the sample (based on number of milking cows)

No of milking cows	No of farms in the sample
< 5	20
5	50
6 to 9	111
10 to 19	77
20 to 49	29
> 49	13
Total	300

Source: Survey data and *Gorton et al.* (2007)

3. On-farm investments and agricultural finance in Armenia

Before presenting summary statistics related to on-farm investments, we briefly describe the vertical relationships between milk producers and downstream buyers in the Armenian dairy supply chain. Dairy processors are the most common main buyers of milk from farmers. In Armenia over three quarters of farms sell directly to dairy processors. Another 20% of dairy farms sells through a co-operative. The remainder of milk is collected by intermediaries: dairy logistics or collecting firms (*Gorton* et al. 2007). The majority of dairy farmers sells milk based on a contractual arrangement: 38% has signed a written contract with the milk buyer; 36% sells milk based on an oral contract; only a quarter of the sampled farms has not entered into a contractual agreement (*Gorton* et al. 2007).

The institutional arrangements that exist between milk buyers and sellers are often much more extensive than simple agreements on price, volumes and delivery conditions. Table 2 shows that vertical relationships in the Armenian dairy sector also involve a wide range of support measures. The most prevalent types of support are prompt payments and quality control, which are received by over 80 per cent of farms. Around 30 per cent of farmers in Armenia also receive credit from their main buyer.

Figure 1 provides evidence of the investment activities of the farms that are included in the sample. A large share of respondents indicate that they have made on-farm investments in the past five years. Also, looking specifically at dairy-specific investments, a total of 120 respondents out of 300 claim to have made investments in cooling tanks, milk lines, cows and so on.

An interesting issue is whether there exists a link between investment behaviour and size of the farm. Figure 2 presents data on investments on farms of different. In general we notice a positive correlation between farm size and propensity to invest, meaning that larger farms have made relatively more

[2]Commencing from 2009, Armenian farms will have to be registered and thus taxed on their activities.

Table 2: Share of farms receiving support from their main buyer

Support measure	% farms receiving support
Quality control	87.7
Prompt payments	82.7
Guaranteed Prices	46.7
Market access	40.0
Credit	30.7
Veterinary support	23.7
Transportation	20.3
Physical inputs	16.3
Business and financial management support	4.0
Farm loan guarantees	4.0
Specialist storage	2.0
Machinery	1.7
Investment loans	1.7

Source: Survey data and *Gorton et al.* (2007)

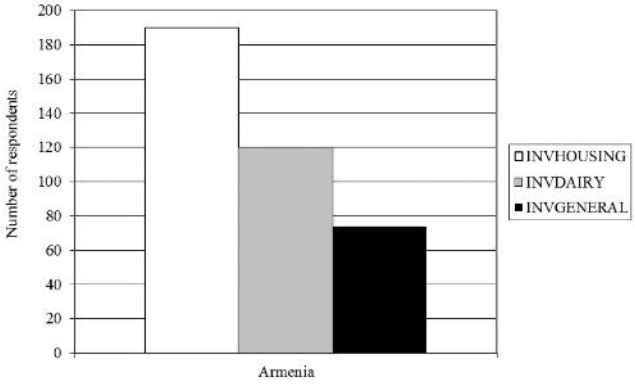

Figure 1: Investments in the past five years on surveyed farms (INVHOUSING includes investments in animal housing facilities: building, enlarging or modernizing stalls sheds and herdsman's camps. INVDAIRY includes dairy-specific investments in new calves and cows, milk lines, cooling tanks and fodder mixers. INVGENERAL are investments that are not specifically related to milk production such as buying new land, pastures, investments in fences and general agricultural equipment)
Source: Survey data

investments in the past five years than small farms (with a small farm being defined as having less than 7 cows).

Finally, we present data on expected future investments by farmers in Armenia (figure 3). The main categories in which respondents are planning to invest are: animal housing, buying new land, buying new cows and improving pastures.

4. Vertical relationships and on-farm investments in the Armenian dairy sector

4.1 Determinants of farm support programs

In this section we will determine the role played by dairy processors' support programs in stimulating on-farm

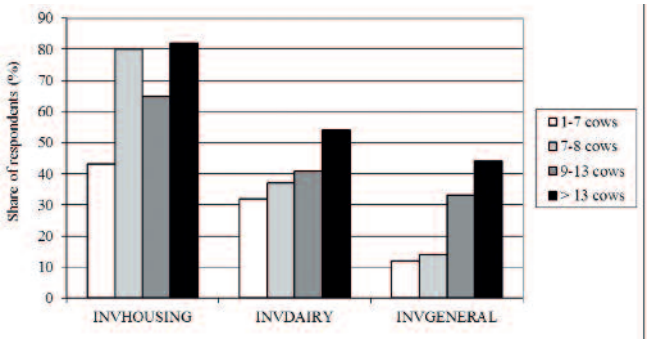

Figure 2: Investments and farm size distribution of surveyed farms ((INVHOUSING includes investments in animal housing facilities: building, enlarging or modernizing stalls sheds and herdsman's camps. INVDAIRY includes dairy-specific investments in new calves and cows, milk lines, cooling tanks and fodder mixers. INVGENERAL are investments that are not specifically related to milk production such as buying new land, pastures, investments in fences and general agricultural equipment)
Source: Survey data

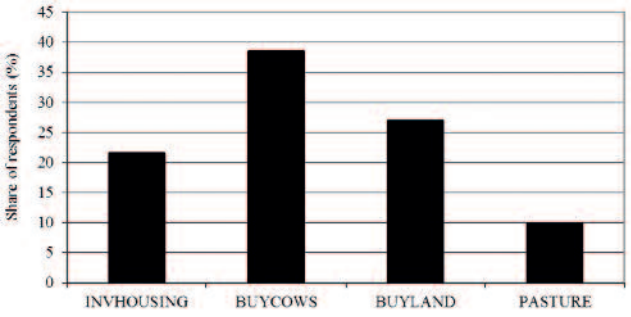

Figure 3: Expected future investments (INVHOUSING includes investments in animal housing facilities: building, enlarging or modernizing stalls sheds and herdsman's camps. INVDAIRY includes dairy-specific investments in new calves and cows, milk lines, cooling tanks and fodder mixers. INVGENERAL are investments that are not specifically related to milk production such as buying new land, pastures, investments in fences and general agricultural equipment)
Source: Survey data

investments. Before we turn to the investment model, we want to gain insight in the elements that determine access to support programs. Support programs are offered as part of a vertical relationship between suppliers and buyers of milk. We will therefore focus on the characteristics of this relationship to identify the factors that make it more or less likely that farmers have access to support programs. The relationship that we estimate is the following:

$$SUPPORT_i = \beta_0 + \beta_1 BUYER_i + \beta_2 CONTROL_i + \varepsilon_i \quad (1)$$

where SUPPORT is a measure of access to farm support programs, BUYER is a vector of variables that characterize the vertical relationship between the milk producer and the buyer; CONTROL is a vector of control variables; and finally ε is the error term.

SUPPORT is a dummy taking the value of one if the farm household received support from their main buyer of milk. The support categories that are included are: credit;

investment loans; farm loan guarantees; physical inputs. BUYER includes a number of variables that identify the vertical relationship between the milk producer and the main buyer of milk. SHARE includes the share of the farm's total milk production that is sold to the main buyer. We expect that a more exclusive relationship with the main buyer (i.e. a higher share of milk sold to this trading partner leads to a stronger vertical relationship and) is a proxy for trust and the reputation effect. We expect SHARE to have a positive impact on the likelihood of farm assistance programs. Another factor that can affect the chances of receiving support through the buyer-supplier relationship is the degree of competition between buyers in the market. On the one hand, contracts are more difficult to enforce in a competitive market and hence providing support is more risky (*Poulton* et al. (2004). On the other hand, *Swinnen* (2007) argues that farmers that are well-informed about policies and assistance programs of different dairies may also put pressure on their own dairy to introduce these programs. COMPETE measures the number of potential buyers of milk that a farmer has access to. Given the two opposite arguments of *Poulton* et al. (2004) and *Swinnen* (2007). The expected effect of COMPETE is ambiguous. Finally, we include two other characteristics of the vertical relationship. Buyer type (TYPE) which is a dummy that takes the value of one if the buyer is a corporate dairy processor and zero if the buyer is a co-operative or an intermediary milk collecting company. FDI is a dummy that takes the value of one if the buyer is either a foreign owned company or the buyer is exporting dairy products. In both instances we expect that internationally focused buyers have 'deep pockets' and therefore have access to the necessary financial resources to provide support programs (*Dries* and *Swinnen* 2010; *Dries* et al. 2009). COLLECT is a dummy that takes the value of 1 if milk is collected by the buyer from the farm instead of through a village collection center and may provide better opportunities for the buyer to monitor and check up on the supplier.

CONTROL includes a number of control variables that may affect the likelihood of access to support programs – independently of the characteristics of the vertical relationship. CAPSTOCK refers to the existing capital stock of the farm. Since the main capital asset in Armenian dairy farms are the cattle, we follow the approach of *Petrick* (2004) by using the number of cows on the farm in the year 2001 as an indicator. It is expected that larger farms have less need for dairy support. On the other hand, larger farms may be in a stronger bargaining position and can negotiate more favourable contract terms. COOPERATE is a dummy that takes the value of one if the farmer indicates that he is cooperating with other farmers to store, market or process milk, to buy inputs, or to engage in lobbying activities. More cooperation between farmers may reduce the need for dairy support programs. On the other hand, more cooperation may also lead to a more dense network that creates more social capital. This may have a positive impact on the likelihood of receiving support.

Table 3 provides summary statistics of the variables included in model (1).

Table 3: Descriptive statistics on model variables

Variable	Share of sample (dummy) or average value	Standard deviation
SUPPORT	37.3	-
o.w. PLOAN	35.0	-
o.w. INPUTS	16.3	-
o.w. PRICE	46.7	-
o.w. PAYMENT	87.7	-
INVEST	72.7	–
INVESTd	40.0	–
SHARE	86.4	18.3
COMPETE	2.0	1.9
TYPE	76.0	-
FDI	22.0	-
COLLECT	70.0	–
CAPSTOCK	8.5	13.24
COOPERATE	29.3	–

Source: Survey data

4.2 Determinants of on-farm investments

The model that we employ to analyse the determinants of on-farm investments and the impact of dairy processors' support measures on investments is based on *Elhorst* (1993) and *Petrick* (2004). The model was adapted in line with *Dries* and *Swinnen* (2010) to answer the specific research question related to the impact of support programs on investments and to deal with a number of data limitations.

The investment model developed by *Elhorst* (1993) and applied by *Petrick* (2004) includes the following independent variables: proxies of the financial situation of the farm (net farm results or solvency indicators); the price of outputs and inputs; capital stock of the farm; the age of the farmer; the presence of a successor; the price of capital goods; the input of family labour. Our empirical model differs from these traditional investment equations in a number of ways. First, we include a series of additional variables to allow a test of our main hypothesis, namely that dairy processors' support programs affect farmers' investment decisions. Next, the cost of capital as well as input and output prices are excluded from the model. Following *Petrick* (2004) we assume that in our cross-sectional dataset, these prices are equal for all farms and hence can be excluded. Finally, we were unable to include proxies for the farm's financial situation due to data limitations. However, we do include indicators of the capital stock of the farm. We estimate the following empirical model:

$$INVEST_i = \beta_0 + \beta_1 SUPPORT_i + \beta_2 CONTROL_i + \varepsilon_i \quad (2)$$

where INVEST measures farm investment, SUPPORT is a vector of variables measuring support programs from the

dairy; CONTROL is a vector of control variables; and finally is the error term.

INVEST is a dummy taking the value of one if a household has made an investment in farm assets[3]

in the past five years and it takes the value of zero if no investment was made in the specified period. *Dries* and *Swinnen* (2010) have shown that there exists an important correlation between the type of finance (own resources, bank loan, processor loan) and the type of investment (dairy-specific investment, general agricultural investment). We will therefore also estimate the model with the dependent variable, INVESTd, being a dummy that takes the value of one only if an investment was made in a dairy-specific asset.[4]

The first set of variables (SUPPORT) includes several indicators of dairy assistance programs. PLOAN is a dummy that takes the value of one if a supplier is delivering to a dairy company that offers financial assistance, in other words, if the supplier has access to dairy processor loans or credit or bank loan guarantee programs that improve access to external financial resources. INPUTS is a dummy that takes the value of one if the supplier has access to an input supply program from the dairy company and that is zero in the other case. Apart from the direct impact on investments through processor loans, dairy input supply programs are likely to have an indirect impact on suppliers' investments by enhancing the profitability of the farm by lowering input costs, or reducing transaction costs in accessing inputs. Furthermore, bank loan guarantee programs have a potentially important indirect impact on investments by facilitating access to external finance (*Dries* and *Swinnen* 2010). We expect PLOAN and INPUTS to have a positive effect on INVEST. Other factors that may cause an indirect impact on the likelihood to invest are the provision of guaranteed prices (PRICE) and prompt payments (PAYMENT). Price guarantees and the absence of payment delays reduce the riskiness of the business environment for the farm operator. As a result, farms may be more inclined to invest than in more uncertain situations.

The control variables (CONTROL) are related to the farm and the farmer. The expected sign of the variable CAPSTOCK depends on the optimal size of the capital stock. A negative sign implies that larger farms are less likely to invest than small farms and consequently, that farm sizes are likely to converge. A positive sign would lead to the opposite conclusion and farm sizes diverge. Apart from efforts to achieve the optimal capital stock, CAPSTOCK may also capture a different effect on investment decisions. Larger farms may benefit from reputation effects and the availability of more collateral. Furthermore, larger farms may benefit from more frequent interactions with the dairy company (*Fafchamps* 1997; *Petersen* and *Rajan* 1997; *Johnson* et al. 2002; *McMillan* and *Woodruff* 1999). This second effect would predict that CAPSTOCK has a positive effect on the likelihood to invest.

COOPERATE is a dummy that takes the value of one if the farmer indicates that he is cooperating with other farmers to store, market or process milk, to buy inputs, or to engage in lobbying activities. We expect that more cooperation leads to a more dense network that creates more social capital. This may have a positive impact on the likelihood to invest.

Table 3 provides summary statistics of the variables included in model (2).

4.3 Regression results

Models (1) and (2) are estimated using a logit regression technique. The results for the support relationship are shown in table 4. Results of the investment model and the dairy-specific investment model are presented in tables 5 and 6 respectively.

Table 4 shows that a more exclusive vertical relationship (i.e. a higher share of milk being sold to the main buyer) increases the likelihood that the milk supplier receives support from the buyer. COMPETE has a significantly negative sign which seems to suggest that milk buyers that operate in a more competitive environment are less likely to offer farm support to their suppliers. The risk of losing suppliers to competitors after support has been provided may be a genuine deterrent for firms to implement farm assistance programs. This finding is in line with *Poulton* et al. (2004) who find a negative effect of a competitive buyer market on farm support in the African cotton sector. Corporate dairy companies seem to be less inclined to offer support to their suppliers. In other words, farmers supplying cooperative buyers are more likely to benefit from farm assistance. Export-oriented firms and buyers with foreign direct investments are offering more farm support to their suppliers than domestic firms. This finding is in line with the hypothesis that international firms have easier access to the financial resources that are necessary to provide these programs. Finally, having the buyer collect milk at the farm gate reduces a farmer's chances of benefiting from farm support. This result is counterintuitive and requires further investigation. As for the control variables, both CAPSTOCK and COOPERATE have a significantly positive impact on the likelihood of farm support. The former means that larger farms have easier access to support from the buyer. This may indicate that large farms benefit from their stronger bargaining position vis-à-vis the buyer and are able to negotiate more favorable contract terms. Furthermore, transaction costs will be lower if support is given to larger

[3] Farm assets include investments in animal housing facilities (building, enlarging or modernizing stalls sheds and herdsman's camps); dairy-specific investments (buying new calves and cows, milk lines, cooling tanks and fodder mixers); and general investments that are not specifically related to milk production such as buying new land, pastures, investments in fences and general agricultural equipment.

[4] Dairy-specific investments include the buying of new calves and cows, milk lines, cooling tanks and fodder mixers.

suppliers as compared to large numbers of small suppliers. The positive effect of cooperation points to the value of being part of a close network.

Table 4: Determinants of farm support programs
(The significance level is indicated as follows: *** 1%; ** 5%; * 10%)

SUPPORT	Coefficient	Standard Error	Significance
SHARE	0.030	0.010	***
COMPETE	–0.170	0.085	**
TYPE	–2.376	0.373	***
FDI	1.920	0.367	***
COLLECT	–1.054	0.332	***
CAPSTOCK	0.032	0.012	**
COOPERATE	0.712	0.317	**
Constant	–1.335	0.847	
Observations: 300			
PseudoR2: 0.243			

Source: Own calculations based on survey data

Table 5: Determinants of on-farm investments
(The significance level is indicated as follows: *** 1%; ** 5%; * 10%)

INVEST	Coefficient	Standard Error	Significance
PLOAN	1.126	0.402	***
INPUTS	1.682	0.783	**
PRICE	0.959	0.302	***
PAYMENT	0.363	0.408	
CAPSTOCK	0.038	0.022	*
COOPERATE	1.059	0.377	***
Constant	–0.696	0.423	
Observations: 300			
PseudoR2: 0.169			

Source: Own calculations based on survey data

Table 5 (6) presents results on the determinants of (dairy-specific) on-farm investments. We are particularly interested in the effect that different buyer support programs have on the likelihood of farmers to invest. First, access to dairy loans, credit and bank loan guarantees plays a significant role in improving the probability of investments in the Armenian dairy sector. This indicates that access to credit through formal channels (rural finance sector) may be restricted and that dairy loans are crucial to overcome this market imperfection and the sector's financial constraints. Surprisingly, PLOAN is not significant in the dairy-specific investment model. Apart from the direct impact of investments through loans and credit, milk buyers' input supply programs increase the propensity to invest indirectly by enhancing the profitability of the farm by lowering input costs, or reducing transaction costs in accessing inputs. Tables 5 and 6 also provide evidence of the importance of reducing the riskiness of the business environment to stimulate on-farm investments. On the one hand, providing guaranteed prices significantly increases the farmer's likelihood to invest. Furthermore, to stimulate dairy-specific investments it seems crucial to avoid delayed payments. Finally, farm size (CAPSTOCK) plays only a minor role in explaining on-farm investments, while cooperation within a farm network increases the likelihood to invest significantly.

Table 6: Determinants of dairy-specific on-farm investments (The significance level is indicated as follows: *** 1%; ** 5%; * 10%)

INVESTd	Coefficient	Standard Error	Significance
PLOAN	0.126	0.297	
INPUTS	1.398	0.388	***
PRICE	0.157	0.256	
PAYMENT	0.867	0.441	**
CAPSTOCK	0.014	0.011	
COOPERATE	0.376	0.280	
Constant	-1.757	0.442	***
Observations: 300			
PseudoR2: 0.082			

Source: Own calculations based on survey data

5. Concluding remarks

This paper has looked at the role of vertical relationships between milk producers and milk buyers – and specifically the support programs that buyers have implemented for their suppliers – in explaining on-farm investments in the Armenian dairy sector. Hypotheses are tested using a unique dataset of 300 Armenian commercial rural household farms. The first part of the empirical analysis has linked the specifics of the vertical relationship between the buyer and the supplier to the likelihood of gaining access to farm support programs. The main conclusions are that farmers with a more exclusive relationship to the buyer and farmers that deliver to more internationally oriented buyers (be it exporters or FDI firms) are more likely to receive support. On the other hand, buyers that operate in a more competitive market are less likely to provide support to their suppliers. These findings have interesting policy implications. On the one hand, our results seem to point to the gains that can be made from openness to international firms – who bring in the financial means to provide farm support programs. On the other hand, the negative competition effect may indicate that buyers are limited in their ability to enforce repayment of the provided farm services in an environment where a lot of buyers are competing for the same supply. Policy makers may want to look at ways of improving the enforcement capability of dairy companies under these circumstances.

The second part of the empirical analysis focused on identifying the determinants of on-farm investments, with special emphasis on the impact of buyers' support programs on the likelihood to invest. The results of this analysis

indicate that dairy support programs play a very important role in stimulating on-farm investments. Farm assistance programs affect investment decisions in several ways. First, dairy loans, credit and loan guarantee programs directly improve farmers' access to financial resources. Second, milk buyers' input supply programs increase the propensity to invest indirectly by enhancing the profitability of the farm by lowering input costs and by reducing transaction costs in accessing inputs. Finally, support programs reduce uncertainty and the riskiness of the business environment by providing guaranteed prices and prompt payments. All these elements have an important effect on the likelihood of investments in the Armenian dairy sector. In conclusion our results show that the linkages between farms and agribusiness have been crucial in stimulating the restructuring process at the farm level.

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COMPLEX PROBLEM ANALYSIS OF THE HUNGARIAN DAIRY FARMS

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Abstract: Hungarian dairy farms went through significant changes in past two decades. The most significant changes were caused by our accession to the European Union in 2004. In Hungary milk production remarkably declined after EU accession due to the decreasing level of support and decreasing milk prices. Size of our dairy herd has been practically reducing since the political transformation (1989); meanwhile the relative yields per cow have been continuously increasing. Relatively low prices, high production costs and tightening quality requirements ousted several producers – mainly small farms - from the market in past years. Feeding cost represents the highest rate in cost structure of production, but animal health expenditures and various losses are also significant. Applied technology of the Hungarian dairies lags behind the Western-European competitors'; in addition they have handicaps in efficiency and product innovation. Moreover Hungarian milk and milk product consumption is about half of the Union average.

In 2007 at the University of Debrecen the opportunities and the problems of this sector were discussed in the framework of a research and development project entitled "Project-generating based on sector-specific innovation". At this workshop farmers, experts and advisers shared their ideas which were all gathered. The main objective of our paper is to provide useful information for the decision makers and the most important members of the sector. Using the practically successful ideas plus the ideas based on previous experience a new strategic concept was created.

To reach the objective of this paper we collected, synthesized and analysed the strengths, weaknesses, opportunities and threats of the dairy farms and performed a SWOT analysis. On the basis of this SWOT analysis we set up a well organised problem hierarchy which would help to identify the main weaknesses of the sector. This analysis gives a great framework for the researches and it also gives a useful tool for the decision makers to improve the competitiveness of the Hungarian dairy sector.

Keywords: Hungarian dairy farms, complex problem analysis, SWOT analysis, problem tree

1. Introduction

In the last twenty years animal breeding was remarkably regressed compared to the previous decades in Hungary. This decrease was serious mainly in the dairy sector, where the size of the national dairy herd declined from 630 thousand to 309 thousand animals (HCSO, 2011). It is obvious, that there are some serious problems in the Hungarian dairy sector. Some experts in different fields have their own ideas about these problems, but so far, nobody has made a complex problem analysis for the Hungarian dairy sector to help creating a single national strategy to develop this sector.

This research focuses on the competitiveness of the Hungarian dairy farms. The general objective of this paper is to answer the following questions: What are the strong and weak points of the Hungarian dairy farms? What kind of problems have nowadays the Hungarian dairy farms faced on? To reach our objective the first task is to give a brief outlook of the World, European and the Hungarian dairy sector. Our second task is to collect, synthesize and analyse the strengths, weaknesses, opportunities and threats of the dairy farms and performed a SWOT analysis. The third task of this paper is to create a problem tree of the farms on the basis of the SWOT analysis, which looks for the main problems and searches for the action-reaction contacts into logically arranged tree structure which also gives a useful tool for the decision makers to improve the competitiveness of the Hungarian dairy farms.

1.1. International outlook – World dairy sector

On the basis of assumption world milk production in 2010 reaches 711 million tonnes. Milk production is expected to increase and it can even rise above 794 million tonnes in 2017. *Figure 1.* shows the tendency of world milk production between 1996 and 2010. In 2010 there is an increase of 1.6% from last year, but it remains below the 2.1% average annual growth experienced in the past decade.

The major contributors of the production growth in 2010 are India and China, but Brazil, the EU(27) and the United States also play important role in it.

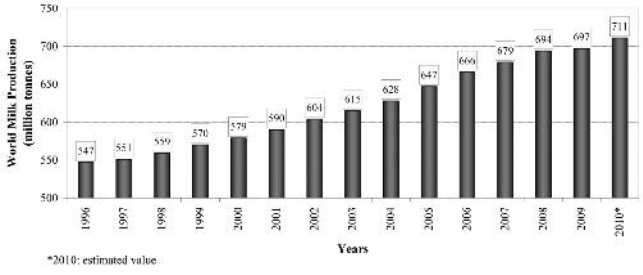

Figure 1: World milk production from 1996 to 2010
Source: FAO-OECD, 2011

Figure 2. illustrates the top 10 milk producers of the world and their contribution to world milk production. The EU(27) is the most significant milk producer in the world with its 153 million tonnes production, although its production rate remains at the same level in 2010.

The production of the Russian Federation is 33 million tonnes in 2010, and there is only a slight growth in it due to the increase of feed prices. In 2010 production increases by almost 3% to 61 million tonnes in South America, where Brazil gives one-third of total milk production.

In Oceania farmers could expand output last year due to good weather conditions. New Zealand is expected to reach 18 million tonnes production, which demonstrates a 6% growth, while in Australia growth is only 2% due to high feed prices, so production is more than 9 million tonnes. In Africa milk production reaches 37 million tonnes in 2010, it demonstrates a slight 1.3% growth.

All over the world people cover approximately 13% of their protein requirement from milk and milk products based on the available data and estimates. There is a continuous growth in consumption of milk and milk products and this tendency will probably not change. In 2009 however, for the first time in years the global per capita consumption of milk declined by 0.4%. The main reason for the decline was the complex credit crisis in the world economy. Another reason for the decrease was the slowing down in the growth of Chinese dairy consumption due to the melamine crisis. On the basis of FAO-OECD data per capita milk and milk product consumption was 103.0 kg in 2009. As regards the consumption of developed countries the average level of it is 245.0 kg/capita/year, while in developing countries it is only 66.2 kg/capita/year. The consumption level of milk and milk products is expected to expand by 1% and reach the value of 104.3 kg/capita/year (FAO-OECD 2010). The ideal and healthy level of milk and milk product consumption would be 260-270 kg/capita/year. Developed countries approach this level, but in developing countries the level of milk consumption is far below the healthy value (*Szakály* 2006).

Consumption of milk and milk products significantly depends on income, so liquid milk can be considered an inferior good. An inferior good is a good that decreases in demand when consumer income rises. As the consumers become monetarily better off (earn higher incomes) the demand for such goods (such as liquid milk) falls because consumers can now afford higher priced substitutes. In accordance with the above-mentioned definition the consumption of liquid milk rises up to a certain point (income) and then its consumption slows and starts to decrease since processed products with higher added value (mainly butter, cheese and yoghurt) take its place.

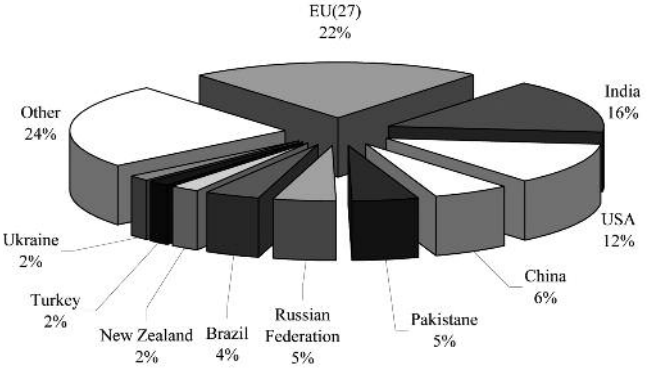

Figure 2: Distribution of world milk production (697 million tonnes) in 2009
Source: FAO-OECD, 2011

The ratio of international trade of milk and milk products to production is 6%, i.e. 42 million tonnes, and it may expand, driven by strong demand from Asian countries and the Russian Federation. Export growth results from the United States, New Zealand and the EU(27). There is a strong import growth in Asian countries and the Russian Federation. In addition, Algeria, Mexico, Saudi Arabia and the United States are also relevant importers.

Since the start of 2009 the dairy market was confronted with a period of extraordinary law prices. The financial and credit crisis in the world economy had a dramatic impact on product prices during the first half of the year 2009. After bottoming out, prices were slowly stabilising during the second part of 2009. At the end of the summer international prices started to strengthen. The strong recovery in prices was triggered by increases demand, mainly from oil exporting countries, but also from China. The last quarter of 2009 was characterized by steady rise in prices.

Analysis of the world market price of the most important dairy products it represents a strong recovery from last year, but it still remains 20% below its peak value in early 2008. However prices have doubled compared with prices of period of 2002-2004. Export prices in Oceania in September 2010 were USD/tonnes 4 100 for butter, 3 140 for SMP[1], 3 360 for WMP[2] and 3 950 for cheese.

In conclusion 2009 showed a mixed picture: a stagnating first half year and a strong recovery during the second part. Dairy sector looks much more balanced in 2010.

1.2. Dairy situation in the European Union

The European Union is the largest contributor to the world milk production. The EU(27) produced 153 million tonnes

[1]Skim Milk Powder
[2]Whole Milk Powder

milk in 2009. *Figure 3.* demonstrates the distribution of milk production within the EU(27), where France, Germany, the United Kingdom, Italy, Poland and the Netherlands give the 67% of total milk production. Hungary with its 1% contribution to the EU(27) production is placed as 19.

The average liquid milk consumption in the EU(27) was 32.2 million tonnes and 64.5 kg/capita in 2009. These values show a 1.2% decrease in comparison with the year 2008. Within the EU(27) the top six consumers are Estonia, Ireland, Finland, the United Kingdom, Sweden and Denmark. As liquid milk consumption butter consumption also decreased in the EU(27) in 2009. Its average value was 1.7 million tonnes and 3.5 kg/capita. France, Germany, the Czech Republic, Austria, Poland and Estonia are on the top of butter consumption. Cheese consumption of the EU(27) was almost 8.3 million tonnes in 2009 and it increased by almost 1% in comparison with the previous year. The average per capita cheese consumption was 16.6 kg. Greece, France, Germany, the Netherlands, Italy and Finland consumed cheese in the largest quantity.

The second major exporter of milk and milk products in the world is the EU(27) with 9.9 million tonnes after New-Zealand. The level of import is much more lower, the EU(27) imports 1.2 million tonnes milk and milk products. Both in the export and import structure cheese represents the highest rate.

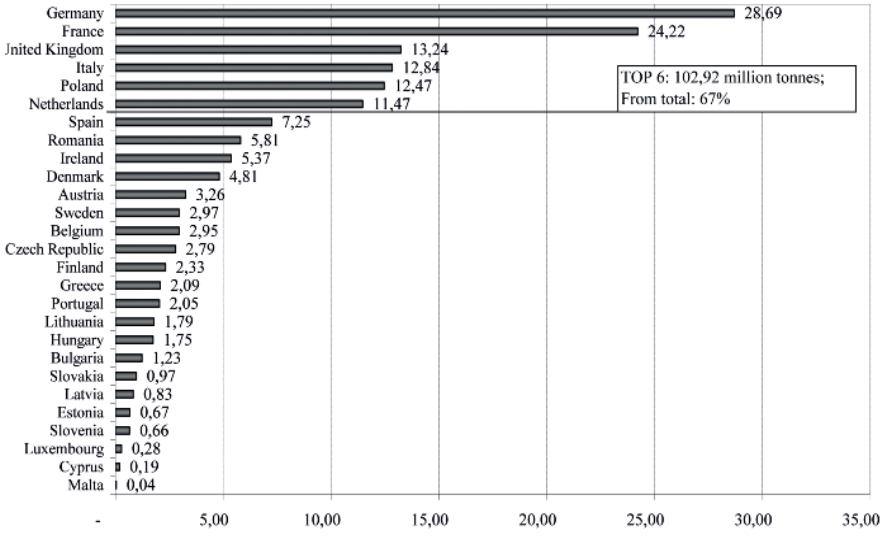

Figure 3.: Distribution of milk production within the EU(27) in 2009 (153 million tonnes)
Source: FAO-OECD, 2011

1.3. Brief overview of the Hungarian dairy sector

In the last two decades the number of the Hungarian dairy cows declined from 630 thousand to 311 thousand animals. In the beginning the decreasing number of cow livestock was not perceptible in the amount of raw cow milk production, which was around 1.9-2.1 million tonnes. Later the increasing specific cow yield was not able to compensate the national milk production descent. Since then the Hungarian raw milk production has been continuously falling down. Currently the national milk production is around 1.7 million tonnes (*Figure 4.*).

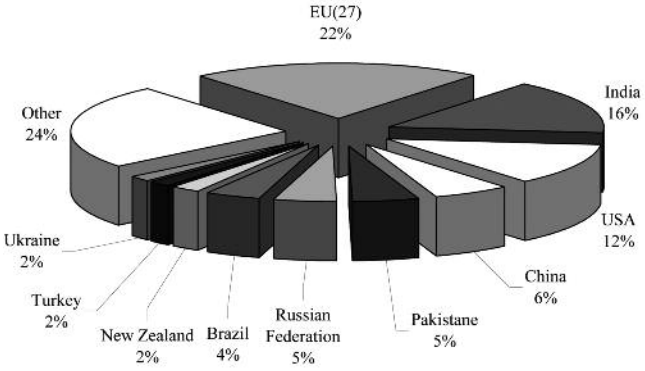

Figure 4: The evaluation of the Hungarian dairy sector
Source: HCSO[3], 2011

As *Figure 4.* illustrates the number of dairy cows significantly declined in the past twenty years. In accordance with the aforementioned statement the specific yield per cow was able to compensate this decline in cow number, so the volume of raw milk production remained stable. This correlation is down to the fact that with our EU accession most of the rural dairies ceased to exist and small producers with only a few dairy cows and low yields were forced to stop production. In this way the average Hungarian yield per cow started to increase.

Figure 5. demonstrates the level of milk and milk product consumption from 1987 to 2009 in Hungary. 1987 was an outstanding year in per capita consumption, because in this year Hungary managed to approach the consumption level of Western-European countries. Currently the average level of milk and milk product consumption is about 145-165 kg/capita/year, which is only the half of the average of the most developed European countries. In all probability cheese consumption will increase in the next few years in Hungary.

The EU accession was defining in all aspects; it had significant impact on our foreign trade position (*Figure 6.).* After 2004 Hungary become a net importer in the field of milk and milk products. Currently we primarily export liquid milk to Italy, Romania and Slovenia. While milk products with higher added value arrive from Germany, Poland, Slovakia and the Czech Republic. Our foreign trade balance is unanimously negative.

[3]Hungarian Central Statistical Office

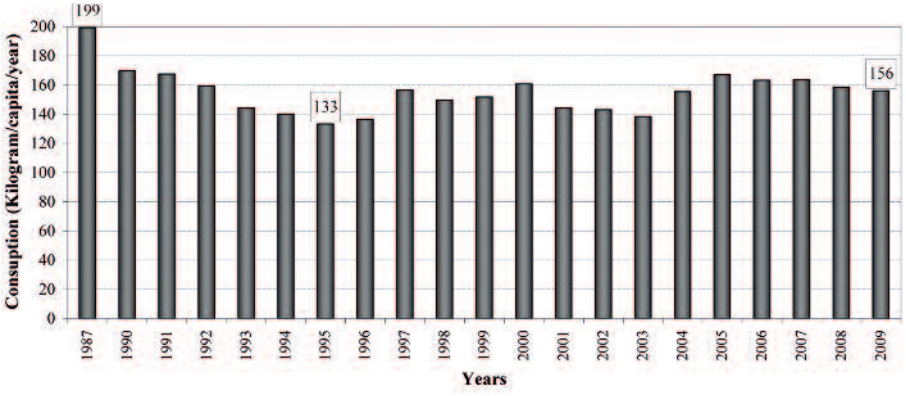

Figure 5: The evaluation of the Hungarian milk and milk product consumption
Source: HCSO, 2011

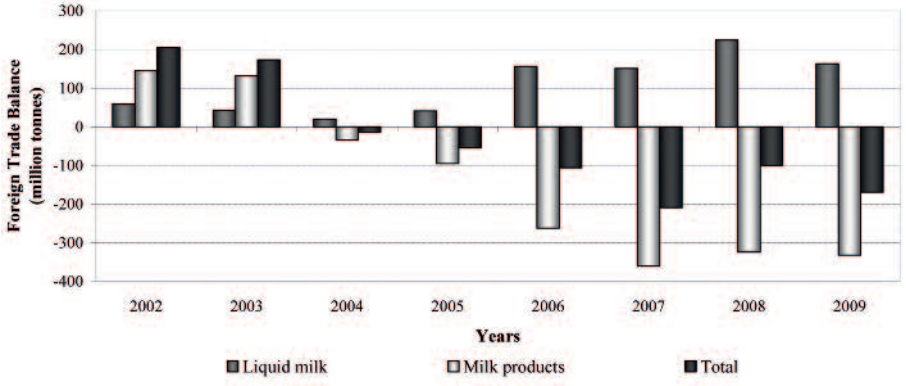

Figure 6: Foreign trade position of Hungary in the field of milk and milk products
Source: HCSO, 2011

2. Materials and Methods

Present study carries out the SWOT analysis of the Hungarian dairy farms and on the basis of it we set up a well organised problem hierarchy which would help to identify the main weaknesses of the sector.

In 2007 at the University of Debrecen the opportunities and the problems of dairy sector were discussed in the framework of a research and development project entitled "Project-generating based on sector-specific innovation". Systematically we collected current weaknesses and problems of the dairy sector in our work, which is reflected the experts' opinions being participated in the above-mentioned workshop and our views about the sector completed by secondary research.

In the first part of the research work we create a SWOT matrix and do the SWOT analysis, which is a „snapshot" with a tabular form and it demonstrates the current status of the examined sector. Results of the SWOT analysis are assorted according to four aspects, these are the followings: strengths, weaknesses, opportunities and threats (Szűcs 2004).

The upper section contains, „Strengths" and the „Weaknesses" which summarize of the inside criteria appertaining to the examined sector, the lower section contains outside outlooks called, „Opportunities", and the „Threats" which summarize the outside environmental facts.

By means of the SWOT analysis the following step of this study is to set up the problem tree of the dairy farms. The problem tree method is a hierarchic system looks for sectorial main problems and searches for the action-reaction contacts.

With the application of these methods we will be able to answer our research questions and give a comprehensive picture about the challenges of the Hungarian dairy farms.

3. Results and Discussion

This section presents the results of the Hungarian dairy farms' SWOT analysis which is followed by the problem tree.

3.1. Presentation of the Hungarian dairy sector's SWOT analysis

The sectorial experts' professional opinions and experience were completed by our secondary research, which contains bibliography review and statistical supporting. On the basis of these sources we set up together the sector's SWOT analysis, which also helps to create strategies (*Figure 7.*).

In the SWOT matrix we create four kinds of improvement strategies of the dairy sector. These strategies are: the offensive, changing oriented, defensive and diversificated strategies. The individual strategies engage the enterprise outer side elements (opportunities, threats) and interior elements (weaknesses, strength).

From the strengths high specific yield per cow and livestock concentration can be highlighted and attached to our proposed strategies, because these two factors can contribute to the increase of the sector's competitiveness. Production of milk products with higher added value (e.g. Omega-3 milk, as a functional food) would be important for the sector to create a competitive position in the export markets. From the opportunities expanding export market can contribute to reach this objective.

The weaknesses and threats were used to construct the problem tree of the dairy sector, which is introduced in detail in the next section.

	STRENGTH – High specific yield per cow index – Feeding based on cheap and good-quality corn silage – Livestock concentration – Good animal welfare condition – Several milk and milk products on the market – Professional feeding management	**WEAKNESSES** – Higher and higher production costs every year – Low domestic milk consumption – Low level of integration in the production sector – Poor management level – Criss-crossed employment relations – Excellent experts become too old for work – Few information about the production – Low marketing activity – Low level of support
OPPORTUNITIES – Favourable climatic conditions – Diverse technological knowledge – Expanding export markets – Good qualified veterinary surgeon – Increasing milk price (farm and consumer price) – Good technical equipments (software) – Expanding opportunities for subsidies – Opportunities to make a good quality feed – Excellent and motivated researchers	***STRATEGY*** • **development of the feeding quality** • **new export markets search for milk products with high added value** • **support more research activities about competitiveness of dairy farms** • **improve the consumers' knowledge about the healthy dairy products**	***STRATEGY*** • **effective exploitation of subsidies** • **subsidies for the farm hygiene and to solve the medical problems** • **improve the collective marketing actions** • **improvement of informatics infrastructure**
THREATS – Lack of consumers' loyalty and unfavourable opinion about the animal breeding – Increasing bio-ethanol utilisation increases the feed prices – Demanding regulations (witch caused high costs) – Low level research support – Good experts go abroad to work – Increasing feed prices	***STRATEGY*** • **bring in the checked Hungarian product brand** • **subsidy for the foreign and Hungarian research, inspire the research projects about the dairy sector** • **setting up of an innovative model farm for the professional and public audience**	***STRATEGY*** • **use of energy saving opportunities (renewable energy)** • **inspire the number of high level national and international professional conference** • **improve the feeding technologies** • **search for new export markets for the raw milk** • **inspire the collective power and the power to enforce interests for the whole dairy sector**

Figure 7: SWOT matrix about the Hungarian dairy farms
Source: Own construction

3.2. The problem tree of the Hungarian dairy farms

Hungarian milk production can be characterised by low income-generating capacity as the problem tree of the Hungarian dairy farms presents on the *Figure 8*. It essentially originates from four main problems: decreasing demand for domestic milk products, low farm prices, high production costs of dairy farmers and low level of other resources. Several factors play important role in development of this four defining problems.

The size of the Hungarian dairy herd decreased by 15% and milk production reduced by 14% in comparison with the data of the year preceding our accession to the European Union. On the basis of the HCSO (2010) database the size of our dairy herd is currently 309 thousand heads, while the amount of milk production is 1 712 million liter. Due to the low level of cooperation in production stage of dairy product chain negotiation power of dairy farmers is poor and they can be described by increased defencelessness against the rest of the product chain. In recent years only one significant producer organization was established in production stage of milk product chain, the Alföldi Tej Értékesítő és Beszerző Ltd., which managed to gain decisive market share. This producer organization was established in 2003, and it received the final recognition in 2005. The objective of this organization is the improvement of the profitability of milk production. On behalf of it the organization coordinates the following tasks: sale, production organization and consultancy, procurement, processing. The result of the increased defencelessness of dairy farmers is the weaker bargaining power against the dairies, which leads to low farm prices. However farm prices are depressed not only by the more concentrated processing sector, but the increasing presence of import products and the "unfavourable" product choice of price-sensitive consumers. Milk price became stable in 2007 and 2008 at a high level, internationally. Growing production and the economic crisis, however, led to a dramatic relapse in the price, leaving a number of producers in uncertainty (*Borbély* et al. 2010). On the basis of RIAE[4] (2011) database price of raw milk was 0.25 EUR/kg[5] in January 2010, however it was already 0.30 EUR/kg in December. In reference to the datum of January 2011 price of raw milk was 0.31 EUR/kg, which was approximately higher by 24% compared to data of previous year.

The above-mentioned consumer price-sensitivity and the growing demand for cheaper import products contribute to

[4]Research Institute of Agricultural Economics
[5]265,36 HUF/EUR (Hungarian National Bank, April 2011.)

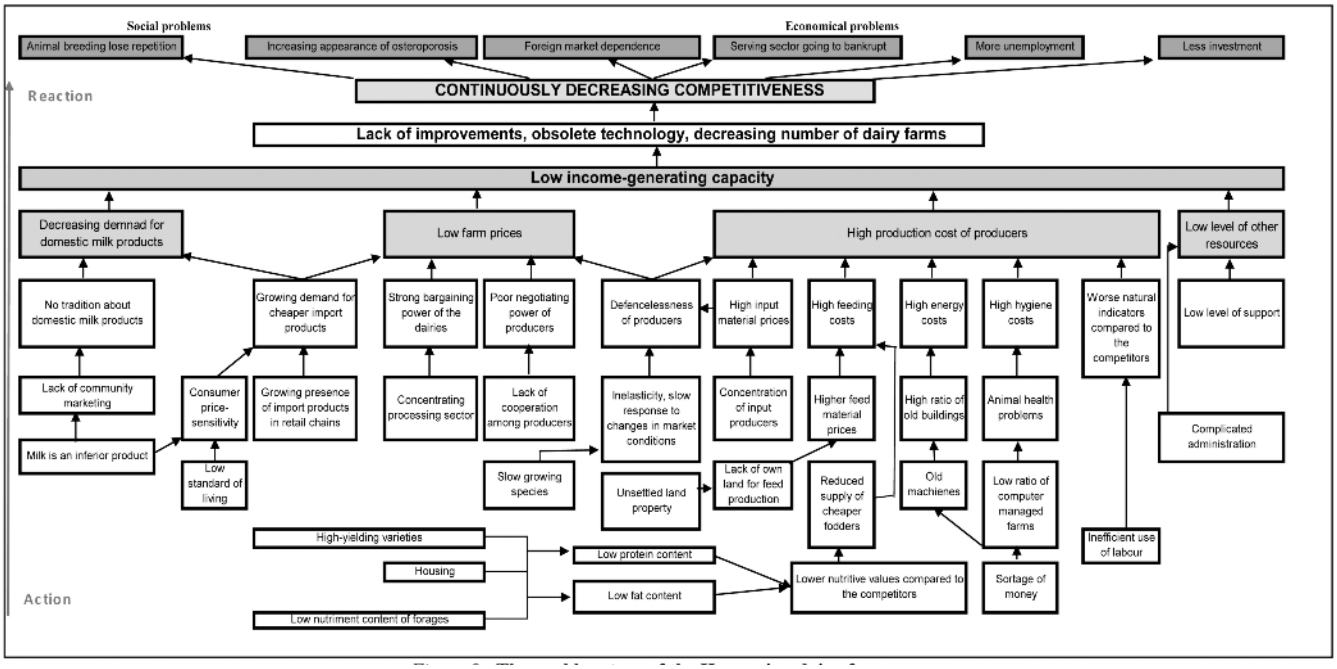

Figure 8: The problem tree of the Hungarian dairy farms
Source: Own construction

another main problem, to the decreasing demand for domestic milk and milk products. On the basis of HCSO (2010) data base the per capita consumption of milk and milk products is about 140-180 kg/capita/year for ages in Hungary, and it was 178 kg/capita in 2008. This value is considerably lower than the EU average (~260 kg/capita/year) and the healthy level of consumption (260-270 kg/capita/year). Disposable income essentially determines the level of milk and milk product consumption of the Hungarian population. Hungarian consumers are not loyal for domestic products. In many cases they choose the cheaper import products of retail chains. They are usually not aware of the features and components of products, do not know the origin of them and they are not interested in the method of production, i.e. they are not conscious and in the first place price influences their buying decisions. Lack of community marketing is typical in Hungary. However the successfulness of this sector exactly depends on the creation of consumer awareness and strengthening of health consciousness, to which community marketing tools should be invoked (*Popp et al.* 2008). A survey carried out by Szakály et al (2005) also proved that in relation to milk and milk products significant misconceptions prevail among consumers. Essential interest of dairy industry is to clarify these existing misconceptions, since the lack of awareness building may have adverse effects on all categories of dairy products. Primary task is to strengthen consumer mentality among domestic products. *Szakály et al.* (2005) and Major (2007) also emphasise the importance of community marketing, which is beneficial to the participants, because they can preserve the independence of their core activity, but apportion the costs of advertising, market research, exhibitions and product policy among each other. However sectoral and national community marketing activity can not function effectively without the establishment of producer organizations and marketing cooperatives. The most important finding of *Szakály et al.* (2005) is that "the domestic community marketing can only be fully effective if a grassroots, marketing oriented system is managed to establish taking maximum into account the market needs and demands."

As described above the Hungarian consumer is specifically price-sensitive and less susceptible to the more expensive novelties. Nevertheless the domestic dairies are not able to compete with the cheaper, foreign mass products. Thus the market share of the domestic dairies continues to decline as a result of increasing import, which further reinforces the expansion of foreign dairy products (Popp et al 2010). Examining their values the import increased fivefold, while export doubled compared to the year prior our EU accession. Examining the product structure finished product sales are prevalent on the import side, while on the export side export of raw materials grew significantly. Our cheese export, which is primarily aimed at third countries, almost halved in the past. It must be highlighted that 80% of the import products come from the following four EU Member States: Germany, Poland, Slovakia, Czech Republic (Hungarian Dairy Association 2010).

Based on the experience of previous years it can be stated, that although the average milk yield of the Hungarian dairy herd – 6 661 liter/cow/year based on HCSO (2010) – is nearly 5% above the EU average, nevertheless not the volume of yields is the most important in terms of the profitability of milk production, but the cost of production. Hungarian milk production is relatively expensive in comparison with the competitors (*Popp et al.* 2008). Feeding costs represent the highest rate in cost structure of production, based on the statement of *Vágó* (2008) 43% of

the costs are feeding costs. One reason for the high feeding costs is that dairy farms often do not have their own land to produce feed. If they can do they produce the necessary feed in leased land, however in worse case they base their production on purchased feed placing them even more vulnerable position. Moreover there is decreasing supply of the relatively cheap sugar-beet processing and cannery by-products, which further complicates the situation of producers. Losses from animal health problems can not be disregarded in the cost structure of production. In Hungary annual loss caused by reproductive disorders is roughly 150-300 EUR/cow, which can even be 9-11% of the farm's revenue. Another significant problem also causing serious losses is mastitis (*Ózsvári* 2007).

However further problem beside high feeding costs is our worse natural indicators, which are often caused by poor feed conversion and in many cases inefficient use of labour. All the above-mentioned factors contribute to the high production costs of dairy farmers. In 2008 centre of average cost was 0.28 EUR in case of defining commodity producers. The so-called better farms could produce milk 27% cheaper, for 0.21 EUR, while the less cot-effective farms produced milk for 0.32 EUR. The differences mainly arise from the costs of feeding (*Béládi and Kertész* 2009).

Although the above-mentioned specific yield per cow is above the EU average, as regards the nutritive values Hungary falls behind the competitors. Compared with other Member States the average protein and fat content of domestic milk is relatively low, which in long run reduces the competitiveness of the dairies (*Popp and Potori* 2010). Based on (2011) the nutritive values of domestic raw milk are the followings: 3.29% protein, 3.72% fat. Poor nutritional indicators may be primarily caused by high-yielding varieties, inappropriate housing and low nutriment content of forages.

On the one hand low income-generating capacity results in the lack of technological improvements, so production can be characterised by increasingly obsolete technology; while on the other hand several producers are ousted from the market choosing sales from house or entirely giving up production. All these factors could further deepen our already existing competitive disadvantage against the Western-European competitors.

Common and defining problem of the dairies and the commercial sector is the inadequate level of milk and milk product consumption.

4. Conclusion

Applying the previously described methods we managed to define the typical strengths, weaknesses, opportunities and threats of the Hungarian dairy sector. The collected weaknesses and threats provided a good starting point to create the problem tree of the dairy farms.

Comparing all factors it can be concluded that the competitiveness of the Hungarian dairy farms is relatively low in comparison with the Western-European competitors. Currently the central problem of the dairy farms is the low income-generating capacity, which essentially originates from four defining problems: decreasing demand for domestic milk products, low farm prices, high production costs of producers and low level of other resources.

The aforementioned facts and main problems derive from several factors, some of which are:

- Hungary became a net importer in the field of milk and milk products.
- The consumption of the domestic milk and milk products decreased.
- Obtaining capital and credit is difficult due to the current credit crisis.

The present study provides useful information for the members and decision makers of the sector with the help of the defined strategies and identified problems.

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THE ASSESSMENT OF INTELLECTUAL CAPITAL IN POLISH REGIONS

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Abstract: In a knowledge-based economy intangible assets are indispensable to achieve competitive advantages. Resources like intellectual capital are perceived as crucial factors especially for regional growth. Intellectual capital is comprehended as a multidimensional concept, defined and explained in many various ways, depending on the context and further application. The purposes of this article is to consider the role and importance of the intellectual capital for regional development and competitiveness and to try to use it for an estimation of regional advance progress. On the basis of literature review the article provides a framework to analyse the intellectual capital and its main components. The central attention of the paper focuses on the evaluation of the intellectual capital in Polish regions and its influence on regional performance. The paper surveys the empirical examination of 16 Polish regions in terms of intellectual capital and simultaneously assesses the level of intellectual capital in rural areas. The article provides the insight into the role and value of the intellectual capital in Polish regions.

Keywords: Intellectual capital, intangible assets, knowledge based economy, Polish regions

Introduction

In a globalised and strongly competitive world, organizations, regions and nations have to develop new forms of economic value and comparative advantage. In the age of knowledge the key source of economic vitality and growth are intangible assets. They play an inevitable and prominent role in enhancing competitiveness. The relevance of the phenomena of the intellectual capital (sometimes denoted as IC) as a fundamental source of sustainable competitive advantage is highlighted and widely acknowledged (*Bonits* 2004, *Edvinson* 2002, *Tallman et.al.* 2004, *Shiuma et al.* 2008).

Recent years proved that the primary spatial units within which knowledge and innovation are produced are regions. They are perceived as central units of economic study, where political and social processes and interactions occur (*Amin,* 1994; *Clavel,* 1998; *Giddens,* 1998; *Harvie,* 1994; *Sharpe,* 1993; *Tomaney and Ward,* 2000). Regions are recognized as a part of global system of interactions where private and public sector meet. That is why, in order to meet the challenges of today's global economy, regions should permanently strengthen their competitive capabilities. In the knowledge – intensive world, under conditions of increasing international interdependencies intellectual capital becomes perceived as a cornerstone of growth and development.

The central objective of this article is to assess and to map intellectual capital in 16 Polish regions that correspond to the EU NUTS II level. Although, the notion of IC is defined in many various ways, depending on the context and its further application we tried to develop the intellectual capital ratio as a single figure. In order to illustrate regional and rural performance in terms of intellectual capital we created and index consisting of several different variables. The paper focuses on the evaluation of the intellectual capital in 16 Polish regions and simultaneously in rural areas and its influence on regional performance. However, one should be aware of the fact that there are many typologies and definitions of rural areas (Eurostat, GUS, OECD), and this is the reason for the difficulty to clearly separate rural and urban areas. Regions in Poland are significantly differentiated but in accordance with the Polish typology (CSO, 2009) in 2009, 93,2% of Polish area was classified as rural and only 6,8 % as urban. At the same time, the share of the population in the total population was as follows: rural areas : 39,0% and urban : 61,0%. Unfortunately, we are not able to evaluate the intellectual capital separately in rural and in urban areas. That is why we will focus mainly on regions. Undoubtedly, there is need for cooperation between the urban and the rural, paying attention to the complementary and synergic relations deriving from the exchange of externalities produced in each.

The paper is structured into five parts. The first provides both the insight in theoretical background and conceptual understanding of phenomenon of intellectual capital. On the basis of literature review this paper provides a framework to analyse the intellectual capital and its main components. The next part deals with the methodology of the survey. In the following part the outcomes are presented and in the last part the final conclusions are drawn.

Theoretical orientation

Over the past few years there has been increasing focus on the issue called knowledge paradigm. In the economy based on information and knowledge the intangible assets gained in importance and become perceived as the undeveloped source of future success and a key determinant of development and competitiveness. The concept of intellectual capital is a new way of thinking about new forms of economic value. Knowledge is considered as the key factor of success and foundation of competitive advantage. (*Bradley* 1997a, 1997b, *Bonits* 2002, 2004, *Daley* 2001, *Edvinsson* 2002, *Edvinsson and Stenfelt* 1999, *Malhotra* 2000 and *Pasher* 1999). Knowledge is perceives as the crucial factor of competitiveness and widely comprehended development. Knowledge is like light, weightless and intangible (World Bank 1998). New knowledge-based economy requires new European policies. One of the ambitious program aimed at making EU the most competitive and dynamic knowledge based economy was the Lisbon Strategy. This aim required higher investment in R&D, improvement of lifelong learning, people mobility and social cohesion (European Commission 2005). In this perspective the Europe 2020 Strategy was established, which outlined 3 mutually reinforcing priorities, one of them defined as "*smart growth: developing an economy based on knowledge and innovation …It's about more jobs and better lives. It shows how Europe has the capability to deliver smart, sustainable and inclusive growth, to find the path to create new jobs and to offer a sense of direction to our societies.*" (European Commission 2010, p. 3).

Intellectual capital is comprehended as a multi-dimensional concept that is reflected in variety of definitions, different components and features of intellectual capital. One of the widely accepted definition explain it as the difference between the market value and the book value of the firm (*Brooking,* 1997a, b; *Daley,* 2001; *Harvey and Lusch,* 1999; *Lev,* 2001; *Nevado Pen˜ A and Lopez Ruiz,* 2002; *Pasher,* 1999; *Petrash,* 1996; *Sveiby,* 2000). Another often used describe IC as the "package useful knowledge", combination of non-material or intangible assets that create added value for its owner (company, organization) (Bradley, 1997a; Edvinsson and Sullivan, 1996; *Stewart,* 1997).

According to Bontis (2004, p. 14) IC is *"hidden values of individuals, enterprises, institutions, communities and regions that are the current and potential sources of value creation"* whereas, Andriessen and Stam (2005, p. 3) define it as *"all intangible resources available to a country or a region, that give relative advantage, and which in combination are able to produce future benefits*".

Intellectual capital has also been defined as the combination of intangible resources and activities that "*allows organization to transform a bundle of material, financial and human resources in a system capable of creating stakeholder value*" (European Commission 2006, p. 10). According to Edvinson (2004) in the economy of knowledge values created by countries, regions, organizations and individual are directly connected to their knowledge and intellectual capital. But the key point is to show that the intangible factors create value and determine the growth and competitiveness. Although, in the literature the term intellectual capital is not used in precisely the same way and there is not one interpretation, a significant number of researchers and practitioners have focused on key factors to be regarded as components of intellectual capital. Undoubtedly, intellectual capital is perceived as a dynamic and qualitative category. Different kinds of approaches to intellectual capital have been developed. Nevertheless, one of the widely used is the typology created by *Bontis* (Bontis, 2002; 2004). He singled out three main components of intellectual capital: human capital, structural capital and relational capital. Each of distinguished components contain a series of assets that are measured by means of a series of indicators. Human capital represents anything related to the people and comprises variables concerning the potential of people, like their educational background, life experience, attitudes, skills and tacit knowledge. Structural capital encompasses both the organizational framework and the tangible elements of social and technical infrastructure designed to ensure the high quality of life. And finally, the relational capital illustrates the potential related to the external image, cooperation, attractiveness and networks.

Methodology

In order to present the performance of intellectual capital in 16 Polish regions we tried to design a framework that enable the investigation of intellectual capital. With the purpose of establishing the intellectual capital of a region we used data for the following 43 variables that a priori might have some connection with the broad concept of intellectual capital:

v1 R&D expenditure in business sector
v2 R&D expenditure in government sector
v3 R&D expenditure in higher education sector
v4 Employment in R&D - Researchers
v5 Employment in R&D - technicians and equivalent staff
v6 Employment in R&D - other supporting staff
v7 Tertiary students per 10000 population
v8 Participants of doctoral studies
v9 Participants of postgraduate studies
v10 Academic teachers

v11 Life long learning (people aged 25-64)
v12 The share of registered unemployed persons in the population age
v13 Number of population (persons)
v14 The share of population by economic age group in % of total population - population at pre-working (up to the age of 14)
v15 The share of population by economic age group in % of total population - population at working
v16 The share of population by economic age group in % of total population - population at post-working age
v17 Migration
v18 The balance of arrivals and departures for work
v19 Average number of retirees and pensioners
v20 Entities registered in REGON per 10 000 Population
v21 Entities newly registered in public sector
v22 Entities newly registered in private sector
v23 Enterprises with access to the Internet
v24 Enterprises with their own web page
v25 Enterprises using Internet in their relation with public administration
v26 Theatres and musical institutions
v27 Cultural centres, clubs and lounges
v28 Infant schools
v29 Ascertained crimes in completed preparatory proceedings
v30 Number of sport clubs
v31 Number of dwelling completed/ per 10000 population
v32 The population per hospital bed
v33 Number of non-profit organisations
v34 Number of nurseries
v35 Number of tertiary education
v36 Patent applications
v37 Patents granted
v38 Subscribers per 1000 population - radio
v39 Subscribers per 1000 population - television
v40 Foreign tourists accommodated
v41 Accommodation facilities
v42 Foreign assets in R&D
v43 Participation in local election

In order to investigate which of the 43 variables listed above are related to the concept of intellectual capital a principal component analysis (PCA) was carried out. The usual criteria in PCA were applied: Eigen value larger than one, loadings on components eventually larger than 0.8 and, theoretically sound labelling of at least the main component. The final result is given in Table 1.0. The component intellectual capital could be discerned, which explains about 91 percent of the total variance. The 15 variables listed in this table have high loadings (weights) on the component which can be clearly labelled as intellectual capital. The scree plot indicates once more that the 15 variables can be headed under one component. The component consists of various dimensions of intellectual capital. It shows the importance of technological development (e.g. R&D, patents granted), the university institute (students, teachers) but also the importance of social capital institutions as not for profits, participation in local elections, and number of theatres and musical institutions.

All the statistical data and indicators it contains are based on sources available in database of Eurostat and Polish Central Office of Statistics.

Table 1. Intellectual capital, factor loadings and relative weights of its relevant variables*

Variable	Factor loading	Relative Weight**
R&D expenditure in business sector	.954	.067
R&D expenditure in government sector	.924	.065
R&D expenditure in higher education sector	.947	.066
Employment in R&D -technicians and equivalent staff	.994	.069
Participants of doctoral studies (persons)	.979	.068
Participants of postgraduate studies (persons)	.970	.068
Academics teachers (persons)	.946	.066
Number of population (persons)	.911	.064
Employment In R&D-technicians and equivalent staff	.982	.069
Entities newly registered in private sector	.945	.066
Theatres and musical institutions (number)	.960	.067
Non-profit organisations (thousands)	.949	.066
Number of tertiary education students	.982	.069
Patents granted	.952	.066
Participation in local election (%)	.930	.065

*Explained variance 91.238 per cent.
**The relative weights sum up to unity.
Source: Own calculation

Results

In the analysis of performance of intellectual capital in Poland the highest scores achieved the Mazowieckie region. In the top of the ranking with comparable outcome ranged from 156,40 to 123,48 we could find Małopolskie, Śląskie, Wielkopolskie and Dolnośląskie. The middle-ranked regions were Pomorskie, Łódzkie and Lubelskie. And finally, the lowest positions were taken by Opolskie, Lubuskie and Świętokrzyskie. Undoubtedly, the absolute leader is Mazowieckie, the capital region where economic concentration goes together with the political centre of the country. Mazowieckie owes its high position to its very dynamic growth, both economically and socially. Undoubtedly, the development of Polish regions is determined by inherited tendencies in terms of industry sectors or institutional development, but the relevance of less tangible assets like knowledge, education or information technologies is not to be underestimated. The analysis allowed us to construct the index of regional intellectual capital and then to compare the position of 16 Polish regions with their locations in the index

of regional competitiveness. Combining the intellectual capital outcomes with the competitiveness performance made possible to observe positive link between intellectual capital and competitiveness. Regions which achieved high scores in the index of intellectual capital are also highly classified in the index concerning regional competitiveness.

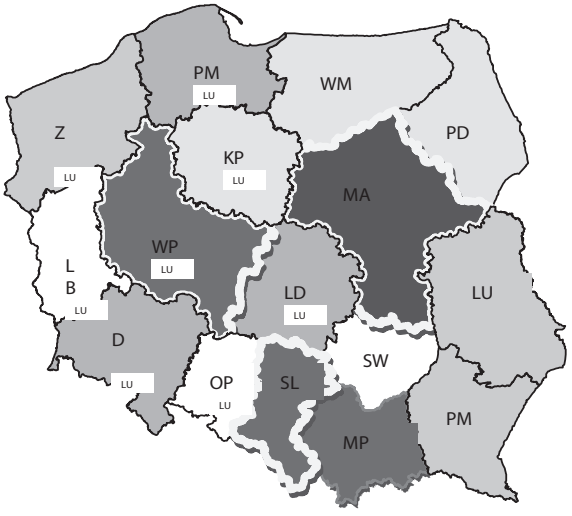


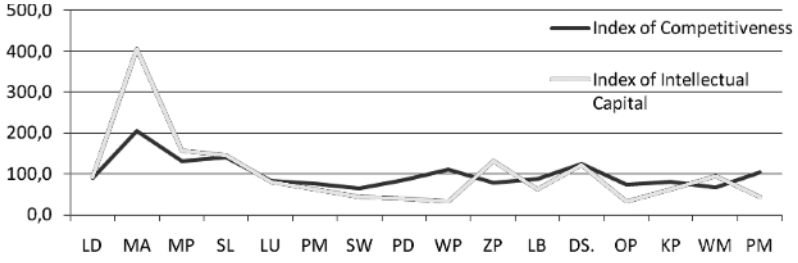
Figure 2. Map of intellectual capital in Polish regions
Source: own calculations

Table 2. Index of intellectual capital of 16 Polish regions

Region	Code	Index of intellectual capital	Rank
Łódzkie	LD	93,36	7
Mazowieckie	MA	405,67	1
Małopolskie	MP	156,40	2
Śląskie	SL	145,48	3
Lubelskie	LU	80,52	8
Podkarpackie	PM	62,13	10
Podlaskie	PD	43,81	12
Świętokrzyskie	SW	39,51	14
Lubuskie	LB	32,27	15
Wielkopolskie	WP	132,68	4
Zachodniopomorskie	ZP	63,16	9
Dolnośląskie	DS	123,48	5
Opolskie	OP	31,52	16
Kujawsko-Pomorskie	KP	61,94	11
Pomorskie	PM	95,62	6
Warmińsko-Mazurskie	WM	43,41	13

Source: Own calculations.

Figure 3. The Index of Intellectual capital and Index of Competiveness of 16 Polish regions



Source: Own calculations

Conclusion

In a globalised and strongly competitive world only regions with the ability to attract and keep intellectual capital can win. The development of scientific research, technological progress and innovation are crucial to attain high competitiveness. Knowledge and its quality, scientific research, technological progress, quantity and quality of human capital are considered as crucial factors for economic growth and high quality of life. Although, the ability of regions to adopt to fundamental changes in economic environmental rests on a range issues including their socio-economic structure, level of initial development and proximity to capital and innovation, as well as the way in which they are affected by national policy decisions (Gorzelak 2000) it is widely acknowledged that the development of regional competitiveness depends mainly on endogenous factors. In this respect we can presume that the intellectual capital will be perceived as one of the most important factors for economic growth.

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ANALYSIS OF THE INFLUENTIAL FACTORS ON GROSS VALUE ADDED IN THE HUNGARIAN SHEEP SECTOR

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Abstract: The competitiveness of the Hungarian sheep sector has been in steady decline for some time now. Crucial has been the problem that the value added in the sector is not generated in Hungary, as most of the produced lambs in Hungary leave the country with an average weight of 21 kilograms, with slaughtering happening abroad. A model has been constructed for our investigations, which introduces the connections between the product cycle phases for mutton in Hungary. This model allows us to calculate the volume of gross value added generated within specific product cycle phases. We used Monte Carlo simulation for our examination, for which the Crystall ball software package was utilized, namely the OptQuest module, for optimization. First, we conducted an optimization of an experiment number of 500,000 for "Gross value added" in the case of the slaughterhouse. During the optimization, Easter, Christmas and August lamb ratio and ewe number, as well as progeny, were set as decision variables and examined as values of gross value added, the decision variables of which contribute to obtaining the best results. The gained decision variables were set in the model and a Monte Carlo simulation was run with an experiment number of 500,000, where only the values of the conditions were changed along the pre-set dispersion; the values of the decision variables were fixed. The most significant aim of our investigation was to identify the volume of gross value added generated during processing in various phases of the product chain and the change of which inputs affected this volume the most. The findings proved that, in the case of capital uniformity, the output of processing was most influenced by sheep progeny on the bottom level of the mutton product chain. This factor is followed by that of weight gain in the source material producing and fattening sub-modules, as well as the gross wage in starter lamb feed and meadow hay in the source material producing sub-modules. Contour plots helped to describe the connections between these factors. By using contour plots, the volume of gross value added might be forecast for various combinations of factors.

Keywords: Hungarian Sheep Sector, gross value added, contour plot

Introduction

The four major products of sheep production include mutton, wool, milk and skin. In several parts of the world, especially in areas with temperate climate conditions, mutton is the most relevant product. The significance of mutton production is growing world-wide (*Morris,* 2009). In Hungary, among the major related products, mutton has been of significant importance, as the largest part of revenues in the Hungarian sheep sector have come from selling live animals (*Cehla,* 2009/a). Hungary looks back on rich sheep breeding traditions; however, sheep breeding represents only 1% of the total production value of agriculture and merely 2% of products of animal origin (*Cehla,* 2009/a). According to records of Hungarian Sheep and Goat Breeders, the number of ewes totalled 969,182 on 6,892 stock farms in 2010; along with ewe lambs over 6 months in total 1 015 556 females were recorded (MJKSZ, 2010). The average farm size means currently 141 ewes. Mutton consumption in Hungary is about 0.3 kg/person. According to the data of the Hungarian Central Statistical Office (KSH), 19 571 tons of sheep for slaughter were produced in 2008. The live weight production was 18 256 tons.

Presently, one slaughterhouse operates in Hungary, where not only primary processing takes place, but mutton production as well. Unfortunately, this slaughterhouse fails to utilize its capacity due to the low domestic demand mentioned previously.

Nábrádi (2009) finds the focal problem in the deteriorating competitiveness of the Hungarian sheep sector and in its low efficiency in terms of *value added* and innovation; accordingly, he does not deem it as being sustainable in the long run. Because this situation has been mostly caused by the poor Hungarian mutton supply chain, the authors seek to find answers to economic-market problems: namely, which factors/input variables exert the most influence on value added generation. In addition to investigating value added, total cash flow and net profit without subsidies were also examined, as these indicators have particulr significance during everyday operations.

Materials and methods

Calculations were carried out by using the product chain model of *Cehla's* (2011). As for the logic of product cycle

models, *Cehla* (2009/b) modelled the correlations of product cycle phases (based on his own definition) up to the second phase of the mutton product cycle.

Due to limited available information, trade was not included in the model. The constructed model consists of three sub-modules:

1. source material producing sector (lamb rearing)
2. lamb fattening farms (fattening lambs produced by source material producers)
3. slaughterhouse (slaughter of fattened lambs and production)

The indicators analyzed in our calculations are total cash flow, gross value added and net profit without subsidies. The net cash flow indicates the change in the capital of the participants of the product chain; thus, it shows the difference between planned revenue and expenses. The net profit without subsidies reflects the difference of production value and cost. In the case of subsidies, Hungarian subsidies and those from the European Union are taken into consideration, as these subsidies significantly influence the result for this sector. For value added calculation, the method used by the Hungarian Central Statistical Office (KSH, 2010) was applied and our calculations were completed by taking the following concepts into consideration:

Gross value added *at basic prices: + output (at basic prices) – intermediate consumption (at purchaser's prices):* The output of the source material producing sector, which was calculated from the value of the produced lambs and other products (wool, manure) counted at basic price. The output of lamb fattening farms came from the value of fattening weight of lambs in fattening farms evaluated on basic price. The value of specific slaughterhouse output was calculated by the product of multiplication from useful lamb body parts and prices applied at the investigated slaughterhouse *Cehla–Nábrádi,* (2010).

Intermediate consumption: during production, the value of products and services purchased from another producing unit in the accounting period which is used for the production of new products and services. However, the depreciation of tangible assets is not included in intermediate consumption. Intermediate consumption is evaluated at purchaser's prices. Similarly to output calculations, slaughterhouse intermediate expenditure was calculated separately in the case of intermediate consumption.

Certain sub-modules of the model were connected under the rubric capital uniformity. In this case, capital uniformity means that the product chain or the participants in the product chain belong to one owner or one owner group. The participants of the product chain operate as a cost center, while processing operates as a profit center. The cost centers pass the semi-ready products on at overhead cost prices.

The most important objective of the investigation was to identify which input changes most influence the value added generated in the various phases of the product chain. In order to reach the set objectives and to test the constructed product chain, we applied Monte Carlo simulation using the Crystall ball software package. OptQuest is a multiple optimization tool of Crystal Ball developed by Glover, Kelly and Laguna (1996) on the basis of the so-called "scatter search methodology" principle. "Scatter search" is a population-based method which bears common similarities with so-called genetic algorithms, but it is basically built on another search philosophy (*Laguna,* 1997). In OptQuest, the objectives (e.g. the minimization of gross value added distribution or the maximization of gross value added or its fall between two values) are actually values which become known merely after the Excel model has been evaluated for actual input values (*Laguna,* 1997). When determining the stock size, the simulation of the lamb fattening farms sub-module was run in the case of a farm size of 500 to 1000 ewes.

During simulation, response surface methodology was used to describe the function of input values saved by the program and gross value added. Response surface methodology (*RSM*) is a combined method of mathematical and statistical techniques, which is especially instrumental if the modelled variable is a function of several other variables (*Montgomery* 2005). In addition, we also attempt to optimize and exploit the multi-dimensional surface generated by dependent and independent variables, its local maximums, minimums and terrain and to identify the location of the area where the optimal (maximum, minimum) values of the dependent variable can be found (*Bradley,* 2007). Quadratic response surface methodology is a mixture of polynomial and factorial regression. The regression function includes the secondary polynomials of variables and the interaction effects (i.e. the products of variables in pairs) (*Statsoft,* 2011; *Bradley,* 2007):

$$y = \beta_0 + \sum_{j=1}^{q} \beta_j x_j + \sum_{j=1}^{q} \beta_{jj} x_j^2 + \sum \sum_{i<j} \beta_{ij} x_i x_j + \varepsilon$$

In order to illustrate the gained results in two dimensions, contour plots were applied.

Contour plot is a two-dimensional plot which shows the one-dimensional curves on which the plotted quantity q is a constant. These curves are defined by as follows (*Boyd,* 2000):

$$q(x, y) = q_j,\ j = 1, 2, \ldots, Nc \quad (1)$$

where Nc is the number of contours that are plotted. These curves of constant q are known as the "contours" of q or as the "isolines" of q or as the "level surfaces" of q (*Boyd,* 2000).

We fitted a second-order polynomial surface to the points in the 3D scatterplot by using Statistica 7.0.

Results and discussion

During optimization, the ratio of Easter, Christmas and August lambs, ewes and progeny was set. The model was run 250,000 times, in such a way that the values of decision

variables were fixed and merely conditions (e.g., input variables: feed prices, fodder prices, feed sales, weight gain, gross wages.) varied.

The distributions of conditions (in the case of inputs) were fitted on the grounds of time series data from previous years, farm level data and expert assessments.

During simulation, saved data were analyzed and a sensitivity report was prepared on gross value added, net profit without subsidies and cash flow revealing which conditions (input data) and in what way influenced gross value added more significantly. Variables influencing considerably the examined outputs are summarized in Table 1.

On the basis of the results of the sensitivity report, the value of every examined indicator was significantly determined by primarily progeny and full-time wage. When investigating inputs, the prices of lamb feed and meadow hay significantly influence the examined indicators and their values exceed one percent. Regarding technological parameters, weight gain and feed conversion have particular relevance. It is important to emphasize the ratio of slaughtering percentage, as the result of the slaughterhouse depends on its ratio in practice. In addition to sensitivity analysis, it was relevant to investigate the absolute values of the gained indicators. The results are summarized in Table 2.

Examining cash flow, the average of cash flow of fattening and slaughtering is negative under the given conditions. Only source material production is able to generate positive cash flow. Under capital uniformity, the average of cash flow is positive, as well. All these results explain why fattening and slaughtering do not exist in Hungary. In the case of maximum values, cash flow may exceed even 75.5 EUR. From practical aspects, only farms utilizing mutton-producing breeds can generate this result, as according to Cehla's previous examinations, the utilized breed provided the basis for profitability in sheep mutton production. Primarily fattening lamb production contributes to cash flow of the product chain, which is turned into positive by subsidies (ewe subsidies, single area payment scheme, agri-environmental farming subsidies).

Table 1: The Results of Sensitivity Analysis

	Source material producing sector	**Fattening farms**	**Slaughterhouse**	**Total**
Cash flow %				
Progeny	56.90%	42%	66%	65.20%
Full-time wage	-23.40%	-26.50%	-10.90%	-18.10%
Meadow hay price	-4.70%	-4.70%		-2.90%
Slaughtering percentage			7.70%	2.20%
Rearing lamb feed price	-2.80%			-1.10%
Starter lamb feed price		-6.50%	-1.70%	1.50%
Daily weight gain H		-3.60%	5.60%	
Daily weight gain VB			1.50%	
Feed conversion H		-4.30%		
Feed conversion AT	-2.50%			
Alfalfa hay price	-2.30%			
Gross value added %				
Progeny	79%	72.8	66%	77.10%
Meadow hay price	-5.10%		-1.20%	-3.30%
Full-time wage		25.20%	-10.9	-2.90%
Slaughtering percentage			7.70%	2.80%
Daily weight gain H			5.60%	2%
Rearing lamb feed price	-3.10%			-2%
Feed conversion AT	-2.60%			
Alfalfa hay price	-2.40%			
Corn price	-2.10%			
Starter lamb feed price			-1.70%	
Daily weight gain VB			1.50%	
Feed conversion H			-1.10%	
Net profit without subsidies %				
Progeny	54.90%	76.70%	66%	65.70%
Full-time wage	-26.80%	-13.10%	-10.90%	-18.7
Meadow hay price	-4.50%	-1.50%		-2.70%
Slaughtering percentage			7.70%	2.10%
Rearing lamb feed price	-2.60%			-1.50%
Daily weight gain H		-1.10%	5.60%	1.40%
Starter lamb feed price		-2.10%	-1.70%	
Daily weight gain VB			1.50%	
Feed conversion H		-1.40%		
Feed conversion AT	-2.30%			
Alfalfa hay price	-2.10%			

Source: own construction

Regarding gross value added, an average of 3.8 to 5.5 EUR per lamb is generated in the various phases of the product chain. Considering the best values, value added exceeds 64.2 EUR.

The average of net profit without subsidies is negative in every case, thus altogether a deficiency of 58 EUR per lamb

Table 2: Several Important Statistical Parameters of the Examined Indicators

	Minimum	Maximum	Standard deviation	Mean
	Cash flow EUR/lamb			
Source material producing sector	-17.8	55.6	8.9	23.5
Fattening farms	-2.0	3.7	0.4	-0.8
Slaughterhouse	-91.3	26.8	12.0	-4.2
Product chain	-100.9	75.8	20.0	18.3
	Gross value added EUR/lamb			
Source material producing sector	-29.2	31.8	7.8	5.5
Fattening farms	2.0	22.7	1.7	4.5
Slaughterhouse	-83.0	35.2	12.0	4.0
Product chain	-90.2	65.1	17.6	13.9
	Net profit without subsidies EUR/lamb			
Source material producing sector	-83.8	-13.9	8.6	-45.0
Fattening farms	-10.0	-3.3	0.7	-4.8
Slaughterhouse	-95.2	22.9	12.0	-8.3
Product chain	-182.5	0.4	20.6	-58.1

Source: own construction (1 EUR = 265 HUF)

is realized in the whole product chain. In the case of best values, only slaughtering may be considered to be a profitable activity to a rate where the ratio of profit compensates the losses from fattening and slaughtering. All in all, positive cash flow may be realized if every condition is given for profitable production. In other words, parameters (progeny, weight gain, feed conversion) identified as a result of the sensitivity analysis should be paid more attention to in the sector. The value of these indicators depends mainly on genotype.

The tendencies of values of indicators influencing gross value added selected during the sensitivity report were investigated in contour plots. In contour plots, chiefly the effect of two variables (full-time wage and progeny) was examined in connection with output (gross value added, cash flow, net profit). The reason why these two factors were analyzed is that during simulation these two factors had relevant effect on the outputs in every sub-module, except for the source material producing one, where instead of wage the price of meadow hay was the second most determinant factor after progeny. Due to the extent limit, the contour plots of gross value added is detailed among the contour plots constructed from the results.

Observing the contour plots, the contours of two types of surfaces may be separated. The first type of surface is an inclined plain; on its contour inclined lines may be found (Bradley, 2007). The other type of surface is similar to a plain, which has a bulge or a valley on a part of it, and the plain bends to any direction. The lines (contours) reflect the varying combinations, which represent equal gross value added (or cash flow, or net profit) in the simulation (Bradley, 2007). The color shades indicate the size of the output variable. The darker green color shows the smallest output values, while the dark red color shows the biggest ones (Fanning, 2011). The width of the contours is also dominant; its ratio reflects that under fixed value of an input variable, its change shows what ratio causes an increase in the output by one isoline, i.e. the interval of which hides in the inputs separately (Bradley, 2007). The steepness of the contours serves information. If the lines were vertical or horizontal (it is not possible in our case), one of the factors would not influence the output variable, only the other factor. In the horizontal axis, progeny was illustrated. The steeper the contours are, the greater the effect of the progeny on the output is contrary to the full-time wage, as the vertical situation would mean that full-time wage could be neglected. If there is a bugle or valley on the surface, the direction of the lines will change, thus it may happen that the line curves back on a given area. The contour plots of the gross value added generated in the source material producing sub-module is illustrated in Figure 1.

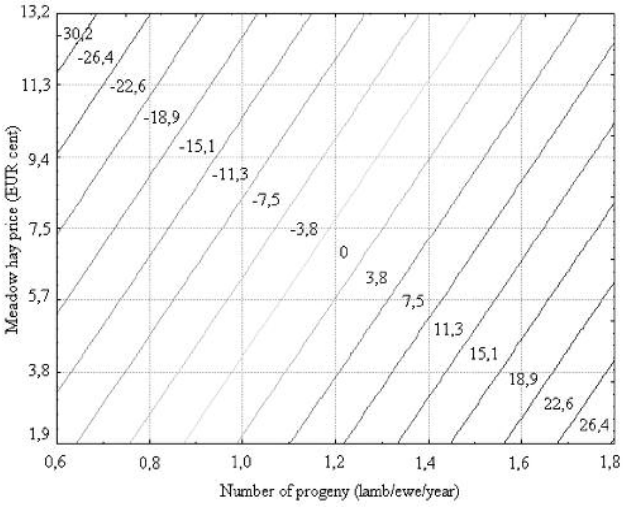

Figure 1: The Contour Plot of Gross Value Added in the Source Material Sub-Module
Source: own construction

The surface may be classified typically into inclined surface contour plots. The width of lines is around 0.1 for progeny, while in thecase of meadow hay, it increases one isoline by 2 EUR cents. Regarding the steepness of the lines, the effect of the two variables is balanced relating to the isoline increases; the dispersion of gross value added is similar to normal in connection with its skew. On the basis of the figure, in order to reach positive value added, at least one

lamb per ewe has to be produced; however, this does not mean any improvement of the profitability of the sector. Regarding the price of meadow hay, it should be lower than 6 EUR cents per kilogram. The next participant of the product chain is fattening farms, the contour plot of which is summarized in Figure 2.

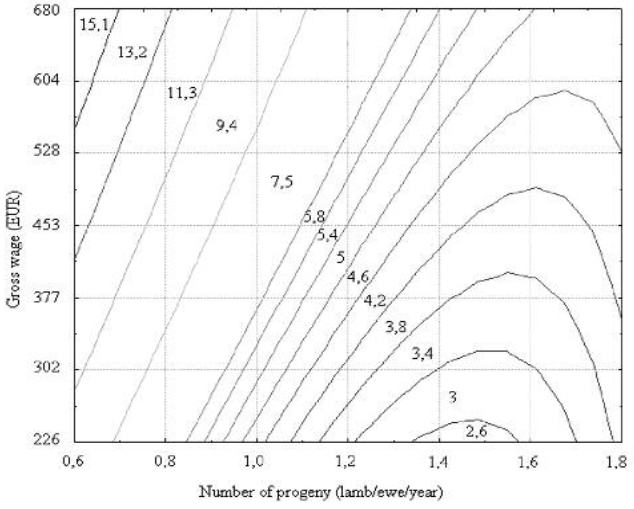

Figure 2: The Contour Plot of Gross Value Added of Fattening
Source: own construction

The contour plot of fattening farms may be classified into plots of bended surfaces. The width of the contours is narrower relating to progeny (0.04), while it increases an isoline by 22.6 to 30.1 EUR cents in the case of full-time wage, which results in about 28 to 38 EUR cents gross value added. There is one valley in the surface, which may be detectable in the case of progeny above 1 to 1.1, especially when the full-time wage is below 453 EUR. The gross value added is the smallest this time (Min.: 1.96 EUR, max: 22.7 EUR, mean: 4.52 EUR). The distribution bends to the left, which means that values below the average are most likely to occur. This is reflected by the figure in a way that the ratio of green area is greater. Firstly, it may be a surprise that the biggest value added is generated under low progeny and high personal cost. In our opinion, the reason for this result is that fattening is a separate economic activity and source material production does not necessarily influence the ratio of its tendency. This is why it may be realized in practice that a few farms purchase lambs and deal with fattening as a sole main activity. However, the value added of the slaughterhouse depends significantly on the ratio of progeny (Figure 3).

Figure 3 may be classified into the second-type one, as there is one bulge on the surface, which may be detected if the progeny is above 1 to 1.1, especially when full-time wage is under 453 EUR. The gross value added is the highest this time (Min: -83, max: 35.2, mean: 3.95). The distribution bends to right, which means that values above the average are most likely to occur. This is reflected by the figure in a way that the ratio of areas colored by red is greater. The width of the contours is 0.05 to 0.06 till 1 to 1.1 progeny; in case of full-time wage it is 37.74 to 56.6 EUR, the isoline increases cause approximately 3.77 EUR gross value added. The

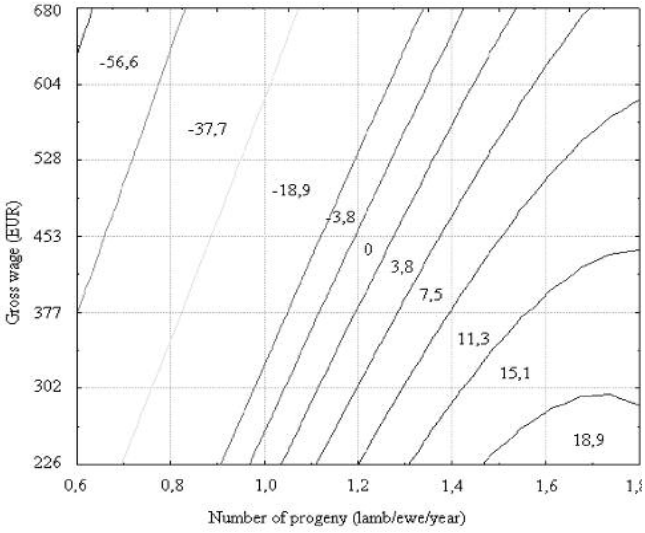

Figure 3: The Contour Plot of Gross Value Added of the Slaughterhouse
Source: own construction

highest value added may be reached in case of 1.2 lambs per ewe or even higher realized progeny.

On the basis of interpretation of the contour plots regarding the factors significantly influencing the profitability of lamb mutton production, progeny has to exceed one lamb per ewe. The price of meadow hay has to be lower than 6 EUR cents; the personal costs should not exceed 453 EUR. Furthermore, largely progeny contributes to the increase of value added in the levels of source material producing and slaughterhouse product chain, while fattening does not depend on progeny.

Analysis of the contour plots revealed the fact that the joint examination of certain factors makes taking further consequences into account possible. In this way, we illustrated how the cash flow, gross value added as well as gross profit without subsidies, change during the simulation in a 3D-figure (Figure 4).

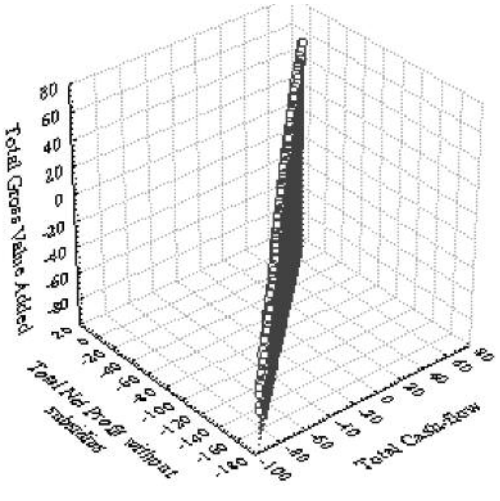

Figure 4: The Tendencies of Total Value Added, Cash Flow and Net profit
Source: own construction

The maximum value of total cash flow is 75.78 EUR, its minimum may reach –98.11 EUR, while the mean is 18.3 EUR. The dispersion of total cash flow bends to right, i.e. the relevant part of the values is located right to the average. This indicates that values above the average are more likely to occur. Furthermore, the dispersion is leptocurtic, which means that extreme values are more likely to occur contrary to normal. The minimum of the total gross value added is about -90.24 EUR, its maximum is 65.1 EUR, while the average is 13.9 EUR. The feature of the dispersion is the same as in the case of cash flow. Regarding net profit the dispersion may be characterized by the above mentioned. The minimum value is – 182.5 EUR, while the maximum is only 38 EUR cents, the mean is – 58.1 EUR cents. The net profit is negative in almost every case, which occurred due to primarily source material production. All these indicate that subsidies have highlighted role in the sector. The ratio of loss is not compensated by the normative ewe subsidies and ewe supplementary subsidies, as their per ewe volume is 6.42 EUR + 4.68 EUR, altogether 11.1 EUR. The remaining loss is turned into a positive result by the value of area payment projected to one ewe. The 3D-figure of the values shows that these three financial indicators move in one lane, which means that they are connected in a linear way.

Conclusion

In our investigations, factors influencing the generation of value added in the Hungarian sheep mutton product chain were examined in a way that, in addition to value added, net cash flow and net profit without subsidies were also focused on among the results of the simulations. All these were necessary because only value added does not serve to provide sufficient information relating to the operability of the activity, which may lead to improper consequences.

On the basis of the sensitivity report, the examined output data depend on mainly progeny as well as full-time wage. When investigating the inputs prices of lamb feed and meadow hay significantly influence the examined indicators, with regard to technological parameters, weight gain and feed conversion have particular relevance. It is important to emphasize the ratio of slaughtering percentage from slaughtering parameters.

According to the statistical analysis of output data of the simulation, cash flow may be positive if parameters (progeny, weight gain, feed conversion) as a result of the sensitivity analysis are paid more attention to in the sector

The contour plots made the quantification of factors influencing profitability of sheep mutton production possible, and on the basis of all these progeny has to exceed one lamb per ewe. The price of meadow hay should be lower than 6 EUR cents, and personal cost cannot be higher than 453 EUR. On the basis of the gained results, chiefly progeny contributes to the increase of value added at the various levels of the product chain, while in the case of fattening, value added does not depend on progeny.

The 3D-figure obviously reflects that the value of net profit may be negative if the value of the other two indicators is positive. All these further strengthen the fact that sheep mutton production generates losses without any subsidies.

To sum up, the chief consequence of our modelling research is that primarily any development may be expected in the Hungarian sheep sector if the processing industry is expanded. Following such a change, the integration of production should occur, under conditions which provide new alternatives to every producer. If producers finally change their breeds or apply the well-tried cross-breeding combinations, the realization of more effective production would have greater opportunity.

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IMPACTS OF THE GLOBAL FINANCIAL AND ECONOMIC CRISIS ON THE AGRO-FOOD INDUSTRY AND RURAL LIVELIHOODS IN SERBIA

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Abstract: Sixty-five per cent of the Serbian land area is agricultural and 55% of the population is rural. Agriculture share of GDP is more than 10% and about 47% of the rural labour force deals with agriculture. The aim of this work is to analyse the impacts of the global financial and economic crisis on the Serbian agro-food sector and rural communities. Measures introduced, mainly by public institutions, for relieving the consequences of the crisis are presented and discussed. Easily accessible yet high quality data from the central Office of Statistics in Serbia and specialized literature have been used. Impacts have been assessed by analyzing and discussing the trends of many socio-economic indicators. The crisis has had general impacts on the Serbian economy (low GDP growth, unemployment increase, price volatility, purchasing power decrease, etc.). Due to the crisis growth in agricultural production has been very low (0.1% in 2009). Agro-food exports decreased dramatically in 2008. About 9000 agricultural jobs were lost in 2008 and 2009. Reduced exports and lower domestic demand impacted negatively on agricultural commodity prices and agricultural household incomes. Access to credit became more difficult especially for small producers. However, agriculture is still a very important safety net. Agricultural employment share has increased both for men and women. The importance of agriculture is even higher if we consider the "grey agricultural economy". To mitigate the crisis effects, the Government provided subsidies to rural people and will adopt the National Strategic Plan and Programme for Rural Development. Nevertheless, public institutions - in partnership with private, civil society and international organisations - should improve rural producers' access to market information and credits and foster investments in rural areas including non-agricultural ones and those aiming at improving physical capital.

Keywords: Crisis; Impacts; Rural economy; Serbia

Introduction

The agro-food sector plays an important socio-economic role in Serbia. According to Eurostat data, farmland comprises 65% of the total surface area of Serbia [*European Commission*, 2011]. The share of agriculture in gross domestic product (GDP) was almost 20%, during the period 2000-2005 [*EC*, 2011], and is currently more than 10%. Agriculture and the food and beverage processing industry represent the largest single sector of the Serbian economy [*Hopic*, 2009]. Moreover, according to the OECD definition, rural areas in Serbia cover 85% of the territory where 55% of the population live [*Bogdanov*, 2007]. Agriculture and agro-processing employ a large share of the labour force [*Arcotrass et al.*, 2006]. For all these reasons, it is very likely that the world economic crisis has had major consequences for Serbian agriculture in particular and the rural economy in general.

Recent data show the crisis beginning in late 2007 and accelerating in 2008 and 2009 [*USAID*, 2009]. Most analysts link the beginnings of the crisis to a great real estate boom in the United States, where the crisis was created at the centre of the world's financial system [*Stamatović et al*., 2010]. While the crisis started off as financial, it has spilled over to the production sectors and real economy [*Živkov et al*., 2009]. Even if the crisis started in the USA, it has had impacts not only on the United States' economy, including agriculture, [*e.g. Shane et al*., 2009] but also on other countries such as Serbia [*Stamatović et al*., 2010].

Živkov et al. [2009] pointed out that the crisis can affect Serbia's agriculture, as well as the rest of the economy, in two main ways: reduced demand and reduced credit activity. According to *Stamatović et al*. [2010], main problems are reflected in reduced demand and difficult access to export and capital markets.

Despite a period of steady growth with an annual average rate of 6% between 2005 and 2008 [*EC*, 2010; *Matković et al*., 2010], the first signs of the crisis appeared in the third quarter of 2008 [*Matković et al*., 2010]. In 2009, Serbia's GDP shrank by 3% in real terms [*EC*, 2010]. Moreover, by end-July 2010, gross external debt had risen to €23.3 billion [*EC*, 2010]. At the end of December 2009, the consumer price index (CPI) rate of inflation stood at 6.6% bringing the yearly average inflation rate to 8.1% [*EC*, 2010].

Serbia was not prepared for the crisis as the private sector is small; the public sector is too large and mostly redistributive; and salaries and pensions are excessively high . The result is an economy with low productivity, low savings and low exports [*International Monetary Fund*, 2009]. Therefore, Serbia has faced a serious fiscal problem [*Grozdanić*, 2011] and its macroeconomic policy has been anchored by an economic programme supported by the International Monetary Fund (IMF) since early 2009 [*EC*, 2010].

The aim of this paper is to analyse the impacts of the global financial and economic crisis on the agro-food sector and rural economy in Serbia. Measures that have been introduced, mainly by public institutions for relieving the consequences of the global economic crisis on the rural economy and population have been presented and discussed. Some other measures have been proposed. Moreover, some coping strategies adopted by households, especially in rural areas, have been presented.

Materials and methods

This paper is based mainly on secondary data from specialised literature using different sources: Statistical data from the Statistical Office of the Republic of Serbia (SORS) as well as the Government of the Republic of Serbia; Ministry of Agriculture, Forestry and Water Management (MAFWM); Ministry of Economic Affairs and Regional Development; the World Bank (WB), the IMF, the European Commission (EC), etc.; and existing national and international reports and publications.

Easily accessible yet objectively verifiable and high quality data have been used. This multifaceted research is based on a set of SMART (Specific, Measurable, Achievable, Relevant and Time-bound) indicators. Impacts have been assessed by analyzing and discussing the trends of different indicators dealing with many relevant economic, social and environmental issues such as: the labour force market (rural employment/unemployment), inflation, agricultural exports/imports, domestic consumption, prices of agricultural commodities, agricultural production, access to credits, agricultural budget, women and gender, migration, poverty, land use and allocation, agriculture intensification (*e.g.* use of agricultural inputs and machines), organic agriculture, agro-food products certification, investments in agriculture and the rural economy, rural wages, etc. Impacts have been assessed by identifying trends in selected indicators from the pre-crisis period to the most recent date, depending on data availability.

The main problem faced during the preparation of this paper was that there are a very few publications and articles covering the issue of the effects of the crisis on Serbia in general and Serbian agriculture and rural economy in particular. Furthermore, another limitation – that was also faced by the authors that tried to analyse the impacts of the crisis on Serbian agriculture [*e.g. Živkov et al.*, 2009] – was that when analyzing a global crisis it is not that easy to distinguish between global impacts and effects on some specific countries. It is even more difficult to determine the impacts of the crisis on individual sectors (*e.g.* agriculture). Analysing the crisis impacts on rural areas is much more difficult since it is hard to find data specific to rural areas especially those dealing with the non-farm and off-farm activities. Incongruence and inconsistency of some statistics and data was another problem faced during the preparation of this article.

Results and discussion

Many of the impacts generated by the global crisis on agriculture in Serbia are similar to those reported in other countries [*e.g.* USA, *Shane et al*., 2009]. However, there are many peculiarities and specific dynamics. Certain crisis consequences have a short-term effect, but long-term changes will certainly be felt. The short term effects of the crisis on the Serbian agriculture are primary manifested as: (i) decreased production value; (ii) reduced income of agricultural producers, and (iii) changes in the functioning of market chains [*Živkov et al*., 2009]. It was estimated that the agricultural production fell by 1.7% in 2010 [*Grozdanić*, 2011].

The first signs of crisis in the labour market were already apparent towards the end of 2008. Employment decreased slightly in October 2008, but by April 2009 there was a large decrease in employment of 5.8%. The greatest reduction in employment was in construction and catering. The decrease in employment in agriculture was also high (-9.2% during the period October 2008 - April 2009) [*Matkovi et al*., 2010]. According to the OSRS, about 9,000 agricultural jobs were lost in 2008 and 2009.

The employment of women has decreased slightly more than the employment of men. By the second semester of 2008, the crisis almost equally hit employment in both urban and non-urban (rural and mixed) areas. Some regional differences were also evident: the most unfavourable trend in employment was present in Central Serbia (-10%), then Vojvodina (-6.8%), and Belgrade (+1.2%) [*Matković et al*., 2010].

Unemployment grew significantly in October 2008 by 5.5% and again in April 2009 by 6.9%, reaching 488,600 persons. The unemployment rate reached 14.0% in October 2008. Unemployment grew similarly in all three large regions of Serbia. Urban areas have been more affected

[*Matković et al.,* 2010]. However, it should be said that unemployment in rural areas was recorded at high levels (21%) even before the crisis [*Hopic*, 2009]. The unemployment rate in 2009 increased to 16.1%. According to the national labour force survey of April 2010, the unemployment rate soared to 19.2% [*EC*, 2010]. As for agriculture, 2,054 people employed in the agricultural sector lost their jobs in the first seven months of 2009 [*Živkov et al*., 2009].

Turbulence in international financial markets affects Serbian producers and exporters in two main ways: decreased buyer financing and tightened credit for producers [*USAID*, 2009]. The resultant contraction of credit has stemmed from the contraction of loan portfolios and an increase in risk aversion [*Živkov et al*., 2009]. The withdrawal of money from Central and Eastern Europe (CEE) has been especially severe. In fact, net inflows to CEE of $217 billion in 2007 reversed sharply to a net outflow of $27 billion in 2009 [USAID, 2009]. The withdrawal of bank financing means less credit and poorer terms for Serbian producers especially smallholders. Banks reduced their credit activity and agricultural producers were less interested in taking loans. When compared to August 2008 data, a drop in agricultural loans was evident, amounting to 7.5% of the total number of loans, and a 4.2% increase of the total sum of the written–off debt. There was a significant drop in agricultural credit activity in many banks (*e.g.* Komercijalna Banka, ProCredit bank, etc.). The fall in credit activity in agriculture was sharper than in other economic sectors. Agricultural loans, generally risky, were on the top of the reduction list [*Živkov et al*., 2009].

Growth in real wages was interrupted during 2009 [*Matković et al*., 2010]. 2009 saw significant wage moderation with nominal wages increasing by only 6.9% on average (17.9% in 2008). Moreover, real wage growth slowed down to only 0.3% per annum (19.5% in 2007). While economic activity has been picking up gradually, the situation on the labour market worsened in 2010. Wage growth has remained broadly constrained during 2010 [*EC*, 2010]. Differences in wages between men and women decreased during the crisis period. Wages in urban and non-urban (rural and mixed) areas were equally affected, and the differences in wages between regions decreased [*Matković et al*., 2010].

According to the Statistical Office data, the food industry saw the largest drop in salaries of 13.6% (the average for all sectors was 8.4%) between August 2008 and March 2009. Salaries in agriculture during the same period fell by 6.3%. When it comes to salaries and employment, the primary sector is among the industries most affected by the global economic crisis, since the food industry saw the largest drop in salaries, while agriculture and fishery saw the highest reduction in the number of jobs [*Živkov et al*., 2009]. The ratio between average wages in urban and non-urban communities is certainly in favour of employees in urban areas [*Matković et al*., 2010].

Since 2001, Serbian agriculture has recorded a constant rise in exports (average rate of 26% in the period 2001-2007) generating a constant foreign trade surplus. However, in 2008 imports grew faster than exports. During the first quarter of 2009, total agricultural exports decreased by 22.59% when compared to the same period of 2008. The drastic drop in the unit value of exports is primarily the result of the drop in exports of grains and plant products [*Živkov et al*., 2009]. According to the OSRS, agricultural production growth has been very low (0.1% in 2009). The trade balance in agriculture did not decline as far as other sectors when comparing January to March 2009 with the same period in 2008. Agriculture saw a more rapid decrease in imports than in exports [*Živkov et al*., 2009].

Decreased global demand for export commodities reduced exports, which combined with a lower domestic demand lowered agricultural commodity prices (deflation), consequently, agricultural households' incomes [*Živkov et al*., 2009]. The level of consumption has declined considerably in Serbia, as it has elsewhere. The average monthly consumption per equivalent adult has declined by 4.5% between the last quarter of 2008 and the first half of 2009 [*Matković et al*., 2010]. One of the reasons for the reduction in total consumption is the decrease in salaries [*Živkov et al*., 2009].

Underemployment is another structural problem in Serbian rural areas [*Hopic*, 2009]. Nevertheless, in the semester October 2008 – April 2009, the least real wage drop was observed in the industry and agriculture. Looking across occupations, the only increase of real wages in the crisis period, although minimal, was recorded in agriculture. However, wages in agriculture are below average [*Matković et al*., 2010].

At times of crisis, when jobs are exceptionally threatened and wages decline, the social status of the vulnerable categories are comparatively worse [*Matković et al*., 2010]. Women and in particular disabled women, single mothers, older women and those living in rural areas still continue to face discrimination in the labour market [*EC*, 2010]. During the crisis, wages increase for certain groups and they move to higher quintiles per wage (the "winners"), while certain categories experience a drop in wages and move to lower quintiles (the "losers"). Wage sensitivity to crisis is measured by the percentage of employed who change quintiles per wage. The sensitivity of women's wages (10.2%) to crisis is somewhat lower than the average (11.4%), which includes women in non-urban areas and those working in agriculture. In general, explicit "winners" during the crisis included skilled workers in agriculture and fishing [*Matković et al*., 2010]. The greatest losers in any crisis are most often elderly households with insufficient capacities for competing on the market. Similarly, the ones doing business in areas with less favourable conditions for agricultural production are additionally threatened [*Živkov et al*., 2009].

Agriculture plays an important socio-economic role, especially in crisis periods, and is considered to be a safety net by many households. According to the Statistical Office data, April 2010, agricultural employment share increased during the crisis. There is a rough gender balance regarding

agricultural employment as of April 2010 (23.9% of men and 21.3% of women employed in agriculture). Almost all active old people deal with agriculture. Real GDP growth slowed down in 2010, in all economic sectors except agriculture. Nowadays, agriculture and the rural economy, play an important role in the overall economic development of Serbia and in alleviating the effects of the crisis [*Grozdanić*, 2011]. The importance of agriculture is even higher if we consider the "grey/informal agricultural economy", not accounted for in official statistics, as many people that lose jobs start some agriculture realted income-generating activities. According to the Labour Force Survey (LFS), a sizeable share of the population is employed in the informal economy, especially agriculture, construction and trade [*Matković et al*., 2010]. Due to the crisis, a certain number of people enter the agriculture sector, especially those who have lost the possibility of doing business in other sectors. Engagement in agriculture offers, primarily, food security, which is important for jobless people [*Živkov et al*., 2009].

The crisis can have certain long term consequences whose intensity will depend primarily on the crisis duration and the intensity of its effects on agriculture and the other sectors [*Živkov et al*., 2009]. These consequences will primarily influence the following processes [*Živkov et al*., 2009]: abandonment of the agricultural sector; migration from rural areas; decrease of investment in machinery; falling asset price income; slowing down of reforms and EU integration processes in agriculture; slowing down of the introduction of new foreign direct investments and privatization; slowing down of the development of high value products (organic, GI, etc.); and an increase in protectionism.

The crisis period can certainly be described as a time of deteriorating living standards and increasing poverty in Serbia. The highest poverty rate of employed persons is found amongst individual agricultural producers [*Matkovićet al*., 2010]. Rural poverty is high among farmers in more remote areas, with small farms and/or those with land exhibiting low fertility [*Hopic*, 2009]. In line with labour market trends, the headcount poverty index reached 7.4% (about 550,000 people) in the first half of 2009 and the poverty gap index increased to 1.6%. In the first half of 2009, the poverty incidence in Central Serbia was higher than in Belgrade and Vojvodina [*Matković et al*., 2010]. The impacts of the economic crisis were particularly felt in Central and South Serbia [*USAID*, 2009] that recorded even before the crisis a higher level of rural poverty [*Hopic*, 2009]. A significant poverty increase was evident in non-urban areas where the poverty risk was two times higher (10.2%). Although increasing poverty hit both genders, it is somewhat surprising that households with male heads experienced a higher poverty rate (7.8%) compared to women-headed households (6.1%) [*Matković et al*., 2010].

As far as coping strategies are concerned, agricultural producers need to find their own strategy to alleviate the effects of the crisis. Many successful individual strategies may lead to a faster recovery for the country as a whole [*Živkov et al*., 2009]. The primary coping mechanism adopted by Serbian households during the crisis was to postpone or cut down on expenditures. Other frequent coping strategies included the deferral of investments in the household's farming activity or the household's business, as well as the reduced requests for loans from other persons and institutions. Moreover, focus group findings [*Ipsos Strategic Marketing*, 2009] revealed that the vulnerable women in rural and mixed areas coped somewhat better than men in the crisis. In the absence of farming activities, women were capable of finding additional cleaning or home assistance jobs. For the poorest, qualitative studies suggest that the most important coping strategy is to gain work in "grey economy" [*Matković et al*., 2010].

However, in addition to individual strategies, there also has to be a Government strategy to send out clear signals to the agricultural producers and other actors in the value chain. One of the main characteristics of agricultural policy in the period before the crisis was its unpredictability; frequent changes and the absence of a clear concept. Moreover, the program for 2009 was intended to alleviate the crisis effects but it is likely to have had the opposite effect [*Živkov et al*., 2009]. As a matter of fact, measures and actions taken at the beginning of the crisis period were weak and sometimes contradictory.They included [*Živkov et al*., 2009]: a reduction of almost 50% in the agrarian budget compared to 2008; suspension of support to agricultural producers not paying their pension insurance contributions; suspension of support to non-commercial holdings; an increase in the amount of money to be paid per hectare (ha), but introduction of stricter requirements for getting these funds; introduction of credit lines funded by the agrarian and municipal budgets; a further reduction in investment and structural support; and switching of funds from the operating funds for credit market development to one-time subsidies per ha.

To mitigate the effects of the crisis, the Government of Serbia adopted modest measures aiming primarily at ensuring financial stability, stimulating the real economy and fostering employment [*Government of the Republic of Serbia*, 2009]. In December 2008, the Serbian government adopted a document entitled "*The economic crisis and its effect on Serbia*", which was rather a list of the measures the Government was prepared to take. This document was rapidly superseded since it was based on an optimistic scenario. The Government soon changed its position, opting for budget rebalancing and an agreement with the IMF [*Živkov et al*., 2009]. Then, the Government of Serbia adopted the "*Program of Measures for Neutralizing Negative Effects of the Global Economic Crisis*" for 2010, which represents the continuation of 2009 measures aiming at preserving and/or creating new jobs as well as achieving economic growth [*Grozdanić*, 2011].

With already excessive public spending and a considerable budget deficit there were no financial resources and/or wide range of real options for large scale crisis intervention policies in Serbia. However, a crisis is always a good moment to reconsider all options [*Matković et al*., 2010]. Public works programs were an important component

of the overall safety net package during the crisis in some countries [*World Bank*, 2010]. It is possible to consider expanding the existing public works budget in Serbia as well as targeting the poor in the population in the areas mostly affected by crises. In line with the results on poverty and labour market analyses, Central Serbia – without Belgrade –and the rural and mixed areas are probably those that should be given priority. The same principle of additional targeting could be applied to other active labour market programs (*e.g.* subsidies and cheap loans) [*Matković et al*., 2010].

Many measures have not been designed specifically to mitigate the effects of the crisis but they can nevertheless have an effect on the rural economy. The government adopted a Decree on the use of subsidies for rural development through support measures for the improvement of economic activities of rural households in 2009. The Directorate for Agrarian Payments, which is planned to serve as a future Instrument for Pre-Accession Assistance for Rural Development (IPARD) agency, has been established. However, implementation of the law on agriculture and rural development remains to be completed. The national strategy for agriculture and rural development, the national programme for agriculture and the national programme for rural development have not yet been adopted. An inter-ministerial mechanism for coordinating rural development policies has yet to be established [*EC*, 2010].

Živkov et al. [2009] proposed many measures and recommendations to alleviate the effects of the crisis on Serbian agro-food sector and rural economy that can be summarised as follows:

- To improve information dissemination in order to raise awareness of the severity of the crisis and its potential effects, and to inform agricultural producers of potential strategies aimed at alleviating the consequences of the crisis. It is necessary to provide information on markets and trade (input and equipment prices; supply and demand; etc.); credit markets; effects of the crisis and strategies to alleviate them, etc.
- To provide predictability in policy making and markets by introducing a recognizable policy for a longer term period and ensuring market stability.
- To provide budgetary support for agriculture.
- To stimulate credit activity and the banking sector: loans are more necessary now than ever before. It is necessary to provide incentives for credits.
- To provide support to farmers ready to take on investment loans or to invest their own funds.
- To provide support for the vulnerable especially in rural and marginal areas.
- To promote cooperation with donors and give priority to building capacities for faster and better utilization of EU funds earmarked for agriculture and rural development (IPARD).

In times of crisis it is particularly necessary to make best use of funds through promoting cooperation with donors and developing joint programs to address the problems generated by the crisis. A particular opportunity is the IPARD funds, the 5th component of IPA funds. However, none of the eligibility requirements are currently met. These funds would be a significant contribution to the development of agriculture and overcoming the crisis. Therefore, it is necessary to have and/or to strengthen administrative capacities [*Živkov et al*., 2009]. Serbia's national IPA allocation for 2010 totalled €197.9 million. Serbia participates in the IPA multi-beneficiary programmes included in an IPA crisis response package developed in 2008 and fully operational in 2010. The first €50 million instalment under the IPA 2009 budget support initiative was disbursed in December 2009. The purpose of the budgetary support is to ease the social and economic consequences of the current economic crisis in Serbia and help pursue the pace of EU integration related reforms [*EC*, 2010]. In fact, the global economic crisis caused a slowdown in the implementation of economic reforms in Serbia [*Grozdanić*, 2011].

In times of financial crisis, when agricultural producers find access to funds for investment more difficult, budget funds for agriculture become more important. However, in Serbia, in 2009 budget expenditures for agriculture were reduced by 42.23% when compared to 2008. The agrarian budget was cut in the 2009 budget to a much greater extent than the budgets for other sectors. These data are dramatic since the agricultural budget is, according to all parameters, one of the smallest in Europe and it has constantly been subject to cuts in the last few years, while the overall budget increased so that the 5% agricultural budget share in 2004 and 2006 fell to 2.2% in 2009 [*Živkov et al*., 2009].

Joining the EU club and family is also one of the proposed anti-crisis measures. *Stamatović et al*. [2010], stated that in a situation where it is necessary to absorb the effects of the global economic crisis, it is of crucial importance for Serbia to approach the EU and fulfil the criteria for accession. Agriculture is a sector where investments are necessary in order to make adequate preparations and reforms for the forthcoming EU accession. However, because of the crisis, the number of employees in the Ministry of Agriculture has been reduced by 10% and the agrarian budget by almost 50%, which can significantly slow down the reforms needed. Meanwhile, there is also a slowing down of reforms and investment (*e.g.* standards and certification) at the level of individual agricultural holdings [*Živkov et al*., 2009].

According to *Milovanovic* [2010], a good model for overcoming the crisis in Serbia is agriculture strategic development, especially the development of safe and high quality agro-food products. However, since the start of the global economic crisis, a drop in sales of organic products, products with geographic attributions and other high-value products has been recorded. These trends do not work to Serbia's benefit in the long term since these products represent an opportunity for the country to increase its agricultural competiveness and to differentiate and diversify its agro-food products supply [*Živkov et al*., 2009].

Conclusions

All in all, the Serbian economy has been affected by the crisis more than most other Eurozone or OECD countries. Moreover, agriculture has suffered the effects of the global economic crisis more than other sectors in relation to specific issues (*e.g.* employment, salaries, credit activities). However, agriculture has played an important socio-economic role during the crisis and is still a relevant element of the coping strategies of many rural households. Under the impact of the economic crisis labour market conditions deteriorated as unemployment approached 20% and salaries remained almost unchanged in real terms. However, macroeconomic stability was broadly preserved against this backdrop of global crisis owing to the adoption of some appropriate measures in agreement with the IMF, mildness of the recession in some partner countries of the EU, Serbia's relatively low dependence on exports, as well as the support of international institutions and certain timely interventions by the National Bank. Nevertheless, the Serbian economy continues to be affected by the global economic crisis while recovery has been slow and fragile. The recovery has been under way since early 2010 but the pick-up in economic activity has been slower than expected. In fact, Serbia's inflation was 10.3% in 2010 and the dinar has greatly much depreciated. However, in 2010, Serbia's GDP, expressed at constant prices of 2002, increased by 1.5% in comparison to the previous year. A positive trend in export growth was registered (+20.3% with respect to 2009) and the ratio of exports to imports has improved (57.2% in 2010 with respect to 51.2% in 2009). The return to a growing world gross domestic product and income, especially in Germany and other countries of the European Union, should lead to a recovery in Serbian agricultural exports thus improving the rural economy.

In the forthcoming period it is necessary to carefully analyze Serbian agriculture and the rural economy to design adequate policies, strategies and measures in order to mitigate crisis effects on agricultural producers and rural people. Nevertheless, for the alleviation of the crisis effects MAFWM – in partnership with the private stakeholders, civil society organisations and international donors – should try to improve rural producers' access to information, especially on the market; to ensure market and agricultural and rural policy stability; to provide subsidies and incentives to rural producers and to make their access to credits easier; to foster public and private investments in rural areas including non-agricultural investments and those aiming at improving the physical capital of rural areas; etc. Serbian policy makers should capitalise on the current crisis to make the necessary structural reforms that Serbia needs, reforms that have previously been postponed several times mainly for political and electoral reasons. Necessary reforms should render Serbian agriculture and the rural economy not only more resilient but also more competitive.

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LABOUR MARKET ATTRIBUTES OF DISABLED PEOPLE IN HUNGARY

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Abstract: Nowadays employment is an evergreen topic in Europe. The North Great Plain Region of Hungary is a typical rural area in Hungary, the unemployment rate is higher in this region as the national average, that's why it is important, to give the possibility of job for the people living in rural areas. This paper focuses on the relationship between the disabled and the labour market in the North Great Plain Region of Hungary. On the basis of the 8/1983 Hungarian Law many kinds of supplies are provided by the State for people living with disabilities. It is very difficult to provide jobs for these people after their rehabilitation. Statistical figures show that the highest ratio of 'people living with disabilities' can be found in the North Great Plain Region of Hungary (30 per cent of the total number of 'people living with disabilities'). The research focuses on special rehabilitation firms (they are specialised to employ disabled employers) and their employees. Two questionnaires for the above mentioned firms and their employees were created in order to gather information on their activities as well as relationship between the firms and its employees. Altogether 400 employees filled in the questionnaires. The current study shows the results of this survey. It can be stated that this paper shows the relationship between the employment and the types of enterprises, and disabled workers' qualification level, the need for further education. According to the latest trends we analyse the attitude to the rehabilitation of people living with disabilities and how they will be able to work again not only in 'rehabilitation firms'. After summarizing all claims of participants we can make an impression in this area and demonstrate the problems for the labour market generally.

Keywords: people living with disabilities, labour market

Introduction

Nowadays the growing rate of economically inactive population is a very big problem in Hungary. Rural development has become more and more important issue in Hungary since rural areas also contribute to the efficiency of the national economy (*Kárpáti et al.,* 2010). There were radical changes in the economy as well as in the labour market in the 1990's. The rate of employment and activity was the lowest in 1996 – 1997, after that in consequence of the economically boom it had been growing for 2000. Between 2000 and 2007 it showed stagnation, except some short temporary growing periods (I1).

There are two big groups in the sector pensioners. 'People living with disabilities' group can also be found in this sector on the basis of the 8/1983. Eüm/PM Hungarian Law. The aim of the Law is to give the possibility of adequate job based on qualification and state of health after their rehabilitation.

Generally speaking it would be better for the Hungarian economy to employ these people because the number of inactive population could be lower and the state wouldn't have to provide them supplies. According to the Hungarian Law, if there is no possibility to give jobs to these people, they receive supply from the state (I2).

Business financing has a very important role in the private sector (*Kárpáti,* 2006). The employer has an obligation in all sectors of the national economy to pay rehabilitation contribution the state, if the statistical number of employed persons is more than 20, and if the number of disabled persons less than 5 per cent of the total number of employed persons. Rehabilitation fee could be replaced through employing 'people living with disabilities' (I3).

As it can be seen from Figure 1, the highest activity rate of population can be found in the capital city and surroundings area. The reason for that is that most of the logistics centres as well as headquarters of multi – companies

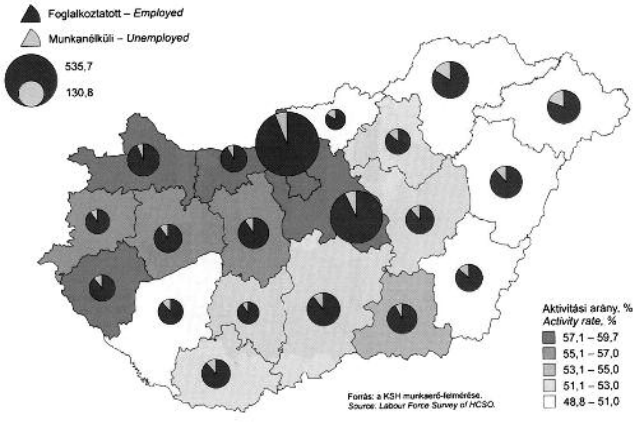

Figure 1 shows the activity rate of population aged 15-74, in the 7 statistical regions of Hungary.

Figure 1: Activity rate of population aged 15-74, distribution of economically active population, 2009

Source: Regional Statistical Yearbook of Hungary, 2009

are located in this region. Relatively high activity rate can be found also in the western part of Hungary, especially in counties located at the Austrian boarder. The lowest activity rate can be found in the South – West and North – East counties of the country. Unfortunately in these counties we can find the highest unemployment rate too. In most cases it is even double higher than the national average.

People living with disabilities have a very special situation at the labour market. Their participation in labour market is very limited (Pfahl et al., 2010). In Hungary – according to the international trends – vocational rehabilitation and workmen's compensation are provided by the state (*Kálmán et al.,* 2002). The disability is no more for one person true but for some activities (*Münnich,* 2007). The holistically, ecological approach become more and more trend (*Pordán,* 2007) that circumstances and the abilities of people living with disabilities have to be harmonize (*Münnich,* 2006). The problem is that these people don't have the right to decision in their job too (*Bass,* 2008) although they are in the practice stable, precise and capable of hard work (*Holló,* 2007).

Materials and methods

The aim of this paper is to give a general overview about the labour market attributes in Hungary, focusing on 'people living with disabilities' in the North – Great Plain Region of the country. Characteristics of the group as well as weaknesses of their employment are introduced. In this stage of the research, results have been reached so far are presented.

The research focuses on special rehabilitation firms and their employees (they are specialised to employ disabled employers). Two questionnaires for the above mentioned firms and their employees were created in order to gather information on their activities as well as relationship between the firms and its employees. Altogether 400 employees filled in the first questionnaires. The second questionnaire focused on special rehabilitation firms. The current study shows the results of the survey of the first questionnaire. It can be stated that this paper shows the relationship between the employment and the types of enterprises, and disabled workers' qualification level, the need for further education. According to the latest trends we analyse the attitude to the rehabilitation of these people and how they will be able to work again not only in 'rehabilitation firms'.

Results and discussion

Data processing was performed by SPSS for Windows 15.0. This research focuses on people, they are individual, and so the anonymity of questionnaires is very important (*Falus et al.,* 2008). The definition: people living with disabilities can be divided into two groups, considering that the incapacity is a congenital malformation – this means an infiltration into the labour market with disability – or an impaired health status caused by a medical emergency or an accident – this means the person had worked in the labour market without disability and later he had to cope with the changed situation according to his impaired health. There were 400 respondents and the sample was obtained by using a simple random sampling (*Sajtos et al.,* 2007) from accredited companies (*Somod*i, 2006). One hundred companies (around 25%) were asked from the registered 390 companies. The total number of the persons work at these companies is around three thousand, and the sample consists of 400 persons (the sampling rate is around 13 per cent). Tables 2 to 4 present the frequency distribution of the sample by gender, age and qualification.

Table 2: Gender percentage in the sampe

Gender	Percentage (%)
Male	34,7
Female	65,3
Total	100,0

Source: own research, 2010-2011

It can be stated that the representation of women was higher (65,3 per cent) in the sample than the statistical average in the region: about 50–50%.

Table 3: Age ratio in the sampe

Age in years	Percentage (%)
under 20	4,6
21-30	13,4
31-40	27,6
41-50	49,8
51-60	4,6
Total	100,0

Source: own research, 2010 -2011

Almost half (49,8 per cent) of the respondents is middle-aged (41-50 ages), and about one third (27,6 per cent) is between 31-40 years old, while 13,4 per cent is between 20 and 30 years old. Below 20 ages and between 51 and 60 ages are the rest with 4,6-4,6 per cent.

Table 4: Distribution of the qualification level in the sample

Level of qualification	percentage (%)
Primary	4,6
Elementary	13,4
Intermediate	27,6
College graduate	49,8
Total	100,0

Source: own research, 201 -2011

Ten per cent of the respondents is college graduated, almost the half has intermediate qualification, while the third finished only elementary school, and the rest finished only primary school.

We conducted different investigations for the two groups of disabled person. The rate of the persons with congenital malformation was 12,08 per cent and we investigate the years spent in work with partial incapacity. It can be stated that these persons have averagely been working since June 1997 (the standard deviation was 8,5 years). This period lasted from the regime change to around the EU membership of Hungary. The other group (persons with impaired health) consists of 57,08 per cent of the total sample. It can be stated that these persons have spent minimum 1 month and maximum 20 years without any work and averagely 4 years and 2 months with a standard deviation of 4 years and 5 months. 27,92 per cent of the respondents have found a job within a month. The start of work can not be determined in 3 per cent of the cases because of the missing data.

We supposed that partial disability for work was considered as „permanently disabled" with a higher ratio in case of those people who had a very serious „health break-down". In Hungary there are two types of classification systems: the old one is the „reduced capability for work" classification for those who had pensioned off permanently before 2008. The recent one is the „total health break-down" classification, which contains the persons whose status had been revised.

We analysed the relationship between the measure of disability and the per cent of 'the health break-down' by Chi-square test. It can be stated that people with a worse health condition were in the 'permanently disabled status' with a higher per cent. The 'reduced capability for work' classification has four categories: below 40%, 40 to 50%, 50 to 67%, above 67% (Somodi, 2006/b). Only 5,2% of the persons in the 'permanently disabled status' belong to the first category, while 31,3% of the permanently disabled persons is in the second category, the majority belongs to the third and fourth category. In case of the 'temporary disabled group' only 35,7 per cent belongs to the third and fourth category.

The Chi-square tests proved the differences in the ratios of the 'reduced capability for work' categories between permanently and temporary disabled persons with p=0,000 significance at 5% significance level.

The 'total health break-down' classification has more categories (6), such as: below 32 %, 32 to 39% , 39 to 49%, 49 to 79% (can be rehabilitated), 49 to 79% (can not be rehabilitated), above 80%. The permanently and temporary disabled statuses can be clearly separated. 73,8% of the permanently disabled persons are in the last three categories (these represent the most serious health break-down status). In case of the temporary disabled status, 54,4% of the respondents belongs to the first three category which represent the less serious health break-down status (Figure 4). Chi-square tests proved the differences in the ratios between permanently and temporary disabled persons with p=0,004 significance at 5% significance level (Figure 5).

Relationship between the company types (individual entrepreneur, LLC, etc.) and the amount of wage was evaluated. Reason for that was, that business environment became even more critical after the Hungary's accession to the

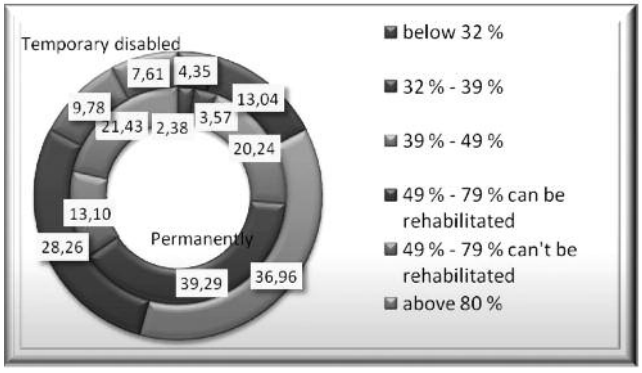

Figure 5: Relationship between the measure of disability and the percent of the health break-down
Source: own research, 2010-2011

European Union in 2004 (Kozár et al., 2010). The Kormogorov-Smirnov test denied the normality test with p=0,000 significance, so non-parametric test. As there were more than 2 company types, the Kruskal-Wallis analysis was the most appropriate for analysing the sample. This test proved the differences of the wages among the 5 company types with p=0,000 significance. Results can be seen on Figure 6.

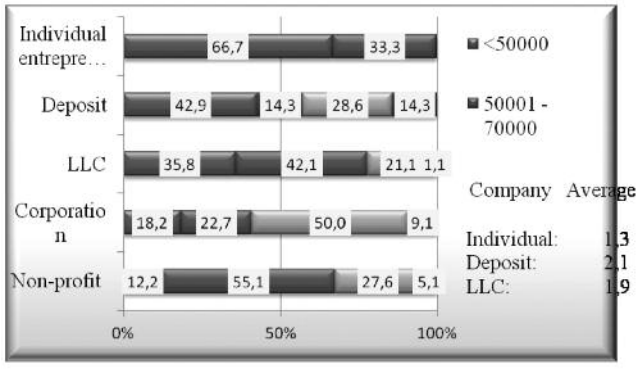

Figure 6: Distribution of the four wage categories (in HUF) among the company types
Source: own research, 2010-2011

A relatively high ratio (57,2%) of persons work for deposit companies and earn the lowest amount (in the first two wage categories). The situation is similar with a bit different ratio for people work for non-profit and LLC. (77,9% for non-profit and 67,3% for LLC.). The situation is a bit more favourable in case of the corporation and non-profit companies compared to the deposit companies as the ratio of the second wage category is relatively higher. Some extremities can be observed in case of the deposit companies, because the ratio of persons in the lowest (42,9%) or in the highest (14,3%) wage category is higher than in case of other types except the individual entrepreneurs. Individual entrepreneurs pay only in the first two wage categories and the two-thirds of their employees are in the lowest wage category. Corporation companies offer the best conditions as half of the respondents who work for these companies belong to the third wage category (Figure 6).

The respondents had to rank some factors according to their importance in working. Safe job was the most frequent

with 81,6 per cent. 54,6 per cent marked the accessibility to work place and 36,6 per cent of the respondents mentioned the wage. 35 per cent named the professional progress. The other factors and the possibility of rehabilitation were mentioned only 11,6 per cent and 25 per cent of the cases. Figure 7 shows that the safe job was not only the most frequent, but the most important factor too. The second-leading factor is the wage followed by professional progress.

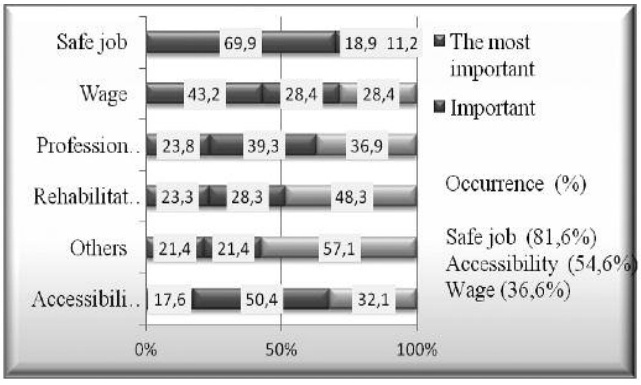

Figure 7: Importance and occurrence of factors related to working
Source: own research, 2011

The job satisfaction was measured on a semantic differential scale, its value ranges from -3 to +3. This factor was proved to be non normal by Kolmogorov-Smirnov normality test (p=0,000), so we used the Mann – Whitney probe for analysing the job satisfaction among the two groups of people living with disability for work. There were no significant differences between the two groups regarding the job satisfaction (p=0,142). Respondents with congenital malformation gave a 2,3 average for job satisfaction, while the average was 2,5 in the impaired health group. This result is unusual comparing it with the newest 'rehabilitation trends' according to the 10/2006 (II. 16) Hungarian law (Garai, 2008).

Conclusion, discussion

Analysing the labour market of Hungary it can be stated that the number of unemployed and inactive persons has increased continuously between 2000 and 2008. Unfortunately this negative trend didn't stop yet. There are some special groups in the Hungarian population, like 'people living with disabilities' whose labour market position even more complicated. Currently different kind of supplies are available for this group, but their position could be effectively improved trough their integration into the labour market. Better utilisation of available EU funds to create new jobs and change the thinking of the society could be the way integrating them back into the active employed population.

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THE ROLE OF EDUCATION, KNOWLEDGE AND HUMAN RESOURCES FOR THE AGRICULTURAL DEVELOPMENT IN THE PERSPECTIVE OF NEW CAP: AN HYPOTHESIS OF CHANGE IN BASILICATA

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Abstract: The role of education, knowledge and human resources in the agribusiness becomes of primary importance for the development of agricultural sector and, more generally, of the territory. The main objective of the present paper is to verify the role of investment in human resources and, consequently, in services for the agricultural development for the dynamics of rural development, trade and international cooperation of agribusiness. After a literature review, the paper firstly analyses the characteristics of the Italian Region of Basilicata, selected for our empirical application, and secondly develops an econometric model to explain the relationship between the rural GDP and a set of economic variables and of network-education-social (NES) dummy variable. These NES is representative of social, educational and, network factors, describing the degree of openness of the region firm. As expected, the results show that farmers may act as engines for economic development when they are trained on the basis of the needs and requirements related to innovation and research, and they are assisted through new models of organization of agricultural services.

Keywords: Development Services; Human resources, Knowledge; Educationet

1. Introduction

The economic and social development in European countries and, more generally, in advanced societies has led to a deep re-thinking of the role of the agricultural sector, generating an extensive and long reflection on the relationship between the citizen (consumer and user of land for food) and the farmer.

In this context, it was necessary to define a new model of sustainable development and integrated land and, therefore, a new model of agriculture that should be developed to provide the rural area, as well as agricultural products and foodstuffs, also goods and services resulting from the many economic functions, environmental and social demands. A farmer capable of being the engine of competitiveness, sustainability and integration of the agricultural component in the countryside, in which he clearly has his social, environmental and economic role. In this framework, sectorial policies and the role of human resources in agriculture must be the instrument that can ensure the development of this new model of farming. To this end, an important role could be entrusted to agricultural extension services, in order to educate, train and create awareness for enterprises, businesses and territories.

2. The role of agricultural extension services

The agricultural extension services are particularly important in order to revitalize the area as they can act on the motivation and knowledge of producers, actively building new relationships and new ways of interacting. It is necessary, however, the direct involvement of the territories, taking a different nature than before. Multifunctional and the subsidiary improve the contextual knowledge and increase the participation of farmers, reinforcing learning ability and decision and generates the creation of new networks of agricultural knowledge. The agricultural enterprise, can also be regarded – within the broader concept of rural life – from the technical and economic point of view and from the legal and economic view, in two distinct parts (*Bellia* 2001): as a producer of services (a concept derived from multifunctional agriculture, as a public good of social relevance as well as economic) and as a consumer of services (those that the company buys and / or otherwise acquires). This *status quo* has strongly diversified the mission of agricultural extension services connecting in this way to the company context to compete in a global market where it is essential to contain production costs and increase productivity of factors. The effectiveness of development services follows from the

perceived ability to generate real benefits for businesses and generate virtuous cycles that have an impact on knowledge systems and networks of relationships. The services are therefore an essential tool to facilitate and identify directions for change.

The Italian experience in the field of agricultural extension services commonly show a strong evolution in the framework (EC regulation 270/79), adopted by Italy in compensation for the disadvantage of the lower level of support for agricultural production in Italian, which has financed the training of agricultural extension and the subsequent establishment of organizations specifically designed to technical assistance, opening the way for the construction of a decentralized system of services.

In this context, the field of "agricultural services" has a strategic role: it is in fact called upon to adapt to the demand of farm innovation induced by the new orientation of agricultural policies and new market and consumer requirements (*Costanzo et al.* 2001). The development services demand is a function of services supply available to farmers and of other variables, such as structure, size, the average age of the settlement, and so on (Dinar 1989) and is directly connected to the amount of operating capital, years of experience of the farmer and his level of education (*Bagi and Bagi* 1989). The problem is the excessive fragmentation and duplication of roles and uncoordinated projects (such as promotion or training). For this reason, human resources have low skills as result of the recruitment method and the lack of training: also general employment in the service sector is undesirable and is often seen as second best, temporary or additional job. This *status quo* means, the prevalence of administrative-bureaucratic support. The goal, is to promote a radical change in the system in regional context.

3. The evolution of development services: from agriculture to rural

The services for agriculture are complex and constantly evolving and include the technical and economic assistance and other forms of dissemination of information and innovations that enable companies to better express their economic and social capacity, reducing the negative influences of constraints and risks due to lack of knowledge of the context. When the application of EU policies has become more complex, public services have supported companies in implementing of new procedures and adapting to the new logical support. The Reg. (EEC) 270/79, had the aim to overcome the disadvantage that divides Italy from the other Members of the EU, thus it aimed to implement the National Framework Plan of agricultural advisory panel to allow the establishment of a multi-regional training system (the ICTAE – Interregional Centre for Training of Agricultural Extension) and to grant the subsequent inclusion of two thousand new professional advisers.

From 1989 to 1993, under the Community Support Framework for Objective 1 Regions was made a Multiregional Operational Programme for the Development of agricultural advisory services and related activities. The second half of the nineties saw the dissolution of ICAE (Inter-regional Committee for Agricultural Extension), which coordinated the activities of the Framework Plan, which closed in 1995, and the beginning of the crisis in the education system of ICTAE. The next *national program on Agricultural Development Services* (PNSSA) was an integrated system of agricultural development services including: research and experimentation, agricultural statistics, training and updating of the paintings; consulting company, technical services support, vocational training for farmers; information. However, due to its complex structure, the National Plan has been only a declaration of intent. With the Fischler reform of the CAP, the EU has reviewed the importance of services for agriculture as a useful tool for implementing policy objectives. The reform indicates that each Member State has to set up an advisory system – the FAS (farm advisory system) – targeted to farms, which cover at least the requirements and compliance standards. The Program for Rural Development 2007-2013 has offered to the Member States a support to the creation of the FAS with specific funding. However, this requirement is part of a global strategic Community design, in which is assigned a role of importance for the agriculture to services for the improvement of human potential and the profitability of companies and more generally the achievement of strategic goals for developing the competitiveness of the primary sector (Axis I).

The establishment of the system of advisory services is therefore provided as part of a series of measures which are complementary and competing, aimed to intervene directly on the development of human capital, such as training and information for professionals involved in the primary sector (measure 111), but also to assist the entrepreneur to carry on business activities such as the use of advisory services (measure 114), goodwill of replacement services (measure 115), the Cooperation for the development of new products, processes and technologies in agriculture and food sector and forestry sector (measure 124).

Modern agriculture, in addition to the function of food production, contributes to the formation of the landscape, the sustainable management of renewable resources and the improvement of the quality of life in rural areas. This characteristic of multi-functionality, although common to other sectors of the economy, in agriculture has special importance for the weight of these "joint products" (*Zezza* 2001). The complexity of problems related to food safety and environmental protection requires increasing cooperation within systems of knowledge in agriculture (research, training, dissemination), and between them and the different actors from producers to consumers and policy makers. This is the latest step in a process of growth and development of knowledge and services in agriculture. In this perspective, the new EU guidelines require a serious change in the behavior of farmers (*Delfino* 2007), assigning a strategic role in development services to develop communication systems,

especially those that promote networking among actors involved in extension services in agriculture, and between these actors and businesses. The regions are developing Rural Development Program (RDP) 2007-2013 EAFRD as well as the ERDF and ESF OP 2007-2013: these are the best opportunities to develop the necessary services and the management procedures in line with the strategies identified in them, and to activate the integrated and multi-fund development and services projects (from research, planning, logistics). This is mainly to take account of new types of entrepreneurs, new organizational models – chains, clusters, etc.. – and new goals and challenges of the food sector in the current programming period and in the near future.

4. The role of knowledge and human resources in agriculture

The changes that have affected agriculture in recent years have been extensive because of new relationships between ownership and enterprise, new organizations of production and work, relationships with different markets, new forms of entrepreneurship. These changes depend by economic, social and demographic factors that have invested several European rural areas (*Montresor and Pecci* 2009). In this context, human resources can play a major role through the effects of spillovers on the creation of production process resources. Human resources have two effects: firstly, the increase of the labor productivity as a result of increased efficiency and skills of more educated labor, secondly there is an external factor that has to improve the average productivity of all workers involved in the productive process. This last effect as an indirect spillover impact and leads to an increase of the average level of skills of the human resources. At the aggregate level, these synergies create a process of endogenous growth of the territories (*Devitiis and Maietta* 2009). On the other hand, the required expertise to farmers from these mutated scenarios are very complex, including not only technical knowledge but also the ability to quickly acquire new knowledge or to work to produce them. The same scenario is valid for the professional skills of business consultants, public and private, often outdated or incomplete for the function of technology transfer requested by this profession (*Arzeni* 2007). This intense process of innovation is characterized by new production methods and new types of collaboration, as well as new products and services to be offered to the entire community. Farmers today have not to only aim to reduce costs, but also to analyze the possibility to better differentiate their production, with the aim of achieving greater competitiveness on the markets, to better respond to consumer expectations and European society (*Ballari* 2005).

Certainly, in the "adoption of a within-farming-system benchmark to set up best practice improves previous analysis of the competitiveness of regional specific farming systems" (*Reig-Martınez et Picazo-Tadeo* 2004), education becomes a crucial element (Suvedi et al. 2010) although the educational function of agriculture has not been fully examined despite the growing need for such services from urbanites (*Ohe* 2010). Furthermore, knowledge can become the key to the success of the farm only if it becomes operative (*Pilati et Boatto* 2007).

The CAP analysis shows that many misunderstandings and lack of efficacy, depend on lack of knowledge, especially informative and relational material in contravention of the cross-cutting nature of knowledge (ibidem). The speed and success of diffusion of the innovation depends upon site-level investments in schooling (*Weir et al.* 2006; 2004; *Weir* 1999).In fact, as it has already been proved in the literature, farmers' education improves eco-efficiency too (see, for example, *Van Passel et al.,* 2009; *Picazo-Tadeo et al.* 2011). Agricultural programs now encompass many high skill fields such as biotechnology, genetics, environmental sciences, renewable energy, aquaculture, veterinary sciences, landscaping, turf grass management, agronomy, natural resources, mechanics and construction technology just to name a few (*Illinois State Board of Education* 2010): a formal and informal education system should serve the promotion of knowledge and awareness to emphasize and motivate human resources too (Sharghi et al. 2010). An example of this process, is the Memorial Middle School Agricultural Extension and Education Center (MMSAEEC) that is an innovative teaching and learning model and unique role for New Mexico University Cooperative Extension Service (*Skelton et al.* 2010). Intermediate and higher education in agriculture continues to play a decisive role in rural development and sustainable agricultural production (*Alam et al.* 2009). In this context, the EU is carefully looking for competitive innovation, which requires the transition to a knowledge-based society capable of more widespread prosperity and greater social cohesion (Lisbon European Council 2000, the Treaty of Lisbon 2007).

Europe 2020, adopted by the European Council in 2010, should combine contributions from various levels: European, national, regional and local levels to build a smart, sustainable and inclusive growth (*Contò and La Sala* 2010). The post-2013 CAP reform process should fit with its own peculiarities in the 2020 strategy, promoting growth of agriculture and the rural economy and ensuring a greater degree of public support to companies to promote development in human resources and create a Knowledge systems for rural development. This would reduce the instability of the system of knowledge and its components through investments that promote skills, specialization, design. Ultimately, human capital becomes an important factor and training and lifelong learning become relevant variables of innovation and regional competitiveness.

5. The Basilicata region: a socio-economic context analysis

The RDP 2007 - 2013 in the Basilicata region, taking the methodology adopted by the National Strategic Plan, ranked

Basilicata entirely rural, mountain and hill defining the "Rural area with complex problems of development" and plain "Rural areas with intensive agriculture specialist (Figure 1).

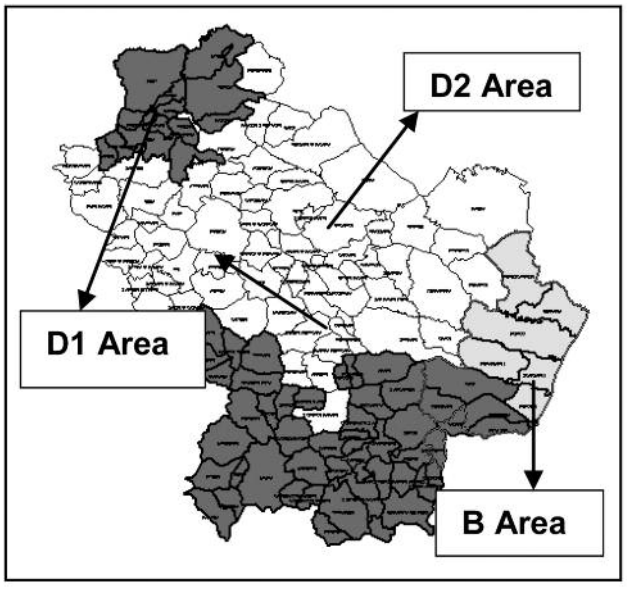

Fig. 1: Rural structure of Basilicata
Source: RDP 2007–2013 Basilicata Region

The classification made by the National Development Program (NDP) in the region showed the presence of two types of land, in which lie the three macro-areas identified at the regional level (Table 1).

Tab. 1: Classification of the territory of Basilicata

Classification NDP	Classification RDP
B. Rural areas with intensive agriculture specialist	**B.** Rural areas with intensive agriculture specialist
D. Rural areas with complex problems of development	**D.1.** Area for agriculture with the most advanced organizational models **D.2.** Areas within the hills and mountains

Source: Our elaboration on DRP 2007–2013 Basilicata Region

Most of the territory (92%) and population (88.1%) falls in the rural area characterized by lower population density and structural problems of development. In such areas it is most felt the problem of an aging population and depopulation of small towns. The population structure by age shows, in fact, in areas D1 and D2, greater aging of the population, as evidenced by the index of aging is higher than the lowest rate of generational turnover compared to the area B and the regional average. This population structure has also a negative fallout on agricultural holdings of those areas where most of the wires are old, and is also reflected in the level of education of conductors of farms (Table 2): D1 and D2 areas, where there are fewer young people, the number of graduates is lower than rural area B, while the percentage of illiterates is almost twice that of the B and also the relative value to the owners of the only primary school is higher.

The data analysis shows the presence of differences between the sexes: males possess a higher level of education in all three areas examined. In terms of employment, the primary sector, in terms of percentage of people, of greater importance in the rural area B with intensive agriculture, with 21% of employment. In the other two areas D1 and D2 has relevance to the tertiary sector, which accounts for respectively 54.3% and 60.9% of employment, because of the presence in these territories of the two provincial capitals, where public offices and services are prevalent.

With regard to agricultural use, the area B has a greater incidence of utilized agricultural area (UAA) is higher than the surface area that the total agricultural area (TAA), confirming the more intensive nature of this territory. The average size business, lower than the regional figure, further confirm the intensive nature of agriculture, if this value is related both to the contribution to the establishment of the regional agricultural value added (25% compared to 9.4% of UAA), and the division of UAA between major destinations. In area B, in fact, more than 1/3 of the UAA is invested in permanent crops. Conversely areas D1 and D2 are predominantly extensive agriculture. In terms of quality of life for people, surely the presence of infrastructure and services and their strengthening, influences and contributes to the retention of principals and productive living in rural areas. From the numerous spatial analysis conducted in the area, there was evidence that the infrastructure framework is not always adequate to the needs of rural people and enterprises, and even less for those living in mountainous areas in agro-forestry and pastoral vocations. This finding, along with a low rate of generation change, depopulation, low population density, negatively affects the ability to trigger new processes and job opportunities. Another

Tab. 2: Conductors by area and level of education

Area	Total					Of which male				
	Degree	High	Junior High	Elem.	None	Degree	High	Junior High	Elem.	None
B	4,3	19,2	27,9	37,6	11,0	4,2	19,6	28,9	36,8	10,5
D1	2,4	14,6	19,3	43,0	20,7	2,7	15,0	20,4	42,4	19,4
D2	2,4	12,5	21,1	44,5	19,4	2,9	13,2	22,5	43,3	18,2
Total Basilicata	2,6	14,1	21,2	43,1	19,0	3,0	14,7	22,4	42,2	17,8

Source: ISTAT 2001 agriculture census

important factor, also linked to the progressive aging of the population and therefore a decline in learning, is the low percentage of adults participating in training: less than 6% of the total. Access to the countryside as an extension, is satisfactory in the region, particularly in the areas located near main roads and area B. The index assumes a value of road equipment in Basilicata significantly lower than other regional groupings (45.6 against 58.8 in the South, 52.5 and 55.1 of central and northern Italy). With regard to the railway network, the region is poorly covered and all the features have a single track, a condition which significantly slows the traffic. With regard to communication infrastructures (ICT) for farms and rural populations, rural areas are generally poorly served than in urban areas.

6. The dataset

Our dataset includes data from farms that are members of the Confagricoltura of the Basilicata region, which are about 400. A stratified random sample of farmers was drawn among the main sectors of the agricultural economy (fruits and vegetables, olives, wine, cereals, zootechnical). The study, developed over two years of work, then used a descriptive-survey method for the data collection on a range of 5 years from 2005 to 2009. The survey methodology was qualitative and on field; the surveys were mailed to the stratified random sample in January of 2010. After two months, a follow-up letter was mailed to the sample population and then there was a contact call (Suvedi et al. 2010); after one month, the survey was completed through the organization of a focus group too. The survey had a response rate of 57,5% (that is 120 farmers). In the case of missing answers, these were treated as missing values. The survey included both closed and open ended questions and was structured in two sections on the five-year period 2005-2009. In the first section respondents were asked to indicate: value-added, capital investment, numbers employed, percentage share of exports, percentage share of R&D expenditure. In the second section respondents were asked to indicate:

- educational level of farmers;
- participation in master, skills, training;
- enrolment in professional associations;
- activation of external collaborations of specialist consultants (agronomists, experts in biological, etc..) and generic (economic consultants, experts in finance and development programs);
- presence of a survey system of customer satisfaction (Arrighetti et al. 2011);
- members to clusters, networks, entrepreneurial networks.

The introduction of the questions in the second section was intended to capture the "degree of opening" to inputs from the external environment and markets (Arrighetti et al. 2011) in terms of network, human resource, and knowledge. The expected results from our research is the creation of Value Added should be increasing at high levels of economic variables and, in special way, of network-education-social (NES) variables too.

6.1. The econometric model

The empirical study will be carried on through an econometric analysis based on a panel data model (OLS and GLS estimates). The econometric model explain the relationship between the agriculture GDP and a set of economic variables and of (NES) dummy variable representative of social, educational and, network factors, connoting the degree of openness of the region firm (such as schooling of entrepreneurs, training, enrolment in professional associations, collaboration with generic experts and/or specialists in the field, presence of a survey system of customer satisfaction, association to districts, cluster or network, etc.) in the period 2005/2009. The relationship between the level of per capita value added (VA) of the sample and the predictor variables was developed in two steps: in the first step we study the link between economic and structural variables and VA; in the second step we study the possible change of the coefficients and statistical significance of predictors with the inclusion of the second set of macro variables, educational-social-network (NES), defined as schooling, knowledge, associations, and ultimately, human resources. The functional equations of the first and second step are:

1. $VA = f(Ec_{it})$ *first step*
2. $VA = f(Ec_{it}, NES_{it})$ *second step*

Where:

VA represents the dynamics of value added in the period 2005-2009

Ec represents the vector of economic and structural variables characterizing the Basilicata farm

NES represents the vector of network-educational-social (NES) dummy variables expressing the degree of opening of the farms to change and the external inputs.

First step

The equation of the first step appears in the simple following form:

$$\ln VA_{it} = \gamma_i + \beta_1(Inv)_{it} + \beta_2(Occ)_{it} + \beta_3(Exp)_{it} + \\ + \beta_4(R\&S)_{it} + \varepsilon_{it} \quad [01]$$

and the final equation of the second step is presented in the following log-functional form:

where:

- $i = 1 \ldots 120$ indicates the 120 farms selected by stratified random technique before and then depending on the response to the survey;
- $t = 2005 \ldots 2009$;
- γ is the constant;

- β represents the estimated coefficients of the first step economic and structural variables (Investment, Employment number, Percentage of exports, Percentage R & D) and of the network-educational-social (NES) dummy variables (DSchooling[1], DschoolingH, DTraining, DAssociation, DExpert_ specialist, DExpert_generic, DSatisfaction, DNetwork);
- ε is error term.

$$\ln VA_{it} = \gamma_i + \beta_1(Inv)_{it} + \beta_2(Emp)_{it} + \beta_3(Exp)_{it} + \beta_4(R\&S)_{it} + \beta_5(DSchool)_{it} + \beta_6(DSchoolH)_{it} + \beta_7(DTrain)_{it} + \beta_8(DAss)_{it} + \beta_9(DExpert\_spec)_{it} + \beta_{10}(DExpert\_gen)_{it} + \beta_{11}(DSatisf)_{it} + \beta_{12}(DNet)_{it} + \varepsilon_{it} \quad [02]$$

6.2. Results

The results obtained by the first model show a high significance of the economic variables, in line with expectations at theoretical and contextual levels. The second step of the model is better specified and there is no heteroskedasticity. Overall, economic variables still have a high statistical significance; the Export variable, in particular, has a strong correlation with the VA. Regarding the NES dummy, they are an important, significant, part the DSatisfaction variable, that might not be significant maybe because of the weakness of the firms that adopt the system for collecting customer satisfaction in the primary sector. The Dschooling variable, significant at 10% (0.094), would result an increase of 1.6% of VA while DschoolingH, significant at 5% (0.050) would lead to an increase of 9% of VA. The Expert_Special dummy (p-value = 0.000), however, would change in the incremental flow of VA in an amount equal to 10.6%. It is necessary to clarify that the present work represents the second step of a study that began two years ago (Contò et al. 2011); this last one uses a mail survey for farms in a Basilicata cluster (the district of Metapontum agro-food district of quality).

Such an investigation was in fact done by expanding the dataset to firms registered at the Confagricoltura; then the results of the survey were used to develop an econometric model. This work may still be considered a work in progress for some of the gaps (treated as missing values) as a result of the incompleteness of the questionnaires and the inconsistency of some data (perhaps because of the complexity of the questionnaire developed over 5 years), due to the not high schooling of their responders. For these reasons, the functional relationship it has ongoing changes and additions that will provide a better definition of the same model and better model specification.

7. Conclusions

The results show, as expected, that the increase of the formation and the degree of openness of the network in terms of human resources and knowledge, associations and cooperatives, corresponds to increased benefits for the farmers and their firms in terms of added value.

Being part of a network, a district or professional network, members of a trade association or a service center, and having a high education and permanent training too, is mandatory to follow the trends and new frontiers of development locally and internationally, may be significant elements for the farmer so that they can be the key to success for the leap of a sector in crisis as the primary.

To improve the competitiveness of European agriculture, therefore, not only businesses are needed but also adequate structured entrepreneurs that are able to organize and manage. The effort of sectorial policies in the coming years should be to gradually shift the focus away from productive structures of stakeholders and status of enterprise to the status of farmer and to the results achieved by the entrepreneur. In this way, not only would it have reaffirmed the centrality of the entrepreneur as a pivot of agricultural development, but the human factor has an economic value to be capitalized thanks to public funds too. In fact, European young farmers, despite the sector's structural and economic difficulties, have shown they have the skills to build a European model of diversified, competitive, innovative, multifunctional and sustainable agriculture. To operate in an evolving market, the source of many opportunities but also new risks, we need tools such as training, counseling, community life and be a member of a network.

The farmers may act as engines for economic development when they are trained on the basis of the needs and requirements related to innovation and research, and they are assisted through new models of organization of agricultural services. These inputs are a useful tool for development strategies to support different levels of local governance and be able to define new models and growth paths of entrepreneurs and enterprises, in line with the development prospects of the sector and implementation RDP 2007 - 2013.

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[1]This dummy associate 1 if the farmer has a graduation, 0 otherwise; DschoolingH associate 1 if the farmer has a degree or two years' professional training, 0 otherwise.

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THE DEVELOPMENT OF INTEGRATED ACCOUNTING IN SMALL AND MEDIUM-SIZED COMPANIES IN THE AGRI- AND FOODSECTOR F THE RUSSIAN FEDERATION

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Abstract: This paper focuses on the regulation of financial accounting in SMEs in the agri- and food sector in Russia. The paper presents the factors which influence the accounting system and the quality of the information it provides. The information and reports that are prepared according to international standards are not comparable with reports prepared by Russian standards. They do not facilitate external users in gathering relevant information on the current financial position. The present usage of different systems for procuring information to satisfy the needs of multiple stakeholder groups takes time, distorts information, and often does not provide a true and fair view on business performance.

One way to overcome this is the use of an integrated accounting system which allows, within the limits of Russian legislation, to provide a broad information base for external reporting. International standards could be used like IAS41 or those applied in the Farm Accountancy Data Network (FADN). The derived data could be used for attraction of investments, presentation of information to all interested users, comparison of results of activities in similar companies, and as a benchmark for the activities of companies in various regions and/or segments. They could be used to compare Russian companies with similar ones in the European Union. This paper describes the benefits and pitfalls which companies potentially experience from implementing an integrated accounting information system for company management and financial reporting purposes in the Russian Federation.

Keywords: accounting, Russian agri-food sector, IFRS, FADN financial report

The accounting process in Russian SMEs

The agri-and food sector of the Russian Federation (RF) is dominated by SMEs. Only companies that operate effectively are able to survive, compete and produce in the long run. Russian agro-holdings survive nowadays only with the help of subsidies. There is no strong competition between them. Also, no effective use of the land is made. The SMEs can solve these problems only if they are able to use the land and assets more effectively, produce on a larger scale and quickly operate in the market. It is the aim of reforms in the Russian Federation to improve family businesses in the agri-food sector. But these reforms have failed one by one, and have not produced the expected outcomes. The problem is that it is very hard to understand how and where the problems originate. One barrier lies in the deficiencies of the present accounting rules and systems which are applied.

The Russian Federation aims to achieve accession to the World Trade Organization. An important obstacle to this is the poor measurement of the effectiveness of foreign investments in Russian companies. A second problem is vested in the fact that nobody is able to compare SME-companies in the RF with those in the EU or other regions, and understand what causes the differences in effectiveness.

Russian SME-companies have land as property. Foreign companies could invest in companies and/or production. They could invest by means of partnerships with or buy-outs of Russian companies. But when these have to provide a balance sheet and income statement the information is uncertain and not comparable. The employment of specialists that can make the information comparable leads to additional costs. Even if companies wish to provide information according to the International Financial Reporting Standards (IFRS) which are applied in the EU, it costs a lot of effort and money, since the locally accepted accounting principles are very different from the European standards. In such a situation investors lose control over the costs and benefits of a company. It accelerates business risk which is experienced in extreme quantities.

A first step to solving information problems is through data collection. The source of these data is the accounting

information system. An important problem in Russian accounting regulation is that it allows companies to avoid publishing financial reports, except for tax purposes. The legal system was designed in this way to give SMEs more opportunity to create their own individual accounting system. Another reason was that the official accounting system is very complicated for SMEs and raises their costs and increases the risks of mistakes in financial reports. The lack of financial and statistical reporting of data (or availability at a low level) and the existence of tax accounting does not stimulate solid information provision to multiple stakeholders: to owners, workers, investors and the government.

To improve this situation, research will be carried out that enables improved financial reporting by incorporating international accounting principles and requirements into the Russian accounting methodology. The quality of reporting should be raised and broadened, to meet the needs of financial as well as tax stakeholder groups. One problem to be overcome is that tax accounting and financial accounting use different standards and rules. Financial accounting uses generally accepted accounting principles [gaaps] -especially on an accrual basis, while tax accounting uses cash as a basis. The lack of clear and consistent rules has created the possibility of acting opportunistically. Four ways to deal with accounting information – especially with respect to taxes- have developed in practice in the RF:

- Use the granted freedom to provide no financial information at all;
- Simplify accounting to a low level – this hardly meets international standards and the information which remains cannot be used for decision making;
- Provide accounting information only partially (for instance cash accounts, credit accounts, liabilities);
- Apply double accounting standards: one for internal purposes and another for external purposes.

In all of these cases we can see that the quality of accounting is low, and that the accounting system does not provide information to support decision making and managerial control. In the first case the company has no accounting system at all, or applies its own rules. The accounting system mainly serves internal purposes. In second and third cases the system cannot provide information for financial decision making, because it is built to a large extent on rules for tax accounting. To avoid the costs of double information, the financial report is often just a copy of the tax report. In this case the company lacks data for decision-making and ranking investment proposals. As in the first strategy, instruments are used to reduce the taxation of company income. This opportunity exists because Russian accounting law is rule-based, and not concept-based: companies will not show the real economic result of transactions, but make statements which are more convenient to them and lower the tax burdens to the company.

The topic of providing high-quality accounting information needs to be discussed, because the absence of it creates difficulties for the government in supporting companies and understanding the economic situation of SMEs in the agro-food sector. The problem to be addressed is how to create an integrated, effective accounting system, that provides data for multiple purposes: taxation, decision making and company control.

Possible methodologies for integrated accounting

According to *Tidstrom* (2010), the information to be provided should address economic, social as well as financial issues in an integrated manner (IFAC conference in Malaysia, November 2010; minutes, speech of president of IFAC, Goran Tidstrom). This can be accomplished in two ways:

1. by preparing a new methodology for integrated accounting and reporting;
2. by widening the data set for one that underpins the present accounting systems.

The accounting information system will have to be based on Russian accounting rules, but in such way that it will be possible to provide the information in accordance with GAAP, FADN and/or IFRS. The first option seems to be preferable, because it uses the same registers as already are available, and prepares data for multiple purposes. The methodology could be handed over to accounting software developers and large agri- and food holdings, which are able to invest in it. Also, this option can be used partially in SMEs to collect information in concordance with international rules in certain activities. The second option is more suitable for individual use. It can be used by SMEs, because the SMEs apply Russian rules in accounting information; results could be evaluated periodically with international standards (FADN or IFRS).

The plan of carrying out research to develop a new integrated accounting information system follows a “step down” approach. First the focus is on the development of a methodology for integrated accounting and reporting, and this, in turn, is gradually applied to SMEs. So the main question of the research is how the accounting methodology should be constructed to be able to provide information for multiple purposes, using international accounting rules, in one single system.

The problem to be solved

The present state of Russian financial accounting is that the accounting rules are neither providing companies nor stakeholders with relevant and high-quality information. This causes the following additional problems:

1. Difference of International Finance Reporting Standards (IFRS) and Russian Financial Reporting Standards (RFRS), and of IFRS accounting rules and the principles underlying FADN.

As already stated, Russian SMEs have the opportunity to avoid publishing accounting information, although information for benchmarking is needed to be able to understand business problems and to compare companies internationally. Russian SMEs have no opportunity or are not motivated to collect and provide information systematically and continuously. In providing accounting information the company pays more attention to reporting by rules and not to supporting the decision making process. Russian accounting is rule-based. In general, rule-based accounting systems do not provide high quality and relevant information for decision making, because transactions are reflected in accounting reports according to their legal content, but not by economic substance. It can be easily proven by regulations (Letters) of the Ministry of Finance and the Ministry of Taxation that an obligation exists to disclose a transaction in a certain way in the accounts. Moreover, from year to year transactions can be stated differently, although they have the same economic substance.

2. Russian added value taxation has many gaps. The value added tax is computed on the documents (invoices), but is not included in the accounting information. In this case a rule-based accounting system is a disadvantage. The reason for this is that companies often use accounting data to avoid taxation and mask operations. This distorts the content of financial reports and thus does not reveal reliable financial information.
3. Low knowledge of IFRS and accounting standards by Russian accountants.
4. Ecological information is not stored and provided. Data on the removal of side-products like manure is not collected and, as previously stated, no report for environmental purposes can be composed using accounting information.
5. Russian Financial Reporting Standards (RFRS) represent a mix of managerial and financial accounting in one system. The concept of fair value is absent. This causes yet another main problem for SMEs: the losses are hidden in assets and will only be revealed if assets are sold. Losses can therefore be hidden for a long time and cause even bigger problems in the future.
6. Standardization of accounting (such as IAS41) in the agri- food sector is absent. Another problem lies in the fact that it cannot be collected systematically from small firms. Scientific agricultural economic research fails, because non-comparable data are presented. Research that can support public decisions in whether to participate in the WTO (costs and benefits) as well as the regulation of food markets is highly desired.

All these problems inform the capability of the accounting information system to provide relevant information. Integrated accounting can be helpful for companies that wish to get more than they already have out of their accounting information, and wish to make managerial and investment decisions based on it. Russian and regional governments would also like to receive information for making financial and regulation decisions with respect to family farms and SMEs in the agri- and food sector, but at present this is virtually impossible.

Scientific significance of integrated accounting

Accounting systems were developed in the past to show the economic result of companies. Accounting information systems should store and provide precise, objective, timely and understandable business information (*Merchant,* 1998). The present method of disclosing financial accounting information is mainly output (profit)-based (*Bremmers,* 2001). It has traditional, classical economic theory as a basis. Classical economic market conditions include the availability of homogeneous products, the absence of influence on prices of individual firms and the existence of many suppliers and consumers. Performance-measurement instruments are therefore output-oriented and profit-related (*Gerlowski,* 1996). Under classical economic circumstances, even technological differences between companies are anomalies (*Bremmers,* 2004). Business efforts are primarily concerned with the adjustment and control of production levels and costs. A definition of a business strategy is not necessary, since individual companies have no economic power. The focus is on ex post profit and output measurement.

Profit measurement in a classical way (profit meaning the increase in assets to liabilities in a past period has major efficiencies (see among others *Kaplan & Atkinson* 1998, *Morse & Zimmerman,* 1997). It is a retrospective activity. So, only past events are included in profit figures. It lacks the inclusion of the *risk which is taken by a business* as a significant part of business evaluation (cf *Hardaker & Huirne,* 1997). However, risk assessment has gained in importance because of a change in consumer perceptions due to food crises like BSE, swine fever and foot and mouth disease. Profit measurement is normally based on accounting data. Accounting data, like the valuation of assets on a balance sheet, are easily influenced (see *Helfert,* 1994). The precision of profit measurement is questioned when it comes to the costing of specific products. As business activities become more and more complex and differentiated, overhead costs take a larger part of total business costs (*Drury,* 1992). It should be clear that profit as a sole performance criterion and base for decision making lacks managerial significance (see *Noori & Radford,* 1995).

After the second world war, countries started to develop their own accounting systems, but experienced problems with benchmarking. International capital movements strengthened the quest for harmonisation of accounting rules. Companies perceived that qualitative reporting information plays an important role in decision-making (*Martin* 1971)

and efforts were put into improving it. Countries had different views on how a report should be composed. A study in 1993 showed that relevant decision-making of annual reporting still mainly depends on retrospective accounting information (*Alford et al.,* 1993). Harmonisation of reporting was also heavily desired to reduce transaction costs for users of information. Later, when studies on the quality of accounting practices were made, it was discovered that the quality of accounting information affects the cost of capital of a firm (*Lambert et al.,* 2005). However, harmonization of accounting reporting standards in the Russian Federation shows big gaps in comparison with international benchmarks in using IFRS for financial purposes (*Dukov,* 2007; *Starovoitova,* 2007; *Savin,* 2008; *Shihatov,* 2011; *Belskih,* 2011) and managerial aims (*Kazora* 200; *Slobodnyak,* 2011). Academics in the Russian Federation are reluctant to advise the use of IFRS because the standard is rather young and should be tried out in practice in European countries (*Serova,* 2008). But well-known international academics that are influencing accounting reforms in Russia are entirely supportive of adopting IFRS for SMEs (*Rozhnov et al.,* 2010), to boost competitiveness by means of using a high-quality information basis for reporting. In practice, many companies in Germany facing the choice of adopting US GAAP or IFRS, implemented IFRS rather that US GAAP (*Van der Meulen et al.,* 2005). We need to take in account that Russia in the long run will be oriented on European capital markets as the nearest ones, and thus IFRS is preferable. The accounting standard also influences the quality of the earnings forecast positively, which is highly needed for investors (*Hope,* 2002).

Adopting IFRS does not provide a solution for all the problems of providing qualitative and comparable information. The reason for this is that IFRS in Russia is more investment-oriented. Adopting it will only be done if the goals of attracting international capital can be achieved without causing a shift in accounting education and theory, as happened in Poland (*Dobija and Klimczak,* 2008). It can be done only if individuals support it or for reasons of expanding international cooperation.

The benefit of using IFRS is that it can provide better information for benchmarking (cf *Ding et al.,* 2007). But here we need to be aware that the adoption of IFRS is not the only key factor of success to qualitative accounting information. Legal enforcement systems, competition rules, market access conditions, and the effectiveness of the legal system should also be taken into account (Jeanjean and *Stolowy,* 2008).

The idea of using FADN in post-Soviet countries firstly appeared in the Ukraine (*Gubeny,* 2010). In Russia it is hard to find papers that include any reference to FADN. The only papers that are available are translations of international researchers. So as a conclusion we can say that FADN does not exist in Russia and is not known. Most interesting is that FADN and IFRS are broadly structured in the same way. IFRS is financially oriented while FADN stresses managerial decision making. This creates opportunities for further integration.

A scientific framework for integrated accounting information for Russian SMEs in the food sector is lacking. The scientific challenge for the future of our research is to provide such a framework and use it to design a practical accounting instrument. The first understanding of integrated accounting was founded on the problem of separating tax and finance accounting. Scientists that worked on this problem provided a basis and methods of integrated accounting that can be effectively used. In this respect, Russian scientists can be divided into three groups:

1. The first group aims to simplify the accounting processes in SMEs (*Novodvorskyi,* 2003; *Kojinov et al.,* 2001-2003). For these scientists accounting should solve only operational problems such as the protection of property rights, the effective use of resources, calculation of financial results and tax reporting. Strategic business problems are not addressed.
2. The second group proposes that the government should change the rule system for SMEs, so they can use a simple accounting system for taxation and reporting to the government. The proposal is inconsistent, because taxation is based on a cash method of recognition of incomes, while financial accounting is based on an accrual base for accounting (*Endovichkiy* 2004).
3. The third group of scientists insists on the development of new methods of preparing information reports. The main requirements are that they should be easy to use and understandable. The focus should be on accounting of areas that are different for tax and financial accounting purposes (*Murzina,* 2005), or by integrating accounting systems by means of additional charts (mirrors) (*Zayceva,* 2004; *Burykin,* 2008). A number of Russian scientists support this opinion because from their point of view the existence of separate accounting methodologies side by side does not respect the main purposes of accounting (*Bakaev,* 2004). Another reason of integrating systems of accounting is vested in the fact that tax accounting [according to present rules] is based on the *cash result* of the companies. The use of the IFRS system can facilitate integration (*Burykin,* 2009). Information can be made comparable to company data in other countries. Finally, preparing a methodology for the use of integrated information can support managerial decision making. Adopting an integrated accounting system can bring about high quality cooperation and induce investments in SMEs from international sources.

Existence of methods for integrated accounting

The basic accounting methods that were provided by Russian scientists, as indicated earlier, can help to develop integrated accounting and be used in ways to collect data for different needs and accountancy policies. These facilitating instruments for integration are:

- minimizing the differences in financial accounting policy. This implies the use of the same principles, approaches,

and accounts that are already available (the same depreciation method, inventory valuation methods etc.).
- calculation of deviations and temporary differences (as in IAS 12). This method is most likely to reflect the differences on the off-balance accounts.
- adding additional prerequisites to the documents. In this case companies develop a new flow of documentation, which contains information for different purposes.
- add on-balance and off-balance accounts for separating the losses, profits and costs by different accounting systems. This method proposes to add more quantitative information that splits up the data into separate information carriers. They provide detailed information, and counts-mirrors prepare information in a specific way (the debits have information based on rules of one accounting system and the credits on another).

Conclusions and suggestions for future research

In this paper, we described the challenges that should be overcome to reform accounting practices so that integrated reporting can be performed, not only according to Russian accounting rules but also IFRS and FADN. The IFRS and FADN appear to be similar accounting systems, so the possibility occurs to develop a system that can provide information for financial as well as managerial accounting.

Our main future aim is integrate the two methodologies of accounting:

(1) provide ways to adopt IFRS for stakeholder investments and evaluating financing decisions;
(2) and provide ways to collect data with the FADN-methodology for managerial decisions.

Realization of an integrated accounting information system provides companies with new opportunities, and gives them competitive advantages as sound managerial and financial decisions can be made. This is especially crucial at present, when competition in agricultural and food markets is fierce.

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REGULATORY CHALLENGES OF INNOVATION IN FOOD AND AGRICULTURE
MARKET AUTHORIZATION REQUIREMENTS FOR NEW FOODS

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Abstract: Regulatory authorities face the challenge to strike a fair balance between the interests of consumers to ensure the safety of innovative foods and agricultural products and the interest of innovative businesses. Worldwide prior authorization schemes are applied. This contribution explores characteristics, pros and cons of such schemes. It identifies concerns but also best practices that may contribute to improving food safety without unduly hampering innovation.

Keywords: food law, novel food, pre-market approvals, risk assessment, WTO, Codex, food safety

Introduction

Regulatory authorities around the globe face challenges of keeping pace with innovations in the food and agricultural sectors. Without any doubt the most challenging innovations – and on those this contribution focuses – concern products not formerly known in the jurisdiction at issue.

In the 1950s and 1960s chemistry was a frontier science providing agriculture with herbicides and pesticides and food processing with synthetic additives. Later, gene technology developed crops and foods that had hitherto been unknown. Currently, innovations in food production are expected from nanotechnology and animal cloning.

New products in this sense, however, do not only come from laboratories. New foods may also originate from discoveries in other geographical areas. Products that are new to a region but have a history elsewhere are often referred to as 'exotic'.

This wide variety of new foods presents authorities with challenges. What is their responsibility in this respect? How do they have to react? Can best practices be derived from international experience?

This article addresses these questions from the angle of legal scholarship. We apply a comparative approach gaining insights from different jurisdictions around the world. Empirics will be derived from legal-economic studies, indicating concerns experienced in practice. From this combined perspective, possible regulatory strategies will be proposed.

Core issue in the regulatory approaches to innovations in food and agriculture are prior authorization schemes requiring a proof of safety before a product belonging to a certain category of products can be placed on the market. Similar approaches are found in the areas of medicines, veterinary drugs and pesticides. The analysis in this contribution, however, is limited to foods and agricultural products intended for human consumption.

This article addresses the following questions. How have prior authorization schemes developed? What are the critical issues? To which concerns have authorization schemes given rise? Which best practices have emerged to deal with these concerns? What can regulators do to face the challenge from product innovation in food and agriculture?

The article is structured as follows: Section II introduces the international meta-framework with which national regulatory systems should comply; Section III discusses schemes that have developed in the EU and US; Section IV describes an example of pre-market approval schemes – the EU procedure for novel foods – in more detail; Section V lays out some concerns regarding pre-market authorization requirements; Section VI discusses best practices and concludes the argument.

Meta framework

International food law

If national regulatory systems (including regional systems) want to fit into the international community, they need to comply with requirements of international law. In the international arena a framework of requirements has developed that applies (not to the behaviour of people and businesses, but) to the national legal systems, and can thus be considered a meta-framework (*Meulen van der* 2010).

At the global level different players contribute to this meta-framework for food and agriculture. The United

Nations (UN) lays emphasis on human rights. The Food and Agricultural Organization (FAO) and the World Health Organization (WHO) have the lead in the core elements of standard setting: risk assessment and risk management. The World Trade Organization (WTO) plays a major role in application of food standards in trade and dispute resolution. The WHO operates risk communication structures, seminal in incident management. For our analysis, the food standard developed by FAO/WHO and trade agreements concluded within the WTO are relevant.

International standard setting

Risk assessment

Risk assessment for international standard setting is undertaken in three main joint FAO and WHO panels: Joint FAO/WHO Expert Committee on Food Additives (JECFA), Joint FAO/WHO Meetings on Pesticide Residues (JMPR) and Joint FAO/WHO Meetings on Microbiological Risk Assessment (JEMRA). They advise on maximum limits for food additives, pesticide residues, microbes and on other food safety issues.

Risk management: Codex Alimentarius Commission

In 1963 the FAO and WHO established the Codex Alimentarius Commission (CAC), consisting of specialized committees, hosted by member states all over the world. Some 175 countries participate in their work. Food standards are established through an elaborate procedure of international negotiations (FAO/WHO 2006). All standards together are called '*Codex Alimentarius*' (Latin for 'food code'). Apart from standards, *Codex* also includes advisory provisions called codes of practice or guidelines, mainly addressing food businesses. At present, *Codex* comprises more than 200 standards, close to 50 food hygiene and technological codes of practice, some 60 guidelines, over 1,000 food additives and contaminants evaluations and over 3,200 maximum residue limits for pesticides and veterinary drugs (FAO/WHO 2002; *Knudsen et al.* 2008; *Masson-Matthee* 2007; FAO/WHO 2006).

Codex standards do not as such have legal effect on people and businesses. To acquire such effect, they need to be implemented in national legislation.

Trade and dispute settlement

The WTO endeavours to liberalize international trade. It is a system based on negotiations. When countries face barriers to trade and want them lowered, the WTO is a platform for negotiating the opening of national markets and removing as many obstacles to trade as possible without undesirable effects. The core of the WTO system are the WTO Agreements, providing rules for international trade. The main agreement concerning trade in goods concluded within the WTO is the General Agreement on Tariffs and Trade (GATT). In some circumstances, however, WTO rules support maintaining trade barriers – to protect higher values. Article XX(b) of GATT recognizes that exceptions to free trade can be necessary to protect human, animal or plant life or health.

The WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement)[1] aims to ensure that countries only apply measures to protect human and animal health (sanitary measures) and plant health (phytosanitary measures) based on the assessment of risk, or -– in other words – based on science. However, if the measures are in conformity with international standards, no scientific proof of necessity is required. These measures are by definition considered necessary. For food, these international standards are in the *Codex Alimentarius*. WTO members who follow *Codex* standards need not prove the necessity of their SPS measures.

WTO agreements bind WTO member states. The Dispute Settlement Understanding provides a procedure to resolve conflicts. If a party so requires, the Dispute Settlement Body forms a panel to deal with the issue. Panel decisions can be appealed to the Appellate Body. The WTO cannot enforce decisions taken in this procedure, but it can allow the winning party to implement economic sanctions if the party found at fault does not comply. These sanctions are usually additional import levies on goods coming from the state found at fault.

Developments

United States

Before the 20th century, new foods and crops were not seen as a matter of concern for authorities. One of the first pre-market approval schemes was introduced in 1958 in the United States. Concerns about the application of chemicals in food processing led to the introduction of an approval requirement for food additives (Table 1). Products within the definition of 'additive' need to be authorized or to enjoy GRAS status. Failing this, foods containing them are considered adulterated.

This concept of food additive is much wider than the concept of food additive in the *Codex Alimentarius*[2] (and in the EU) in that it is not limited to substances with a *technological function*. A food additive in this wide sense of the word that has not been on the US market before 1958 has to undergo safety assessment, except when it is 'Generally Recognized As Safe' (GRAS). In other words, when within

[1]The SPS Agreement can be found at: http://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm.
[2]CODEX STAN 192-1995.

the scientific community consensus has been reached on the safety of a certain product (category), it no longer needs to be assessed by the authorities.[3] Separate authorization requirements apply to colour additives and dietary supplements.

Table 1. Section 201(s) FFDCA [21 USC 321].

The term "food additive" means any substance the intended use of which results or may reasonably be expected to result, directly or indirectly, in its becoming a component or otherwise affecting the characteristics of any food (including any substance intended for use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding food; and including any source of radiation intended for any such use), if such substance is not generally recognized, among experts qualified by scientific training and experience to evaluate its safety, as having been adequately shown through scientific procedures (or, in the case of a substance used in food prior to January 1, 1958, through either scientific procedures or experience based on common use in food) to be safe under the conditions of its intended use.

European Union

Back in 1958 when the USA introduced its scheme for food additives, the European Economic Community (now the European Union) was only just starting its activities. One of the earliest examples of harmonisation of national laws can be found in legislation on colorants. The directive concerning the colouring matters authorized for use in foodstuffs intended for human consumption set out to harmonise Member States' legislation by establishing a single list of colouring matters the use of which is authorized for colouring foodstuffs and laying down criteria of purity which those colouring matters must satisfy.[4] As a result, one of the first positive lists in the EU was created. The list is a part of the law (in this case an annex to the directive). To include later a product in the list (or delete it from the list), the law must be changed by the applicable procedure.

While the details differ greatly, positive lists or similar market authorization requirements exist in EU food law, as well as in Member States' food law. Examples at EU level include food additives (including sweeteners, colourants, etc.)[5] flavourings,[6] extraction solvents,[7] infant formulae and follow-on formulae,[8] foodstuffs intended for particular nutritional uses,[9] food supplements,[10] genetically modified (GM) food and feed,[11] food contact materials,[12] nutrition and health claims made on foods,[13] and novel foods.[14]

Some Lists are More Positive than others

From the above follows that case-by-case risk assessments preceding the placing on the market of new products is a common feature in regulatory responses to innovations in food and agriculture in many parts of the world and – to a certain extent – also at the global level of the *Codex Alimentarius*. Within the world of positive lists, however, we find many different flavours. The most important differences are discussed below.

Object of authorization

Different categories of foods are submitted to premarket approval. Some products are subject to premarket approval based on certain *processes* that have been applied to them. An example of such a procedure is the regulation on GM foods in the EU. The pre-market approval responds to consumers' concerns to ensure the safety of food products which have been produced with help of modern biotechnology. Another category of pre-market approvals refers to food or food ingredients new to the market and which will be used for a certain *purpose*, e.g. food additives or processing aids. The Regulation on novel foods in the EU provides an example of a regulatory scheme for foods that are new because they have no history of safe use prior to a single cut-off date (15 May 1997).[15]

Subject of authorization

To whom does the authorization grant rights? Generally speaking, authorization schemes come in two different forms. Some schemes are *specific* in that they address the applicant (applicant-linked). Others are *generic* in that they address the product. In a generic scheme, the product is

3 On a voluntary basis, Food and Drug Administration's opinion can be sought.
4 OJ 1962, pp. 2645-2654.
5 Reg. 1333/2008 on food additives, OJ 2008, L 354/16.
6 Reg. 1334/2008 on flavourings, OJ 2008, L 354/34.
7 Dir. 2009/32 on extraction solvents, OJ 2009, L 141/3.
8 Dir. 2006/141 on infant formulae and follow-on formulae, OJ 2006, L 401/1.
9 Dir. 2009/39 on foodstuffs intended for particular nutritional uses, OJ 2009, L 124/21.
10 Dir. 2002/46 on food supplements, OJ 2002, L 183/51.
11 Reg. 1829/2003 on genetically modified food and feed, OJ 2003, L 268/1.
12 Reg. 1935/2004 on materials and articles intended to come into contact with food, OJ 2004, L 338/4.
13 Reg. 1924/2006 on nutrition and health claims made on foods, OJ 2007, L 404/3.
14 Reg. 258/97 concerning novel foods and novel food ingredients, OJ 1997, L 43/1.
15 Regulatory framework based on similar criteria exist also in Australia and New Zealand. To some extent, food additives regulation in the US is also based on a cut-off date.

placed on the (positive) list. All businesses are allowed to bring the authorized product to the market. In a specific scheme, the authorization decision addresses the applicant, authorizing the applicant to bring the product at issue to the market. All others who would want to bring an identical product to the market need an authorization as well (usually through a simplified procedure).

Applicant-linked schemes reward the applicant for the investment made in the safety assessment and in the procedure by granting him an exclusive right. The downside is that repeated procedures are required, even though the outcome of the risk assessment is already known to the authorities (the product is safe and allowed on the market). Generic schemes reward the second to come to the market who benefits from the investment made by the applicant, without having made the effort.

Currently, the EU is experimenting with an in-between form: data protection. If the application is based on proprietary data, these data can be used only to the benefit of the applicant for a certain period. Thus, innovative foods based on considerable product development could be granted a specific authorization to protect the applicant. Only after the data protection period has elapsed, the authorization could become generic. Applicants who would like to enter the market before that time would have to provide their own data. Data protection rewards the investment made in scientific research, not in the approval procedure as such.

Assessment

A decided advantage of a prior authorization procedure on a case-by-case basis is that all the uncertainties that surround food and agricultural innovations can be given a place. In all procedures, be they positive lists or authorizations for specific foods, applicants have an interest to actively contribute to solving problems. In the case of applications for the authorization of a new food additive (positive list), a full technical dossier must be submitted showing that a reasonable technological need exists for the proposed food additive, that it presents no hazard to the health of consumers and does not mislead them (EC 2001). Similar requirements are set for businesses sponsoring a novel food (individual authorization). An application must scrupulously identify the product and present evidence that a product is safe to consumers and – if need be – adequately labelled not to mislead them.[16]

Finally, it has to be mentioned that most prior authorization schemes apply only negative criteria, that is to say they focus on risks and do not take into account benefits. One of the current debates on risk assessment raises the issue if benefits can be accepted to outweigh certain risks such as (potential) allergenic properties (EFSA 2006). In pharmaceutical law, for example, usually it is accepted that a beneficial medicine may have certain side-effects. In foods, side effects are usually not accepted.

GRAS

In the EU system of prior authorization for novel foods no exception exists to the requirement that all foods that were not on the market before the cut-off date must be explicitly approved. There is no possibility to exclude certain categories from this requirement when it has been sufficiently established that the category as such does not pose a relevant risk. If over time science would establish that a certain new type of process does not give rise to safety concerns, in theory each next product made with this process would still have to undergo safety assessment. To put it more simply, in the EU system there is no way out of novelty. The American system may hold a solution to this problem in the concept of 'GRAS'. A food additive that has not been on the US market before 1958 has to undergo safety assessment, *except* when it is 'Generally Recognized As Safe' (GRAS). This is the case when consensus has been reached within the scientific community on the safety of a certain product or category of products. In that case, risk assessment is no longer required by the authorities.

Concerns

Trade barriers

In literature it has been argued that prior authorization schemes hamper innovation. Brookes in his analysis of the economic impact of the novel foods approval procedures on the EU food sector finds that it is fairly common for the costs associated with meeting regulatory requirements to be between € 0.3 million and € 4 million, and that the considerable additional time taken to authorize novel foods in the EU adds an extra € 0.3 million to € 0.75 million per application (Brookes 2007). Further, he concludes that the rate of return of the costs made on these investments would be around 25% if the procedure were to take 6 months. If delayed to 2.5 to 3 years, the rate decreases to 17%-18%, and if it is extended to five years (60 months), it becomes negative as the rate is then 14.6%, which is lower than 15%, the commonly used baseline for determining whether investments take place.

These concerns are supported by the little empirical evidence that is available from the EU. In the period 2003 – 2008 a total of 25 genetically modified foods were approved. Nineteen novel foods were approved and some 30 new additives. It seems that less than one hundred product

[16] Commission Recommendation 97/618/EC concerning the scientific aspects and the presentation of information necessary to support applications for the placing on the market of novel foods and novel food ingredients and the preparation of initial assessment reports under Reg. 258/97, OJ 1997, L 253/1.

innovations in the food sector requiring prior authorization have actually been approved under EU prior authorization schemes. This small quantity is in striking contrast to the total number of innovations. Data for the entire food sector are not available, but for the dairy sector alone *Poppe et al.* identified over 1,400 innovations in the same period (*Poppe et al.* 2009).

Also in the world of exotic foods – these are foods that have a history outside the EU, but, due to a lack of history of use inside the EU, are considered novel – the potential is huge but hardly used. Worldwide, some 7,000 plants are known to be used in the human food supply. About 300 of these are likely to be considered traditional in the EU. Most of the rest would come within the ambit of prior authorization requirements if anyone tried to bring them to the EU market (Knudsen et al. 2008). Thus, with the potential of over 6,000 already existing food sources, only five or six exotic plants or oils derived from such plants have been approved for the EU market under the Novel Foods Regulation.

WTO

From the above follows that, with regard to innovations in food and agriculture, regulatory authorities face the challenge to strike a fair balance between the requirements of safety – that is consumer protection – and the interests of the business sector. The considerable burden that pre-market approvals place on businesses must be scientifically justified and not constitute disguised restrictions on international trade.

According to the WTO SPS Agreement, members have the right to adopt sanitary or phytosanitary measures necessary for the protection of human, animal or plant life or health, provided that such measures are based on scientific principles and not maintained without sufficient scientific evidence (Article 2 SPS). This requirement is further elaborated in Article 5 SPS, which also provides for one exception: Article 5.7 SPS allows to adopt provisional SPS measures in cases where the scientific evidence is not sufficient.[17]

Hence, although the choice of an appropriate level of protection is perceived as a democratic choice of each WTO member, food safety measures must meet rather strict risk assessment requirements to be considered justified barriers to trade.

Pre-market approval schemes are not forbidden under WTO law, provided that certain conditions are met. Article 8 permits procedures aimed at 'checking and ensuring the fulfilment of SPS measures' and undertaken in the context of 'control, inspection, or approval'.[18] Annex C sets out requirements for these procedures. They have to be, i.a., undertaken and completed without undue delay and in no less favourable manner for imported than for like domestic products, the applicant has to be duly informed by the competent authorities about the progress of the application at all stages at the procedure, and any requirements for control, inspection and approval of individual specimens of a product must be limited to what is reasonable and necessary.

Concerning the Novel Foods Regulation, the Panel stated in the *Biotech Products* case that the granting of marketing approval for these foods is conditional, i.a., on a satisfactory demonstration that the product for which approval is sought not present a danger for the consumer. To the extent the Novel Foods Regulation is applied for this purpose, it meets the purpose element of the definition of an 'SPS measure'.[19] In consequence, the pre-market approval procedure for novel foods constitutes a procedure 'to check and ensure the fulfilment of SPS measures' within the meaning of Annex C.[20]

Thus, in the SPS Agreement pre-market authorizations fall within the category of procedures aimed at checking and ensuring the fulfilment of SPS measures. The risk analysis paradigm is applied to individual authorization decisions taken within the framework of the Novel Foods Regulation.[21] However, the main issue that begs the question here is whether the regulatory framework setting out the pre-market approval requirement itself should be based on scientific evidence.

Concerns over the legality of the Novel Foods Regulation in the WTO forum were first raised in 2006 by a few developing countries, including Peru, Ecuador and Colombia, supported by interventions from other South American and African countries. Peru in its communication highlighted that, as a consequence of the implementation of the regulation, exports of dehydrated lucuma meal ('harina de Lúcuma') and yacon had been stopped.[22] According to Peru, the Novel Foods Regulation is therefore an unnecessary and unjustified barrier to international trade because of the very high costs of producing the scientific studies required and a lengthy authorization procedure.[23]

As already mentioned, the main problem of the Novel Foods Regulation is that it makes no distinction between

17 See also WTO Appellate Body Report, Japan – Measures Affecting Agricultural Products, WT/DS76/AB/R, adopted 19 Mar 1999 (Japan – Agricultural Products II) for conditions that have to be met if Art. 5.7 SPS is to be applied.

18 WTO Reports of the Panels, European Communities – Measures Affecting the Approval and Marketing of Biotech Products, WT/DS291/R; WT/DS292/R; WT/DS293/R, adopted 29 Sept. 2006, at para. 7.424.

19 Ibid., at para. 7.427.

20 Ibid., at para. 7.1491.

21 Ibid., at paras 1525-1526.

22 G/SPS/GEN/681 (5 Apr. 2006).

23 G/SPS/GEN/713 (12 July 2006). The trade concerns regarding Reg. 258/97 were raised again in 2011, after the EU institutions failed to agree on the revision of the regulation, which aimed, i.a., at making the procedure for exotic novel foods simpler. See G/SPS/GEN/1087 (7 June 2011).

strictly novel foods, i.e. those that have not been consumed anywhere in the world, and those that are novel only in the EU, e.g. exotic traditional products with a history of safe use outside the EU. Such products are submitted to pre-market authorization procedure in which the applicant has to prove that a product is safe to consumers. These safety considerations refer to a category of products determined solely on the basis of an arbitrary date (May 1997), despite the fact that some of them have been used safely for human consumption for centuries in the country of origin and elsewhere in the world.

Discussion and conclusion

The figures show that a side effect of the authorization requirements is that comparatively few truly innovative foods and crops become available for businesses and consumers. If regulatory authorities want optimally to protect consumers without unduly hampering innovation, they should apply authorization schemes in the least intrusive way possible to mitigate heavy burdens placed on industry.

The safety approach via prior authorization schemes seems to be truly global. The schemes themselves, however, remain national or regional. This means that the same product has to be submitted to multiple risk analysis procedures for the same purpose to acquire access to different markets. Obviously, burdens both on authorities and on businesses would be much reduced if authorities could trust each other's judgement on the safety of products to the extent that they dare rely on them. To the extent risk management authorities can recognise risk assessments performed by (certain) foreign risk assessment bodies, one single risk assessment procedure would provide a key to many markets.

International trade law and international food standards do not provide much guidance on pre-market approvals. Most food safety pre-market approvals do, however, fall under the SPS Agreement, which means that they have to be scientifically justified. Legislatures are thus given a strong incentive to exercise self-restraint in setting up prior authorization schemes. These schemes should only be required when scientific evidence shows that a risk to human, animal or plant life or health exists.

Positive lists instead of individual authorizations should be applied where possible. Similarly, flexible authorization schemes, i.e. generic in principle, granting a specific authorization only in justified cases, would help avoid duplicating work.

Furthermore, pre-market approval schemes should contain mechanisms to keep them up to date with the current progress of science, by providing the option to exclude certain categories of foods which can be 'generally recognized as safe' in light of new scientific evidence. Technologies that were 'new' in 1997 do not necessarily need to raise safety concerns 15 years later. Updating the regulation can also be done through issuing guidance documents explaining which categories of foods fall within the scope of broad legal definitions.

Finally, setting clear deadlines for authorities to complete authorizations procedure is a minimum requirement (still lacking in, e.g., the Novel Foods Regulation) that could greatly increase the efficiency and predictability of the system and decrease the costs of placing new products on the market.

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SEMI-SUBSISTENCE FARMING SITUATION AND POLICY – THE EXAMPLE OF HUNGARY

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Abstract: In Hungary small farms have played very important role since collectivization (1959-61). Up to radical changes small households have received strong support from coops in the field of providing inputs on one side and, marketing their products on the other. The latter was disrupted by radical reforms and small farms started struggling with survival under market conditions. Government took measures to provide a development path for those having a chance to become competitive after five years development. Three calls (2004, 205 and 2006) were released. In Hungary SSF from three regions were more interested in getting the grant as North Great Plain, South Transdanubia and South Great Plain. All three regions are agriculture dominated ones. The policy with the call has reached a very moderate number of SSFs and, on the other side small farms, either because not meeting the criteria of the call or not wanted to take the additional costs of being registered and monitored for such a small amount of support decided not to apply. The paper ends with policy lessons.

Keywords: subsistence farms, semi-subsistence farms, small farms, CEE agriculture

1. Introduction

Different countries use different criteria for subsistence and semi-subsistence farms. Main stream approaches to the topic are connected with criteria such as: farm size, economic size and market participation.

To understand the Hungarian case we have to look at the concept of SF and SSF what Central Statistical Office (CSO) uses for definition. Carrying out a census for obtaining data from agricultural households CSO puts three questions for categorization. First, do you produce agricultural products for self supplying only (subsistence farms, SFs)? Second, do you sell products on the market that your family does not consume (semi-subsistence farms, SSFs)? Third, is your farm is a commercial oriented one (commercial oriented farms, COFs)? According to CSO definition all those households having at least one big animal (cattle, pig, horse etc.) or minimum as many as 25 poultry or minimum field of 1500 square meters for farming can be regarded as agricultural holding. Data on small farms are recorded in details by agricultural census once in a decade while data on small farms are collected by survey based on sampling between two census in order to follow structural changes and development.

The paper draws a picture of small farms' development since the beginning of the sixties of the last century. Existing small farms in the country goes back decades and since collectivization (1959-1961) it has been a characteristic of Hungarian large scale farm system. Following putting into force the new economic mechanism in Hungarian agriculture (1967) a process of integration between small and large farms and especially between small farms and cooperatives has been taken place. It is discussed how these integration brought economic advantages for both small and large farms. However, at the beginning of radical reforms it was a challenge for small farms to adjust the Common Agricultural Policy (CAP) following the country's joining the EU.

Taking ESU as indicator to find out how many SFs and SSFs are existing in the country CSO counts household as SSFs if their size is between ESU 1 < 2 and SFs below ESU 1 while it is a commercial oriented one if ESU is between ESU 2 <6, however in the latter case a small part of produce may also be consumed by the family.

Concerning to support of small farms Ministry of Agriculture and Rural Development (MoARD) defined SSF farms eligible for a call between ESU 2 <5. MoARD fixed the minimum guideline for viable farms as ESU 2, meanwhile for some other EU programs (e.g. in Agroenvironmental Oprerative Program) 5 ESU was set as criteria to become eligible getting support under National Rural Development Plan (*Hegyi J.-Kacz K.-Kettinger A.* (3).

2. Materials and methods

In order to get a picture of small farms' development in the country an analysis will be carried out. The latter makes it possible to understand the development of small farms since early sixties of last century. The social and economic aspects of small farms will be highlighted and their struggling during transition be discussed. An analysis on measures to support small farms after EU eastward enlargement and the outcomes of measures is the essential part of the paper.

2.1. Historical background

In Hungary SFs and SSFs have played very important role for decades. During collectivization (1959-1961) large number of cooperatives was organized and the coop sub-sector of agriculture produced some half of Gross Agricultural Output (GAO). Agricultural policy decided to allot small plots of 0,3-0,1 ha to cooperatives' members for household production (SF, SSF) as good incentive. Household farms produced mainly fruits, vegetables and animal products for the family and partly for the markets. Coop members also could use their labor force and that of family members on household production when no tasks were given in the coops.

To increase efficiency of national economy there was a need to introduce new economic mechanism into practice giving more freedom to enterprises and farms to fix their production structure under their objective function of maximizing profits.

2.2. Developing integration between small farms and cooperatives (1967-1985)

During the years following economic reform in 1967 for agriculture labor and capital intensive production (e.g. fruits, vegetable, pig) has been gradually moved to small scale farming and, branches offering the possibility to take the advantage of economic of scale and needed relatively less capital were kept in large farms (e.g. crop, poultry, beef production to a certain extent). The income disparity between people engaged in agriculture and in the rest of the economy was significant, and the channel of cooperation between coops and household production was used as one to provide additional income for coop members. Coops provided inputs for coop members mostly at costs level, while paid premium price for products produced by coop members' households and marketed by the coops and, other services to households were also offered by the coop. Coop members had to pay for inputs and services only after marketing the products.

In 1972 as many as 1.6 million small scale farms were in Hungary, some half of them belonged to coop members. Most of the second half of them meant farming around the house (kitchen gardens). The market share of small farms has become significant in some branches. E.g. it amounted to 60-80% of outputs of vegetable production, 50-60% of pig production. As far as the income distribution between small scale farming is concerned 36 % went to peasant families, 25% to families with double income sources, 25 % to workers and intellectual people and 14 % to people where pension was the main source of income.

The development of household farming clearly showed producers are really interested in increasing output if, at the end of the day, they will be compensated by getting additional income. Small scale production (mostly coop members' households) had a share in GAO some one third since the seventies up to political reforms. In late eighties of last century more and more coops had severe financial difficulties so coop leaders decided to charge services towards members' households.

2.3. Effect of the economic and agricultural reforms in the late 1980's early 1990's

Hopes dealt with political turn were as follows: (a) part of national debt will be canceled and, (b) Hungary may become EU member until the middle of the 90s of the last century. None of these two expectations have happened. Instead, in compare with data of 1989 there was a decline of 20% in GDP and 30% in GAO in 1993-1994. Standard of living reached the level of that in 1990 was achieved in 1999. At the beginning of 90s politicians had the vision of family farm model as the most desirable one for the country and should be focused by agricultural policy and as part of the policy large farm system started to break up.

Production type coops had to be reorganized and transferred to meet new legal needs. New coops were not obliged to provide members with jobs any more. In early 90s some 1,4 million private agricultural holdings, mostly SFs and SSFs, were counted by CSO and they cultivated more than 50 % of agricultural land. Dual character of Hungarian farm structure occurred similar to some other CEECs, but neither large, nor small farms dominated the sector in Hungary. In the late eighties, as part of the policy of previous years, those coop members and coop employees (1.6 million people) having no land were allotted 0.5-2 ha land as ownership according to their coop shares. Another more than 1 million people got land back as original landowners or their descendants according to four laws passed on compensation (Table 1). The average land area of private agricultural holdings amounted to some 2.3-2.6 ha in early 90s.

After radical reforms COMECON (Council of Mutual Economic Assistance, CMEA) integration was collapsed

Table 1. Land distribution by eligible people due to compensation in Hungary in 1991

Eligible people	Number of people eligible	Number of land parcels	Average size of parcels, ha
Compensation to original landowners	1,040,000	592,000	1.8
Allotted land to those not having land ownership (coop members, and coop employees)	1,600,000	3,000,000	1.7
Total	2,640,000	3,592,000	1.8

Source: Varga Gy. Presentation (2002)

affecting Hungarian food exports substantially. Domestic food consumption went back by 20 %. Small farmers in general have severe difficulties to find markets for their products. Weakening households of coop members was less fast but it also started when coops decided to establish cooperation with members' household on market basis.

During the first decade of transition number of private holdings started declining steadily as farming has not been proved profitable. Number of individual farms amounted to only 958,5 thousands one decade after political turn. Their number increased due to compensation laws passed, but many new landowners at old age leaving in towns and cities or being retired were not interested in farming and decided not to cultivate the land but to lease it out or to sell it if, it was possible. However, over time the land use pattern showed a clear trend of concentration but not the land ownership. Small and medium size private holdings and large corporations (apart from some special cases practically only individuals can own land in Hungary) having not sufficient area for production wanted to rent more and more land.

Changes have affected small farms a great extent, meanwhile they have played an important role as part of the social net. Most of the difficulties of small scale farming can be generated from the quota system introduced, the delay to adjust to market needs and the assimetry in direct payments between farmers in NM states and those in EU 15. Number of private farms has been further decreasing since early nineties, still there were as many as 706,9 thousands in 2005, 73.3% with not more than one ha of UAA (Annex 2), indicating the low level of concentration by ESU in compare with selected EU 15 members.

Most of people loosing their job in rural areas especially due to breaking up coops had no chance to get a job out of agriculture, and the number of employees engaged in agriculture also went back from some 700 thousands at the beginning of 90s to around 120 thousands in 2007. For most of fired people the only way for surviving was to run SSF or at least SF. Among them there have been also ones having off farm job (full time or part time) besides part time farming. As the input costs of farming went up (prices were increased for chemicals, seeds, etc.) and small farms were not able to modernize the farm they had no other choice than giving up farming. Increasing number of people, mostly old pensioners started getting a standard of living below the poverty line. Unemployment level in agriculture dominated rural areas amounts to 30-35% but in some areas it reaches 50-70%. All this happens when UAA amounts to 63 % in Hungary while it is only 43% in EU.

2.4. Socio-economic characteristics of SSFs

In 2000 private holdings amounted to 958 534 and were very much dominated by small farms having small parcel of land. 60.4% of private holdings produced for the family only. Another 31.5% of small farms were regarded as SSFs and only 8% individual farms (75-77000 farms) produced mainly for markets (COFs). Total land area of private holdings accounted a bit above 50% of agricultural land. Besides arable land, grassland and forests areas were the most important types of cultivation of land in 2005. 41.8% of holdings have no arable land at all. They mainly had animals around the house or some grass area, orchard, wine yards mostly in gardens. Another 30% of holdings have no more arable land than 0.5 ha. While less than 1% of private holdings, having arable land above 50 ha, cultivate more than 42% of arable land used by private holdings.

Average age of farmers and workers of private holdings has been increasing. In 2005 ratio of people above 54 years amounted to 52% in 2000 and that of people below 34 years increased and reached 8 % in 2003. Concerning education of farmers not much change took place between 2000 and 2005. In 2005 people with college/university degree had a share of 2%, and 6% of those obtained secondary school certificate. However 80% of farmers had only practical experience and were educated not higher than primary school. In average men were higher educated than women. In 2005 every second primary producer was a pensioner, employees amounted to 42%. Full time farmers had a share of 61% with no significant change to previous years, 38% had full time job other than in agriculture. In two third of holdings there were 2-3 working people and, in 30% of holdings had only one worker.

2.5. Survey on small farms

According to Farm Structure Survey 2007 (FSS 2007) about 7400 agricultural enterprises were engaged in agriculture and nearly 619 thousand private holdings were carrying out agricultural activity not taking into account the noticeable agricultural production in kitchen gardens and holiday home gardens (CSO). Most of SFs (43.8%) and two third of COFs were involved in crop production, while 45.6% of SSFs belonged to mixed type category (Figure 1). 48.2% of crop production and 77.8% of animal husbandry in private farms came from SFs .

Looking at the distribution of individual farms by EU regions SF was the leading on in all regions with very high share (around 60 %) in Central and West Transdanubia and in Central Hungary (Annex 6). In all regions except South Great Plane crop production has the highest share and mixed farms get second place except in Central Hungary Region. In South Great Plane the three types of farming is well balanced (Annex 7).

Between 2003 and 2007 decline of mixed cropping farms was around one third, that was more than 25% in case of other mixed farms. At the same time specialized farms went back less. Within the latter specialist grazing livestock indicates significant share (20.5%), while specialist horticulture and specialist granivores decreased (4.5% and 3.3%). Concerning the distribution of private holdings between different types the dominant ones were specialist granivores (19.2%), mixed crops (17.4%), specialist

permanent crops (16.7%) and mixed livestock holdings (16%) in 2003. In 2007 specialist granivores extended their share to 23%, special grazing livestock increased by 50% and, share of all other types except non-classifiable farms decreased. In 2003 SFs amounted to 79.2% and SSFs 8.9% of total private holdings and these figures in 2007 were 81.4% and 7,5% respectively. Number of total private holdings decreased from 2003 to 2007 more than the decline of SFs and less than that of SSFs (Annex 8 and 9). Especially people at old age living alone decided to quit their semi-subsistence farming. The decline in SSFs exceeded that of total individual farms (Annex 10).

Based on MoARD SFs amounted to some 50% more than that of SSFs, this ratio was around 400% in case of animal husbandry farms, concerning mixed farms SSFs exceeded SFs by two third. Commercial oriented private holdings amounted to 15.5% in 2005, much higher in SFs and less in SSFs (Table 2.)

Table 2. Breakdown of private agricultural holdings by goal of farming, 2005.

Goal of farming	Crop produc	Animal husb	Mixed	Total
	%			
SF	48.15	77.96	38.06	51.46
SSF	29.73	19.18	47.55	33.06
Commerc. oriented	22.12	2.86	14.39	15.48
Total	100.00	100.00	100.00	100.00

Source: MoARD, 2009

2.6. Production orientation of SSF

Value of GAO in private holdings, in average, amounted to HUF 525 thousands in 2000. This figure in holdings with mixed profile was almost double (HUF 914 thousands), while in farms with animal husbandry it accounted to only HUF 260 thousands. The picture was spreading by regions. Farms located in the Great Plane were above the average (especially in the South part of it, while figure of all other crop and mixed farms in all other regions were below the average level. Private farms with animal husbandry in West and South Transdanubia had better figures than the average.

Looking at farms by production goals the average GAO of commercial oriented holdings had a figure of HUF 2196 thousands, however, SSFs produced GAO as high as HUF 738 thousands and this figure in SFs accounted to only HUF 192 thousands. No data available on market share of SSFs. Generally it can be said that SSF sell their products on local producers' markets once a week, mostly on Saturday.

Willingness to cooperate, apart from long term cooperation between small producers within the village or town, especially in case of SSFs and SFs is not very high during the last two decades. Political propaganda against cooperation has been very strong in early nineties and this "brain wash" was rather efficient. Small farms trust themselves rather than in cooperation even if they have to pay a higher transaction costs.

Hungary has 7 EU regions. Three are located in Transdanubia, three in Eastern Hungary and one in Central Hungary. Six regions include three counties each while Pest county and the capital Budapest compose Central Hungary Region. Looking at the geographical location of SFs, SSFs and COFs an interesting phenomena can be observed. The share of COFs within individual holdings is the highest in North and Eastern Hungary (North Hungary, North and South Great Plane) with highest unemployment rate and the latter two are agriculture dominated regions. The two highest shares of SSFs also belong to North and South Great Plane. People loosing their jobs in these regions were more forced to do farming for survival as job opportunities other than in agriculture has been shortage. Most of SSFs applications (83.7%) between 2004-2006 came from Eastern Hungary and South Transdanubia regions. In the other four regions, where unemployment level in relative term has been lower the share of SFs is the highest (50-60%).

2.7. National policy measures for SF and SSF

Major tool to improve farming facilities and to increase outputs of SSFs and SFs was the taxation system. Basically these farms were subject to taxation according to personal income tax rules. Below a certain level of turnover private holdings were not obliged to pay tax. SSFs and SFs are regarded as primary producers if the source of income is from selling the products produced by the SSF and SF himself/herself. Taxation of SSFs and SFs is complex and the limits on turnover and tax change from year to year but the basic philosophy of taxation left the same. A simplified version of taxation of 2007 is the following: For taxation purpose primary producer can choose (a) costs based taxation or (b) fixed tax version. Within costs based one concerning the tax of primary producer can be calculated as follows: 10 percent of total turnover is costs but no receipts for justifications were required or, the producer should use full costs record approach backed by invoices. If the total annual turnover is below HUF 600 thousands than there is no tax obligation. In case of using full costs record approach (if turnover from primary producer's activity does not access HUF 7 million) then 40% of total turnover over justified costs can be recorded as general costs without any receipt. The calculated income from primary producers' activity becomes the part of total tax base and the latter is taxed according to personnel income tax table. In case of those choosing fixed tax system 15% of turnover is regarded as tax base. If the latter comes from animal husbandry activity then tax base is 6% of total turnover. Tax is calculated on personnel income tax table.

If primary producers choose full costs record having turnover between HUF 600000 and HUF 4 million and having no other income they can submit a simplified tax

sheet indicating not having income from primary production if having justified costs (receipts) equal minimum 20 % of the turnover. The tax of total tax base can be decreased by a maximum HUF 100 000 conditionally. If total annual turnover is above HUF 6 Million the tax reduction is equal to the amount above the 20 % of actual turnover after deducting HUF 6 million. No tax preference can be justified if total annual income is above HUF 5,5 million. On the one side, government wanted to have small farms be registered at the tax office, but on the other side to fix tax rules in a way leaving farms interested in future farming and increasing outputs.

According to Law LXXX. 1997 (Tbj) agricultural primary producer has social security. Some exemption about paying social security fee is described in the law. Level of labour tax is the following: according to social minimum wage: 29% goes for social security fee, 7% for health care and 8.5% for pension fund. However, if total amount of turnover from primary production has not exceed HUF 7 million in previous year then 20% of actual turnover is the base and 8.5% of the latter goes to pension fund and 4% to health care fund.

According to VAT tax rules anybody running business subjects to taxation and should be registered at the tax office from January 1, 2010 on.

2.8. Measure to support SSFs' restructuring

Providing EU (70 %) and national support (30%) to SSFs MoARD released three calls for restructuring SSF sub-sector. The calls indicated the details of measures, the goals of support and gives information on how to get a grant. The program was targeted to provide help especially those small farms suffering from lack of capital but want to change farm structure in order to establish a viable one.

Eligible agents are: primary producers, entrepreneurs engaged in agriculture and family farms.

Conditions for eligibility were as follows:

a) to have **min 2 max 5 ESU** in previous year to submitting application from the following activities: cultivation of arable **land between 5 to 10 ha**, or having orchard or vineyards or running greenhouse vegetable production on maximum **0,3 ha** or having sufficient **grassland for 2 to 10 animal units** where 1,4-1,8 animal units per ha can be calculated or, from other agricultural activities.

b) to have at least a certificate of a middle level professional school or having 3 year long professional experience.

c) A business plan should be worked out for 5 years and obligation to increase the farm size by ESU by 50 % in the final year in compare with that in the year prior to submitting application should be taken.

d) taking the commitment of applicants to reach ESU 5 by the end of the fifth year.

E). Application should be submitted on official forms.

3. Results

Holdings had the chance to apply for grant in 2004, 2005 and 2006. Grant covered 5 years with Euro 1000 in each year. Besides normal monitoring there is a check in the third year and, if farmer do not keep the conditions then the support is terminated.

According to the number of applicants it looks like that the calls were not attractive for SSF sub-sector to get a grant in order to establish a viable farming after five years. SSFs from three regions were more interested in getting the grant as North Great Plain with 440 applicants (38.6%), South Transdanubia with 262 applicants (23 %) and South Great Plain having 252 applicants (22,1%). All three regions are agriculture dominated ones but not homogenous. However, altogether in average less than 400 SSFs applied for grant annually. The total number of applicants amounted to 1139 that amounted to some 2-3% of total SSFs (ESU 2< 5). The policy with the call has reached a very moderate number of SSFs and, on the other side small farms, either because not meeting the criteria of the call or not wanted to take the additional costs of being registered and monitored for such a small amount of support decided not to apply.

Much less applications has been submitted during 2004-2006 than expected. So it is an important government policy goal to have more SSFs be supported in period 2007-2013 and after that.

For future policy a detailed analysis of the results of the first three calls should be made and consistency of criteria should be checked and improved for the next call. Surprisingly, number of applications for claiming payments was much less than the number of applications submitted for grants (Annex 12). The budget spent on supporting SSFs under this scheme accounted for less than EURO 2 million in 2005-2009. It amounted to annually EURO 5-600 thousands in the first two years followed by a decline in subsequent years.

4. Discussion

According to poor results of applications to support restructuring SSFs MoARD ordered a study to find explanation of this situation. It was underlined: the report should be based on a survey using sampling of applications. There was a need to figure out the reasons of the low number of applications and, making proposals for changing policy. In addition there was a need for a well prepared coordination and communication with other related professional organizations, lobbying groups during writing the study. It was also a goal, to take the advantage of the program as much as possible by using up all financial resources available, and the revision of the conditions applied in previous call should be given, and proposal should be initiated to extent the circle of eligible farms.

Besides the call for SSFs for restructuring farming there were possibility for SSFs to join other measures as

supporting producers' groups, agro-environmental measures, meeting standards and technical assistance. Concerning above mentioned possibilities SSF have not been interested in organizing or joining producers' groups, and also hesitated to meeting standards and technical assistance. Those joining the agro-environmental measures were not significant. Small farms found that getting Euro 1000 annually for five years is not a big amount and in change farms should register and be ready for checking and keeping contact with tax office was not encouraging.

However, expert say that setting up conditions in a new call more fit to farmers' needs then probably some 15-20 thousand farms could be regarded to be interested in considering taking the advantage of this measure.

Lessons for future policy from Hungarian experience:

a) have a more clear vision on what farm structure the country would like to have in the future;
b) keep in mind that SF and SSF – are not only an economic units but belong to households and are also part of the social net;
c) have a state-of-art of weak results of the first three calls;
d) revise criteria for becoming eligible for the grant;
e) a good promotion on advertising the call should be carried out;
f) a better communication with SFs and SSFs on the goal and benefits of the measure is needed;
g) simplify the administrative burden for applicants as much as possible.

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