Rural Economies and ICT Policies for Rural Development

Benefits of Integrated ICT Systems for Farmers, Advisors and Vertical and Horizontal Chain Partners

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ABSTRACT

In the following there are summarized the benefits of integrated technologies where farmers, advisors, contractors, supply chains, industries and consumers are integrated

Keywords*: Integrated farm- and landmanagement*

The Integrated Concept

The food insecurity situation is effected by global warming, population growth, focus on bio-energy, low technology acceptance, unfavourable policies, sustainability criteria, changing natural risk-situations, subsidies etc. Sustainability-, agriculture-, forestry- and environmental targets belong together and influence each other. Therefore we need **new types of ICT based land management,** covering the protection of land and biodiversity, ensuring a sustainable management based on multipurpose use of land, optimising economical benefits and taking into consideration the land use potential and its carrying capacity. **ICT technologies,** integrating **local and science based expert data, easy to use software** and manageable **precision farming technologies** will be essential to achieve a sustainable bettering. Large and small farms must have access to know-how, equipment and technologies to optimise food/wood production processes to reach nutritional- and/or biomass targets.

We summarize subsequent the benefits of integrated technologies where farmers, advisors, contractors, supply chains, industries and consumers are integrated: GIS gives detailed information on **size and location of fields -** base for calculation and logistics. Farm management tools allow **cultivation planning and control, documentation (also GLOBALGAP), nutrient- and CO^2-balance, cost calculations** and provide information for trust centers or farm advisory services.

Logistic solutions with central and mobile GIS systems allow planning of complete regions and serves **farmers, food-industries and contractors. Meteo-data** allow better decisions. **Business-plans assist cooperation with banks** and **insurance companies.** Machine interfaces allow the set up of **precision or virtual farming** solutions for groups of users, further **statistical analysis** for regions or countries and a possible **upgrade with forest-** or **environmental caretaking** solutions are supported. **Risk management** solutions can help to better defining and measuring farmer's integration into environmental caretaking. We can show solutions and discuss the requirements – technological and organizational - to use these technologies.

The overall concept - "Agroffice" is, to support farmers and/or foresters and their horizontal and vertical chain-partners with new ICT technologies that allow them to work better, at lower costs, to increase benefits and also to lower environmental impact or increase the natures capability to lower natural risks. This means beside detailed know how of farmers and/or their chain partners needs, a detailed know how of the nature and their capabilities as well as an overall organisational structure and concept is necessary, which is either available already or to be set up.

Worldwide, the farmers must be enabled to work for the production of food for 10 billion people after 2050, for sustainable and CO2-neutral bio-energy as well as for environmental caretaking and natural risk management.

The technologies behind is WinGIS, an object-oriented and hybrid raster- (images) and vector- (polygons, lines, symbols, text etc.) GIS, that beside the location and the link of an object to a database with an internal or external database also enables the use of a SDK (Software Development Kit) to link any database with AX-technology to the GIS component as well as develop with tools, customized user-interfaces that allow an integration of time and activity management as well of an expert information system.

Since 2010, in cooperation with Microsoft, their worldwide available Bing maps - also other maps can be used instead or crunched – are linked to the system and allow starting to work in any country worldwide immediately. Also a Google maps interface is available. Further, around 20 applications are supporting agriculture, forestry, environmental caretaking and risk management as well as the integrated chain-partners. Last but not least we also work as a system integrator and link existing other technologies to the system: Samples are weather stations, mobile equipments, RFID technology, GPRS or UMTS communication etc.

User Interface

The key target was to develop a user interface that allows farmers, advisors, even tractor drivers easy to learn/use the interface that has 4 elements: GIS, database, time- and activity management and a down-sizeable expert information.
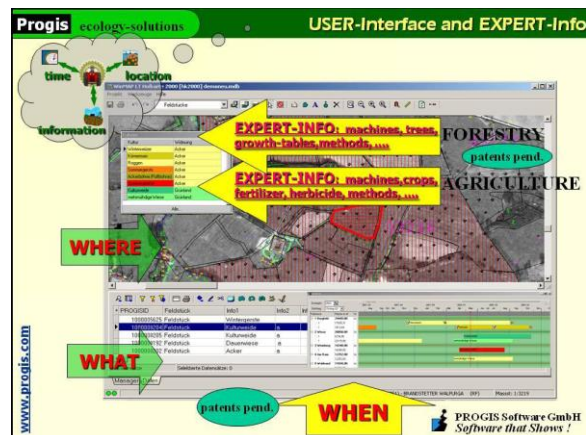
Beneficiaries and Benefits

An integrated model has many beneficiaries. From the Minister who has better organized farmers to the farmers who get better tools for managing their farms or get better support by advisors till to the advisors who are embedded into a powerful tool that is permanently upgraded with data from the science. Traders, the food producing- and processing companies are as well beneficiaries as banks and insurance companies (why should not banks support to run an advisory concept? It would help them to use their rural area branch offices better) or also the producers of machinery or agro-chemicals. Foresters, land managers, utility managers or environment- and risk experts will also benefit from such an intelligent maintained system. Even telecom companies could support them to be able to run their new services also in rural areas – they are needed there.

Benefits In Detail

Not all benefits can be listed but some of them show already the power of an integrated system:

- GIS gives detailed size of the fields as base for exact calculation
- GIS gives exact location of the field for later logistics use
- Farm management allows with underlaying expert data planning and documentation
- Farm management as a tool supports e.g. GLOBALGAP´s documentation needs
- Farm management allows nutrient- and CO_2-balance and is a subsidy tool if needed
- Farm management allows calculations (cost, contribution margin etc.) of fields/farms
- Farm management gives access to traceability (§§) and documents sustainability (§§)
- Farm management and GIS allow the development of modern advisory services
- Logistic and mobile GIS tools allow detailed logistic planning of complete regions
- Logistic and mobile GIS tools serve farmers, food industries and contractors
- Meteorology-data integration allows better decisions – just in times of climate change
- More benefit comes from business for banks or information for insurance companies
- Machine interfaces (ISO- or CAN-BUS) allow integration of precision farming
- Group solutions allow statistical analysis for regions or even countries
- Upgrade with forestry (forest inventory and forest management or forest logistics)
- Environmental caretaking solutions allow even farmers integration into this topic
- Risk management solutions allow farmers integration into risk management tasks
- Banks and insurance integration gives a win-win situation also for farmers
- A trust centre allows the integration of different users of agro-information
- An open space notary´s office will give benefits to ground owners resp. farmers
- ICT will support the fast distribution of new scientific know how; an organized feedback will allow to verify and optimize results over the time!

WinGIS Enabling MS Bing-Geodata to Become A Full Gis

The decentral geodatabase MS BING got coupled with our WinGIS - either alone or with our agriculture-or forestry applications or even with 3rd parties applications developed by Microsoft partners with the help of WinGIS SDK., Bing data become herewith "GIS enabled". The user benefit: Visualising his data over a map but keeping his personal data local, the basemap from Bing decentral. Suddenly the principle of a combination of PC and Internet or bottom up and top down works for GIS.

1. **Introduction**: During the last months PROGIS has developed the technological link to the Microsoft BING maps technology. This development has been taken place in two steps:

2. At first, a technology allowing to **export any WinGIS project** or any project developed within the WinGIS SDK to Bing data to use all benefits that raster or additional vector (e.g. road maps) information of BING provides to users. The result of this export function is an

   HTML document that can be easily embedded into an existing web page.
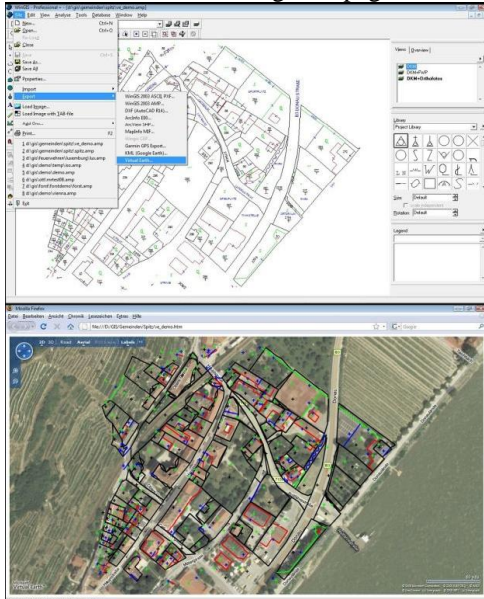
3. The second development was a technology that **BING became the raster layer within WinGIS** or any WinGIS application or in other words, BING data can become part of any WinGIS or WinGIS application project. This innovation means that all PROGIS technology can work in any country of the world where Bing data are available. Depending on the quality of these data, users can start their project immediately without thinking about buying existing raster data (satellite images, aero-images). In the case of older images or images with less resolution, these images will be the background information only. Updated vector data show the actual situation and are further updated with GPS/dGPS data based on recent information.
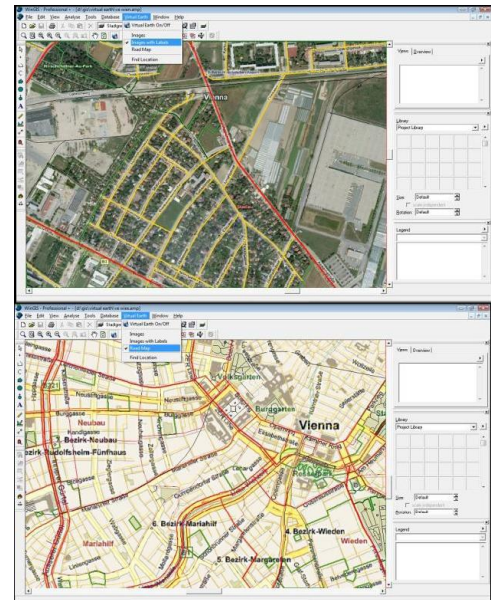

4. To enable mass consumers (business- as well as home-users) to deploy this technology, PROGIS presents a concept of integrating both technologies and preinstalling them on hardware. To enable users to get immediately a benefit, three applications could be developed (these samples show other applications that agro, forest that was mentioned in the 1st part already).

4.1 **Log-book**: The user has a GPS device or a mobile phone with integrated GPS that collects automatically data during a daily trip or within a week or month. Coming back, the GPS data are imported into WinGIS, visualized on BING and a logbook is produced automatically: Mo 1.3. 250km start time .. end time .. Tue 2.3. 147km etc.

Thematic maps – e.g. the daily route or even colored lines displaying the speed at given partial route are displayed.
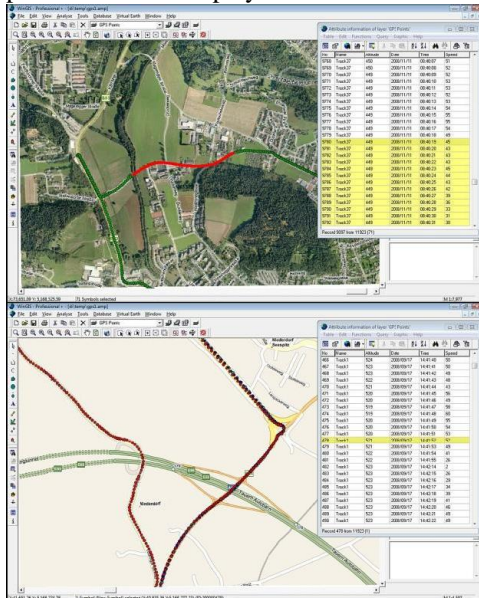
4.2 4.2. **GIS related adressbook**: The user is able to transfer from all of his relatives, friends, customers or suppliers the address-data (country, postcode, city-name) into WinGIS that sets for these data automatically a predefined symbol out of a symbol-database at the right location of the map and links the symbol to the database.
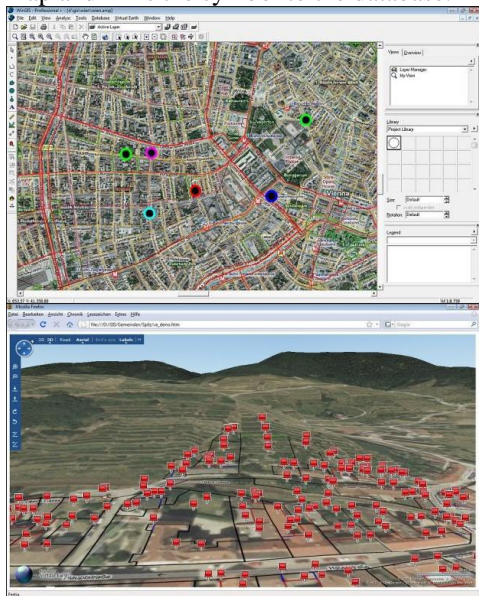
4.3 4.3. **Local thematic maps** that can be used for any map related displaying needs: Within WinGIS on different BING locations a link to a database and/or image or video is set. After an export of WinGIS into BING a

website of the whole project is made available to every user.

The Ict Backbone – A Practiced Integration and Lower Costs

The following cooperation was agreed to offer an integrated solution to countries/regions.

Microsoft (MS) will produce new aero-images for Europe and the US with priority I-III in 30cm resolution with a planned update frequency of 5 years and has offered to PROGIS a possibility to setup a similar system in Africa and other regions worldwide as follows:

To fly the most important agricultural areas in any region (a country or a continent) in predefined 100 x 100 km grids with 50 cm resolution (we need local consortia to define these 100 x 100 km grids). The new Microsoft Vexcel camera (Vexcel was a former Austrian company, had the technology for highest resolution cameras and was bought by Microsoft) allows embedding the camera into a jet and reducing the pricing by 50% compared to competitors. Microsoft is also ready to share the costs 50:50 with others and we can negotiate for support also with donators. This means, that the cost for local governments would be 25% of the normal costs only (100% - 50% because technology advantage and minus 50% because of 50:50 cost sharing with Microsoft). These 25% would amount to e.g. 50 Mio $ that MS is ready to invest by expecting to get the same amount from a local partner or a group of partners with whom also the license rights will be shared. The local group can get exclusivity for 4 years what has to be used to build up a detailed agro-forest-environment-risk map.

Also the Austrian company **ADCON** as producer of weather-stations and soil moisture measuring technology supports this concept. Their offer is to support with low costs a network of e.g. 5.000 weather-stations throughout a continent like Africa (or similar number in other regions) and link them on one side to the Internet and on the other side to the PROGIS WinGIS technologies. In parallel, know how transfer, update, upgrade and service will be delivered within 4 years and ADCON will also support local organizations with training and know how transfer as well as, together with local experts with the setup of local expert systems for agriculture, forestry and environmental caretaking in regards of meteorology. ADCON has worldwide the reputation as THE weather data expert and has additionally beside many others two outstanding networks of weather-stations in Mexico (1000 stations) and Romania (900 stations).

For details of ADCON´s technologies and concepts see: www.adcon.at

In this business model **PROGIS** offers a flat rate for its technology, WinGIS, DokuPlant, ForestOffice, logistics including mobGIS, precision farming tools, Z-GIS-Land consolidation, and environmental- and risk-management tools for a country or a region. The PROGIS site license includes the public use of the a.m. technology within all Ministries and linked governmental organizations of all states of a region (not only agriculture-forestry). The use within private structures stays an independent. During this period PROGIS will also support local organizations with training and know how transfer as well as, together with local experts, the setup of local expert systems for agriculture, forestry and environmental caretaking. All update and upgrade within this period is transferred to the customers. PROGIS technology is installed thousand fold worldwide in different languages and has in the agricultural field with the cooperation with Südzucker (=largest food factory in EU) and the German Machine Cooperatives (200.000 members, 250 offices, 7.2 Mio ha) in Southern Germany on 40.000 km², with 40.000 farmers and more than 100.000 fields and hundreds of mobile equipment linked with mobGIS, the largest business case and best practice sample in use. After the success in Southern Germany now the installation-plan for whole Germany is worked out including use of the images by 250 offices, all mobile equipment and farmers.

Consequences of Integration for Public & Private Structures

One of the outcomes of EC-FP7 project "Future Farm" - PROGIS participated – was showing the need of INTEGRATION, something that PROGIS has been doing for 15 years. Within the whole sector, agriculture–forestry-environment-risk management is a huge integration need that is not available yet because of on one side the admin-sector-structures plus on the other side diverse public and/or private interests and in many cases not streamlined interests. On the other hand we have the nature that is fully integrated and should be managed by us! Nothing happens without being related to something else within nature. We have to be more aware of this and have also to understand that ICT will be the driver of integration as data and based on them the information is necessary and urgently needed for public as well as for private structures. Naturally we can do it separately, doing things in parallel and multiple times with multiple costs and reduced results. The other option would be to work together on an integrative model!

One sample to be mentioned is the EC subsidy payment model where the same information is asked by the government as the farmer would need for his farm management. The farmer must enter data twice, or even more often, because he enters nearly the same data for GLOBALGAP or another certification institute once more, or for a food chain a third time, for a logistics operator including the location a 4th time, and for an environmental body a 5th time as well as for the precision farming contract again (6th time) etc.. It is always the same field. We have one principle law in IT: Enter data only once!

To solve this problem several facts are necessary to be mentioned: We need on one side an **ICT BACKBONE** that is available for all within a chain and must have basic data available like images or LPIS data etc., as well as basics like soil-maps, geological-maps etc. have to be in common as also a meteor- and/or soil sensor network with agro-forest-environment expert models integrated. It can be done by agro-meteorologists only!

Based on such a backbone, private and public structures can easily operate with their own applications and the results can be downloadable for the partners in a **TRUST CENTER** on agreement. Only such a model would allow to integrate private ownership of ground including related data and make them downloadable according legal needs or bilateral agreements. Suddenly it would work if e.g. farmers arrange with buyers the need of documenting the pesticide use to make data downloadable for partners. In a risk case the Minister can also get access.

Beside ICT backbones and trust-centers **STANDARDS FOR DATA EXCHANGE** (PROGIS is part of the EC project Agri-X-change) for the horizontal and vertical sector integration have to be set up. ISO-Bus is too less.

From cooperating with farmers we can learn since Raiffeisen started his concepts: Some elements only can be setup together. Not every farmer will have a silo to store his grain and not every farmer is able to handle his own export etc. Similar facts will be valid for an ICT backbone. The trials of the past, bringing farmers closer to ICT failed during last years. Not because of the farmer`s disability but due to his feeling that the technology does not fit to his needs and only solves one or two of his many problems. This happened also because of non-integration and the trial of big players in the market like tractor producers, agro-chemistry giants, certification bodies, the Ministries etc. to setup their own solutions without thinking on farmer`s needs – NO INTEGRATION happened. A study of Ehud GELB done with experts between 2002 and 2008 showed a percentage rising from 50% to 70-97- 95% in 2008. More and more experts did not believe on

uptake of ICT within agriculture. Why? Because of non-integration and a setup of solutions for everybody within the chain but not for farmers. They refused – they were correct!

Beside this non integration following other facts were not correct settled to arrange the uptake of ICT within agriculture and forestry: The public private antagonism, the top down versus bottom up need, the availability of basic data and the total different structures with huge differences within advisory services, the – wrong – integration of the sales into the advisory process, the farmers private ownership versus the public freely available commons, the farmer and the common understanding that farm- and forest management automatically must be environmental management, the not yet understanding that technologies like precision farming or logistics are equal to significant CO_2 reduction, the wrong GIS developments with top down approach only and last but not least the trial to externalize costs from many groups on the shoulders of the nature, in many case on the farmers and foresters worldwide.