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INFORMATICS DEVELOPMENT IN MODERN AGRICULTURE (PART 1)

Summary

In the range of computerization, the nature of the agricultural sector is specific in comparison with other areas of the economy. To stay up-dated and meet the requirements of the modern, changing world, agriculture sector should introduce the computerization into its practice. ICT can be a huge help with key challenges in agricultural value chain development. Proper use of software improves the efficiency and economics of a farm, by reducing the amount of working passes, selection of appropriate equipment for carrying out the field activities, reducing the consumption of plant protection products or dose reductions of mineral fertilizers. The European Commission whereas the improvement in the sphere of optimal farm management and workflow of products and services in the common market supports two projects in call CIP-ICT-PSP-2013-7, that integrate similar philosophies which wish to significantly improve farm management processes. Both have been implemented since 2014, in cooperation with Polish partners: Industrial Institute of Agricultural Engineering (project AgroIT, Grant agreement No. 621031) and Poznan Supercomputing and Networking Center (Project Foodie, GA no.621074).
Key words: *ICT, AgroIT, FOODIE, farm management, service, cloud platform, sensors, decision support system*

ROZWÓJ INFORMATYKI W NOWOCZESNYM ROLNICTWIE (CZĘŚĆ 1)

Streszczenie

W obszarze informatyzacji charakter rolnictwa jest specyficzny w porównaniu do innych dziedzin gospodarki. Aby nie pozostać przestarzałym i sprostać wymaganiom nowoczesnego, zmieniającego się świata, w rolnictwie należy wprowadzić informatyzację w praktyce. ICT może nieść ogromną pomoc przy kluczowych wyzwaniach w rozwoju rolniczego łańcucha korzyści. Prawidłowe korzystanie z oprogramowania poprawi wydajność i ekonomikę gospodarstw, poprzez zmniejszenie ilości przejazdów roboczych, dobór odpowiedniego sprzętu do prowadzenia zabiegów w polu, zmniejszenie zużycia środków ochrony roślin i redukcji dawek nawozów mineralnych. Komisja Europejska dążąc do poprawy w zakresie optymalnego zarządzania gospodarstwami i przepływu produktów i usług na wspólnym rynku współfinansuje dwa projekty w konkursie CIP-ICT-PSP-2013-7-, integrujące podobne filozofie, które w założeniu chcą znacznie poprawić procesy zarządzania gospodarstwem. Oba są wdrażane od 2014 roku, we współpracy z polskimi partnerami: Przemysłowym Instytutem Maszyn Rolniczych (projekt AgroIT, umowa nr. 621031) oraz Poznańskim Centrum Superkomputerowo-Sieciowym (projekt FOODIE, umowa nr. 621074).
Słowa kluczowe: *ICT, AgroIT, FOODIE, zarządzanie gospodarstwem, usługi, chmura, czujniki, system wspomagania decyzji*

1. Introduction

The process of informatics development in agriculture sector is the consequence of structural changes in modern economy. Preparation of Polish agricultural communities to participate in this process requires taking into account the specificity of this sector, its different economic situation and social relation to the urban area [7].

In the range of computerization, the nature of the agricultural sector is specific in comparison with other areas of the economy. Such situation may deepen the gap between agricultural areas and others, both in terms of economic, educational, and social [6].

To stay up-dated and meet the requirements of the modern, changing world, agriculture sector should introduce the computerization into its practice. The best farmers modernize their farms in an unusual pace. At the same time they are forced to use more and more advanced technologies. Farmers crammed with electronics machines, tractors, combines, equipment for breeding and cultivation, ect. At the same time they fall into the world of modern technology. Modern farmers use the Internet (web pages, e-mail) to track prices, receiving offers, getting contacts with suppliers and customers. Using GPS/GIS satellite technology become everyday life practice. Such farmers follow modern

technologies with the development of their farms. This raises the question of how large is this group and what happens to the others [3].

Farmers, in general, slowly discover the potential of technology information that recently were reserved only for urban environments and youth. The statement "*I am too old to the Internet or to the computer*", slowly become embarrassing proof of backwardness. Nowadays, there is an effective solution for such situation. European Union funds is a chance to improve the Internet usage in Polish countryside. The arising problems can be solved on a larger scale [4].

ICT can help tackle key challenges in agricultural value chain development, as follows [3]:
- Pricing and weather information systems,
- Applications (apps) to help buyers manage transactions with the thousands of small-scale farmers who supply to them,
- Mobile banking and apps that facilitate quick payments,
- Initiatives to expand the reach of farm extension services through phone, radio, video, etc.,
- Text messaging campaigns for enabling environment advocacy.

Technical developments in information and telecommunications technology (ICT) have significant impact on modern society, including agriculture. It has a role to play. empowering farmers to make better production and marketing decisions [5.]

The system aimed for getting information in order to proceed the decisions making process should deliver accurate, complete, concise data in time or on time. The information provided by the system should be in user-friendly form with easy access, cost-effective and well protected from unauthorized accesses.

The digital format of record text, drawings, photographs, audio, video, process descriptions, and others can transfer information and knowledge rapidly over large distances through communications networks.

There are several main applications of the ICT in agriculture that should be mentioned:

- Office automation,
- Wireless technologies,
- Global positioning systems,
- Geographic information systems,
- Computer-controlled devices,
- Smartphone mobile apps,
- RFID,
- Knowledge management system,
- E-learning and E-commerce,
- Agricultural resources and services management,
- Computer-aided manufacturing,
- Computer aided design (CAD).

Farmers are more and more users and deliverers of data and information as well as of resources and products. Data exchange is needed with contractors, traders and administration offices for tax perspective as well as obtaining grants. External data sources (e.g. geodata, meteorological data, product data) have to be integrated in offline or online process planning. The heterogeneous data structures of many existing systems for data acquisition, GIS-based field indexing, different documentation tasks and precision farming applications result in a variety of data formats and interfaces. But the data incompatibility of different farm equipment and software for internal use is only one part of the problem. Many manual steps are often required while processing data, just converting data from one format to another. In most cases specialized software and knowledge and sometimes even programming experience are needed. In fact, numerous systems are still incompatible. To avoid creating themselves an additional problem, farmers have to make their decision of system purchase for reasons of compatibility and not to obtain the specialized functionality they need for the specific optimized farming processes.

Proper use of software improves the efficiency and economics of a farm, by reducing the amount of working passes, selection of appropriate equipment for carrying out the field activities, reducing the consumption of plant protection products or dose reductions of mineral fertilizers. More efficient logistics of products allows to deliver fresh products without preservatives. The software can help to maximize profits or productivity in existing systems of crops and livestock production.

The European Commission whereas the improvement in the sphere of optimal farm management and workflow of products and services in the common market supports two projects that integrate similar philosophies which wish to

significantly improve farm management processes in call CIP-ICT-PSP-2013-7. Both have been implemented since 2014, in cooperation with Polish partners: Industrial Institute of Agricultural Engineering (project AgroIT, Grant agreement No. 621031) and Poznan Supercomputing and Networking Center (Project Foodie, GA no.621074).

2. AgroIT Project

The overall objective of the project is to create and implement AgroIT platform [1], which meant to deliver applications and services to various stakeholders: farmers, local communities, government agencies, advisory institutions in agriculture (public and private) and EU institutions. Implementation of the system will help accelerate the transfer of innovative applications and services to the Europe market by quicker integration of new ICT elements (applications, databases, information exchange services, monitoring systems) into the platform and as a consequence quicker transfer of integrated ICT solution to farms.
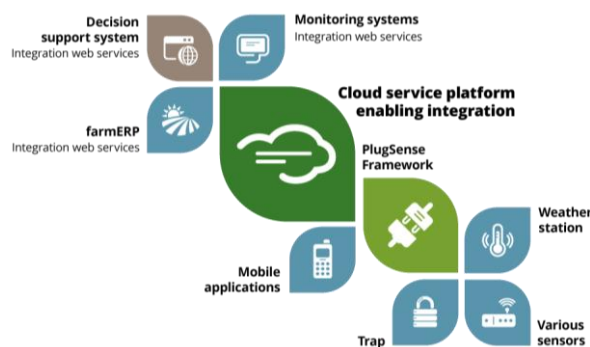
Fig. 1. Organization chart of cloud service platform enabling integration in AgroIT project
Rys. 1. Schemat organizacyjny platformy usług w chmurze, umożliwiającej integrację

The draft provides that the system will be based on open standards, so that farmers will not be restricted to choose only the products created by the project partners (final products that eventually will be based on prototypes implemented under this project), but will allow for the integration of third-party products in single system. The project has identified additional four specific objectives. The first objective is to implement various mobile applications for farming that enable simple and efficient input of data during the execution of farmer's daily activities. Based on existing prototypes, project partners will implement a scenario-oriented user interface which will enable farmers to have a sequenced order of daily activities based on farm management system (farmERP). Within farmERP will be defined support of individual elements of the farm: livestock and crop production, fields service (fertilizing and spraying), park of the machines and storage along with modules for accounting and reporting. The second objective is to integrate monitoring systems, which will enable the collection of data from sensors and other devices through wireless communication technologies (mobile). They will be monitored meteorological data collected from weather stations, data about conditions in crops and orchards, data about conditions in livestock buildings (measurement of gas concentration) and even automatic control of the amount of in-

sects in crops. The third objective is to create advanced decision support system for farming, which will help farmers in making decisions based on the results of monitoring systems and the data from the system of farm management. The fourth objective is to integrate the various elements to the platform as a whole and to create open standards to enable integration. Standards will be published, in public domain or creative-commons license to enable cooperation and gain support within sectors and agriculture-related communities.

Expected benefits for the farmer with the implementation of the project is the acceptance of a concept called the "input data as you go". More efficient use of resources on the farm due to access to current information. Up to date, extensive amounts of data collected from the sensors will bring new opportunities for analysis and decision support. Quickly generated current reports will save time, compared with the previous arduous and time consuming administrative work. On the basis of reports or measurement data will be possible to precisely and immediately offer farm advisory services which, like the whole system can be placed as a service in the cloud. Open standards used in the project will integrate multi-vendor solutions. The farmer will be able to choose which module or program will be most suitable for his farm.

The benefits for government or EU institutions are better opportunities for additional information (beyond those currently received), which can be the basis for better and more complex analysis in order to identify strategies and guidelines for agriculture.

3. Foodie project

The key point of FOODIE project [2] (Farm Oriented Open Data in Europe) is creating a platform hub on the cloud where spatial and non-spatial data related to agricul-

tural sector are available for agri-food stakeholders groups and interoperable. It will offer an infrastructure for the building of an interacting and collaborative network; the integration of existing open datasets related to agriculture; data publication and data linking of external agriculture data sources, providing specific and high-value applications and services for the support of planning and decision-making processes for farmers, stakeholders groups, entrepreneurs and the public sector including the European Commission.

Concepts and objectives of the project foodie will be realized with the help of mentioned platform in three pilot scenarios in European countries, thus allowing the collection of detailed requirements. The first pilot scenario will be implemented in Spain and will apply to precision viticulture. Will focus on the proper management of the variability of crops, increase economic benefits and reducing the environmental impact of crops. The second pilot scenario will be implemented in the Czech Republic and will focus on "open data" for strategic and tactical planning. This phase will focus on improving the management of agricultural enterprises (farms) through the introduction of new management tools and methods that will be the way to optimize costs, reduce the burden on the environment and improve the energy balance while maintaining the current level of production. The third scenario implemented in Germany will be devoted to technology integration by enabling providers of logistics services and farm management, including solutions based on GIS technologies. This pilot project will focus on the integration of embedded systems in the machine with the existing logistics systems and farm management. This solution will be used to develop new and expansion of existing models of business cooperation with various affiliated partners, which will create additional opportunities for B2B using new IT solutions.

Source / Źródło: http://www.foodie-project.eu/
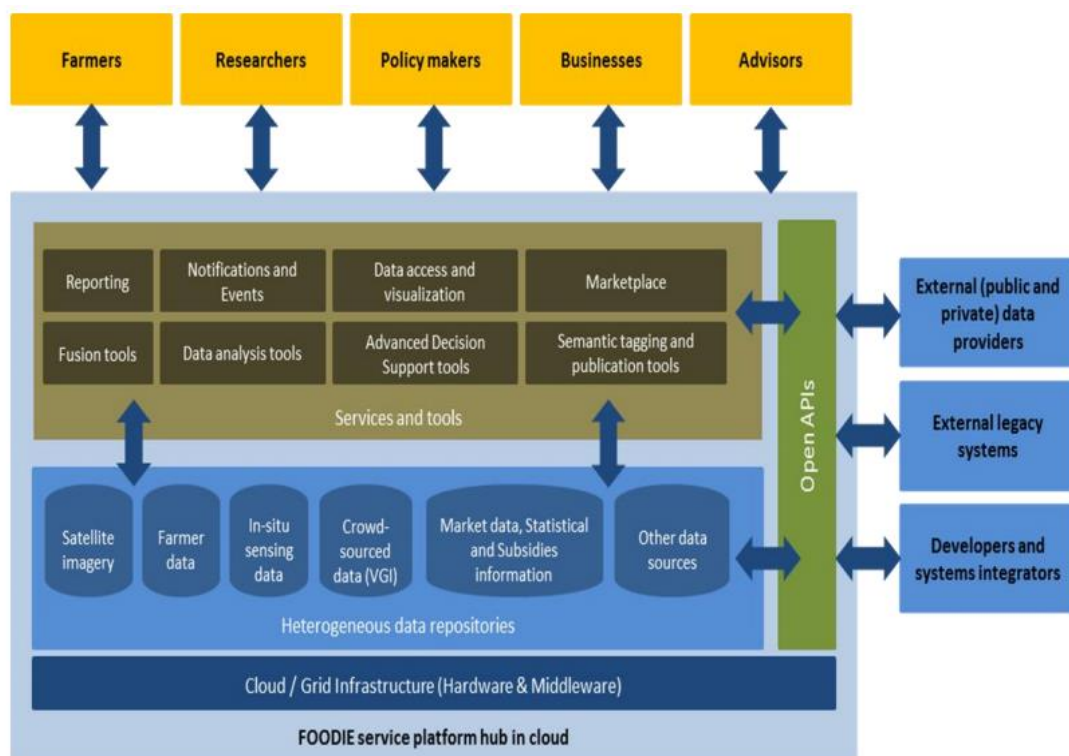
Fig. 2. FOODIE service platform hub in cloud
Rys. 2. Schemat platformy usług w chmurze projektu FOODIE

Project partners want to establish an impact on the agro sector. Increase substantially the exploitation opportunities for open GI. Open GI data exchange could become via FOODIE easy as well as the governments will more and more understand that it is not their target to host data but to make them available that better decisions are done based on their data. Facilitate market entry of new companies, and the development of innovative services. FOODIE will encourage SMEs to seize the novel business opportunities offered by FOODIE platform infrastructure and develop products on top of it. These products will use the existing data sources available in the platform and may integrate them with other datasets in their possession to provide specialized services. FOODIE will enable and incentivize the creation of high-value applications and services for the support in the planning and decision-making processes of different stakeholders groups, through its open, standards-based and interoperable agricultural specialized platform hub on the cloud. In addition, FOODIE will provide reward mechanisms for data sharing in order to incentivize external data providers to bring their data sets to the platform.

Ever since farmers have grown crops, raised livestock, caught fish or fertilise, they have sought information from one to another because the information and communication have always mattered in agriculture. Updated information allows the farmers to cope with and even benefit from these changes. Data from farmers play a key role for contractors, traders and administration offices. Will develop new ways of communication and improve work of these parties. Innovation in agriculture is still needed. It can be accomplished through more effective products, processes, services, technologies or ideas. Over the last decade, ICTs have been playing an important role in promoting innovation in the agriculture sector and step by step improve the quality of rural life.

4. References

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