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PREFACE

Information technology is an everyday means that is found in all walks of life today. This is also true for almost all areas of agricultural management. The aim of this Journal is to improve scientific knowledge dissemination and innovation process in the agri-food sector. The Journal of Agricultural Informatics has been established in 2009 by the HAAI within a project of the Hungarian National Development Plan Framework. The peer-reviewed journal is operating with international editorial and advisory board supported by the EFITA (European Federation for Information Technology in Agriculture Food and the Environment).

Agricultural informatics serves not only the development of the management systems of the industry but also obtaining and publicising information on production, organisation and the market for the producer.

Technologies into network based business systems built on co-operation will ensure up-to-date production and supply in food-industry. The sector-level approach and the traceability of processed agricultural products both require the application of up-to-date information technology by actors of domestic and international markets alike.

This journal serves the publication as well as familiarization the results and findings of research, development and application in the field of agricultural informatics to a wide public. It also wishes to provide a forum to the results of the doctoral (Ph.D) theses prepared in the field of agricultural informatics. Opportunities for information technology are forever increasing, they are also becoming more and more complex and their up-to-date knowledge and utilisation mean a serious competitive advantage.

These are some of the most important reasons for bringing this journal to life. The journal “Agricultural Informatics” wishes to enhance knowledge in the field of informatics, to familiarise its readers with the advantages of using the Internet and also to set up a forum for the introduction of their application and improvement.

The editorial board of the journal consists of professionals engaged in dealing with informatics in higher education, economists and staff from agricultural research institutions, who can only hope that there will be a demand for submitting contributions to this journal and at the same time there will also be interest shown toward its publications.

Dr. Kálmán Rajkai

Chair of the Editorial Board

Content

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Developing a smartphone app for m-government in agriculture

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A B S T R A C T

The high penetration of smartphones and the advanced capabilities of the software that they can host, forces public agencies to rapidly transform their services in the mobile government environment for maximizing utility of services and minimizing costs. In this context, the aim of the paper is primarily to review the smartphone use and capabilities in agriculture. An overview of apps targeted to the agricultural business sector is provided. Secondly, the potential use of smartphones for mobile government is discussed and a transactional mobile government app for the Android operating system is proposed based on a case study for agriculture. The mobile government app is based on a previously developed electronic government system for farmers. Design and technical aspects for the implementation of the proposed app are presented and discussed. Such apps hope to be a promising solution for farmers enabling them to access government information and transact with public agencies at their convenience and at a location of their choice.

1. Introduction

Mobile communication technology forced governments to be transformed from electronic government (e-government) to mobile government (m-government). It provides citizens and businesses with an immediate access to certain government information and services, on anywhere and anytime basis. While e-government is the practice of information and communication technologies (ICT) to improve the efficiency of the governmental services which are provided to citizens, employees, businesses and agencies (Carter and Belanger, 2005), m-government refers to the practice of mobile and wireless communication technologies in government administration and its delivery of information and services to citizens and businesses. Usually, m-government is considered as a subset of e-government comprising an alternative provisioning channel (Ntaliani et al., 2008).

The development of e-government services has been traditionally based on non-mobile services but now, with the high penetration rate of mobile devices in the population, more people are able to use m-government services. The International Telecommunication Union (ITU) estimated 6.8 billion mobile subscriptions worldwide in 2013 (ITU, 2014). Moving from customary, traditional paper-based services, or even wire Internet access based services to the wireless Internet services, m-government provides the ability to citizens and businesses to be supplied with the most suitable and quickest means of acquiring government services. Therefore, through mobile devices, governments can reach a greater number of citizens improving communication effectiveness and maintaining relationships (Hung and Lin, 2013). Additionally, the digital divide is gradually decreased with significant benefits for both citizens and governments.

The generic term “mobile device” is related to a mixture of devices that permit the people to access data and information from anywhere. ICT has allowed mobile devices to do nearly anything which had previously been done with personal computers. Mobile devices include cell phones, portable devices

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such as personal digital assistant (PDA) and lately smartphones. In particular, a smartphone combines the utility of a cell phone and a PDA into one device. Smartphones are now equipped with high-resolution touch screen display, innovative sensors, camera, more memory and processing capabilities as well as effective mechanisms for saving power. They have Web browsing capabilities, Wi-Fi connectivity and the ability to accept sophisticated applications and access the Internet over a 3G or 4G/LTE wireless network. The most well-known mobile operating systems (OS) for smartphones are Android, Symbian, iOS, BlackBerry OS and WindowsPhone.

The intrusion of smartphones is enhancing day by day. The advance of smartphones that can be used virtually anywhere, gives users access to all information of the Internet and puts tools such as calculators and record keeping literally in the palm of one's hand. On the other hand there are thousands of mobile applications (apps) related to Android, iOS and the other platforms that offer several advantages and functionalities. However the development of mobile apps and in particular smartphone apps is currently focused on private consumption. It is known several efforts of penetration of mobile technology within the government for almost a decade now, but the mobile features are not widely utilized in e-government services (Chang and Kuo, 2013; Wimmer et al., 2013).

While mobile devices are increasingly being used in daily activities (e.g. learning, tourism, medicine) there is a need for research on mobile devices used in interactive and transactional e-government services. In spite of the necessity of research on m-government apps, as a new channel of delivering government services although, there is a restricted number of studies dealing with it (Eom et al., 2012). It merits noting that in this paper the term m-government apps or public apps is used to depict smartphone applications provided by public agencies to achieve more accessible, efficient and effective government.

In this light, this paper presents the design of transactional m-government apps for agriculture based on the Android platform. The business sector of agriculture has been selected because farmers are a special group of users. They have a distance from decision and policy-making centres; it is often neither feasible (due to lack of transportation, time, money, or bad climate conditions) nor suitable to travel for gaining the necessary information or for using the available public services in their disposition (Chatzinotas et al., 2006; Ntaliani et al., 2008). On the other hand, smartphones have penetrated in almost all the environments where people carry out their everyday activities, and perform tasks that are normally run in personal computers. Also, mobile literacy is higher than computer literacy, even though mobile devices might have inconvenient user interfaces. Therefore, m-government apps appear to be a promising solution for farmers, agriculturalists and extension staff.

The structure of the paper is as follows: Section 2 provides an overview of smartphone apps in agriculture. Section 3 presents an e-government system for agriculture called Agroportal which has been previously described by the authors (Ntaliani et al., 2006). Four agricultural fields (i.e. apiculture, sericulture, forestry and horticulture) were put under study and related apps are disused. Also, it presents the design of a transactional m-government app for agriculture. Finally, section 4 concludes the work and provides directions for future work.

2. Background

2.1. Use of mobile devices in agriculture

Agricultural sector is among the most important business sectors in the world since it is the main food supplier. However, agricultural sector is one of the business sectors that have been left aside in terms of the application of new technologies. According to a study conducted by (Jain et al., 2014), "agricultural information system needs to be developed based on the mass communication technology such as mobile systems. It is also noted that localization and native language of farmers are the concerns to be incorporated into the systems". The aforementioned study suggests also that farmers "need specialized information for their crops and cultivation techniques but it is not always easy to find it. More specifically, agricultural practices need precise and accurate information to be disseminated promptly to farmers so that better decisions such as managing farm fields, making continuous and scientific changes in their production systems and grabbing advantage of market opportunities can be made (Jain et al., 2014). Extending the aforementioned approach we can include also the provision of governmental services as a means to better administer their interaction with governmental agencies.

Stakeholders involved in the agricultural sector are progressively using ICT technology and sometimes with remarkable proportions. In the reality, a research conducted in 2011 in USA demonstrated that farmers are rapidly adopting smartphone technology and, in fact, are making greater use of the devices than does the general public. The research results showed that farmers are utilizing smartphones more as a working tool and less for entertainment (Agriculture.com, 2011; USA, 2013). There had been a recent survey in Canada by Farm Credit which showed that nearly 30% of farmers have smartphones. This occurs in other well developed countries too. Farmers are conducting a range of work-related tasks with the devices including sending/receiving email; checking weather, news, and markets; and text messaging. More than 70% of survey respondents say they access agriculture information and services on their phones. Farmers increasingly prefer to get to the Internet with their mobile phones vs. other devices. About a third of survey respondents say they utilize their mobile phones to access the Internet as much as they do with other devices, such as desktop computers. The same number says they use their phones to access the Internet daily. Younger farmers are having greater use of smartphones: 71% of respondents under age 39 say they own a smartphone, in comparison with the overall total of 39% (Agriculture.com, 2011; Chang and Kuo, 2013; Educase.com, 2013; Digby.com, 2013).

2.2. Smartphone Apps for agriculture

There are many agriculture smartphone apps on crop prices, weather conditions, inventory levels and innovative farming techniques and machinery. For example in Australia some samples include tracking and managing livestock, monitoring calving, managing water points, managing irrigation, talking between machinery, remote performing of roles such as unloading grain, monitoring sensors in crops, marketing produce, estimating and mapping yield, performing as substitute tools (such as spirit levels), calculating area, mapping soil types etc. However apps specifically for agriculture are still limited. Up to now, the most dominant app is the apps related to weather (Roberts and McIntosh, 2012). Other apps related to record keeping and accessing agricultural news and technical information (Lorimer, 2012).

Digital technology and agricultural expertise and knowledge have been merged, thus an assortment of smartphone apps according to the needs of farmers has been evolved. These apps can be grouped into the following main categories, namely agriculture management information apps; agriculture information resource apps; agriculture calculator apps; agriculture news apps, weather apps and m-government apps. In the following some examples are given mainly from USA and Australia.

Agriculture Management Information Apps: Applications that are included in this category are in a great deal mobile extension of an operational management system or a farm. For instance farmers can decide what varieties and other inputs want before planting starts (e.g. Virtual Farm Manager App). They can generate electronic maps of fields to keep a history of growing crops in the fields (fertilizing, planting, harvesting), to take notes on the fields as points of interest (e.g. warehouses, gas stations), to keep the location of objects in the farm (e.g. soil sampling for agrochemical laboratory), to keep a diary of field operations for each field (e.g. eFarmer App). Professionals in the green industry and homeowners can have access to pictures, information, and recommendations for managing weeds, diseases, and pests (e.g. Turfgrass Management App). Ranchers and grassland managers can keep records of grazing use and range and pasture conditions (e.g. South Dakota Rangeland and Pasture Grazing Records App). Farmers can access timely, accurate data for each and every one of the climate/moisture monitoring stations or irrigation sets in their fields (e.g. PureSense Irrigation Manager App).

Agriculture Information Resource Apps: This category includes apps that are first and foremost utilized as a lookup implements or else a tool which assists to the identification of species, reviews regulations and takes expertise on a subject. For example farmers, agricultural students and any other interested in agriculture can get information in several categories such as farmer information, general information, fertilizers and pesticides prices etc. (e.g. Agriculture Information). Farmers can have access to a vocabulary of 4,500 words and terms utilized for the field of entomology (e.g. Entomology Dictionary). Farmers can have access to crop disease resistance ratings. They can compare the resistance ratings of a number of crop varieties for different crop diseases (e.g. Crop Disease). Also, an innovative Greek mobile app is an app, named ToTheShelf that links growers to traders and vice versa locally or globally. Agricultural products can have access to the local or global market fast and easy and go from the field to the shelf. Up till there are about 500 subscribers.

Agriculture Calculator Apps: This group of apps includes smartphone tools to help make in field calculations without having to head back to the home office. For instance farmers can based on where the grain markets are currently trading (e.g. Farmer's Partner). Also, farmers can measure the maturity of a crop by viewing current and past growing degree days data of farm's location (e.g. Growing Degree Days). Farmers have the ability to obtain local, personalized information that is crucial for their farming operation (e.g. Growers Edge). Farmers can search for used farm equipment via categories or a selection of other criteria such as price, year (e.g. Landwirt Used Farm Machinery Search).

Agriculture News Apps: These are a token of agri-media focused news aggregators. For instance farmers can have access to a website presenting agricultural management news, markets, weather, several alerts, farm business blogs, articles and radio (e.g. AGWeb). Farmers can reach local agricultural news, grain and livestock markets, weather and blogs (e.g. Farm Progress). Farmers have the ability to customize lists of markets as well as to find market commentary, news and audio (e.g. Farm Futures). Farmers can receive local market commentary and agricultural news and compare risk management options (e.g. Growers Edge). Greek farmers can be informed using the AgroNews.gr app which provides access to the latest agricultural news.

Weather Apps: This category describes only a sample of smartphone weather applications, since there are lots of them. Some apps are quite focused on farmers' needs to whom they offer the ability to access weather pinpointed on their fields and find their local and best price bids within a 100-miles of their location (e.g. Growers Edge). In Australia, there are about seven weather apps (Weatherzone Plus, Elders Weather, Yr.No., Rain, Pocket Weather AU, Oz Weather, Aus Weather) and each one of them provides different advantages and user's preferences. In Greece, there are few weather apps for general use such as Meteo and MeteoKairos.

M-government Apps: In this category are included some information apps provided by governmental agencies. For example in Australia farmers can pick up varieties of barley, canola, chickpeas, faba beans, field peas, lupins, oats, triticale and wheat (e.g. CropMate Variety Chooser). Farmers can identify the most ordinary weeds in southern Australia (e.g. Weeds: the Ute Guide). In addition they can compare current crop disease resistance ratings, disease symptoms, map diseases and share images of diseases with others (Crop Diseases). They can use GPS to know heritage places, wetlands, protected species, protected areas, weeds and invasive species around their fields (MyEnvironment).

3. The Agroportal system extended as a smartphone app

3.1. The notion of the Agroportal system

Agroportal system is an e-government portal which aims at supporting agribusinesses (i.e. a farmer is also considered as an agribusiness) in transacting with Greek agricultural governmental agencies. It is based on the notion of one-stop shop that refers to the integration of information and services to a single point of access from the user's point of view. An agribusiness can access the Agroportal system through a PC with connection to the Internet in order to reach information and governmental services, as well as send and receive Short Message Service (SMS) messages to a mobile phone in order to request information or apply for a public service (Chatzinotas et al., 2006; Ntaliani et al., 2006). The design and development of the Agroportal system based on methodology described in previous works. The main aspect of that research (i.e. 435 questionnaires) is the preference of farmers to use their mobile phones for e-government services. Therefore, the current work is an extension of the previous analysis to include the new capabilities of mobile phones. Agroportal provides the following types of services:

- *Information Services*: These services aim at providing the users with relevant information about the portal's domain of interest. There are three main information sections: news, frequently asked questions (FAQs) and useful links.
- *Governmental Services*: These services are divided into e-government and m-government services. The e-government services enable (a) the electronic submission of applications by the users; (b) the processing of the application by the appropriate government actor; and (c) the forwarding of the application response back to the user. The m-government services provide information via SMS messages for: agricultural products and their cultivation; epidemic alerts for the outbreak of an epidemic and proposing measures for confrontation; weather alerts for extreme conditions; legislation news for the issuing or abolition of related law; administrative information for deadlines (e.g. submission of applications); market information for traders, wholesalers, processors (e.g. price tendencies, demand forecasting and trends); chat among agribusinesses.
- *Value-added Services*: The communication services are meant to enable the communication between the users and the government actors. The portal aims at providing synchronous communication methods (e.g. real-time chat), as well as asynchronous communication methods (e.g. email, forum, private messages).

The extended notion of the Agroportal is presented in the following figure 1. Therefore, the system can be accessed through the Web at the following URL: http://meli.aua.gr/agroportal/. Also the agribusinesses are able to exchange informative SMS regarding several agricultural issues as described above. The extended version of the system provides availability also on smartphones and tablets.

Figure 1. The extended notion of Agroportal system

3.2 The smart agricultural services

The proposed app has been developed for the Android platform for smartphones. This decision is based on the rationale that the Android OS has greater freedom in its development program. Android is an open source mobile operating system developed by Google for mobile devices that uses a modified Linux kernel. Moreover, an app is a software application running on such a platform. The app developed using the Android Developer Tools (ADT) v22.2.1, and tested for displays from 3.2 up to 10.1 inches. The minimum required Android version is 2.2 (Froyo) and the target Android version is 4.3 (Jelly Bean).

Much of the development effort has involved also configuring Agroportal Web services which are the core of the app's functionality. The key functionality of the developed app, at present, includes a front screen comprising a list of eight options namely horticulture, apiculture, sericulture, forestry, agricultural news, FAQ, forums, and weather (figure 2). Touching on the options horticulture, apiculture, sericulture or forestry another list of options is revealed. Figure 3 presents the menu for horticulture. Figures 4 and 5 present informative content for forestry and apiculture respectively. Figure 6 presents an m-government service for apiculture and specifically the application for issuing apiculture booklet. The application for ordering silkworm eggs, an m-government service for sericulture, is presented in figure 7.

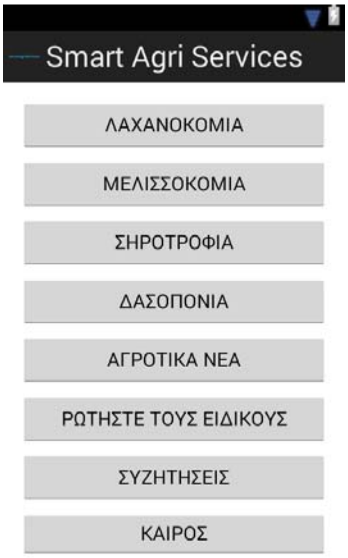

Figure 2. The front screen

Figure 3. List of options for the horticulture case

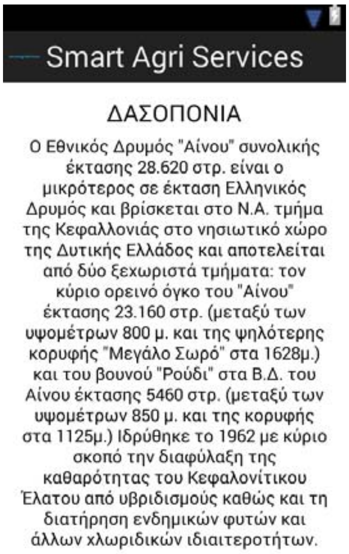

Figure 4. Informative content for forestry

Figure 5. Informative content for apiculture

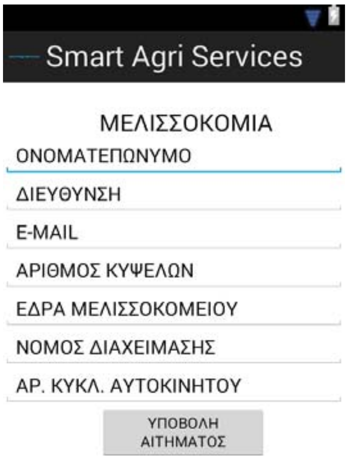

Figure 6. M-government service for apiculture

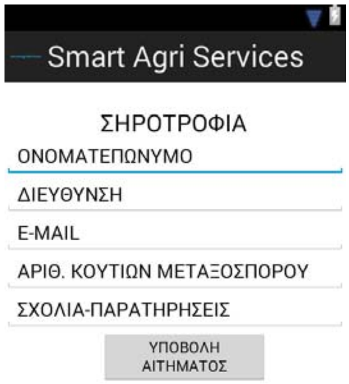

Figure 7. M-government service for sericulture

4. Conclusions

Digital government can offer to the public administration significant opportunities to achieve better government as the citizens and businesses become more technologically advanced. Indeed, recent advancements on smartphones and the capabilities of the related software, can offer great easiness and wider access and extend the reach of governmental information and services to the public. However, according to the presented overview, the use of smartphones for m-government services is still in its infancy. Few m-government apps exist, especially of the interactive and transformational type, but they are constantly evolving. In this work we propose a transactional m-government app for agriculture as an add-on to an existing e-government portal. The proposed app is easy to use and the user is able to find information and submit requests and applications in a convenient and simple process. They are also able to be up-to-date about the administrative information and processes of their requests. With the use of such apps, farmers could save time and money since they don't need to travel in order to submit applications and documents by physical presence. On the other hand public agencies and local government related to agriculture can lower their administrative burdens and improve their accessibility, effectiveness and efficiency. Farmers and other interested parties in agriculture could gain more by using smartphones as a working tool, and government access medium. The proposed app is in continuous evolving process in order to incorporate more governmental services. It has been tested for screens from 3.5 to 4.7 inches. Also, as future work we plan to make the app available on other platforms such as iOS and WindowsPhone as well as to include functionalities that have to do with payment transactions (e.g. tax payments, subsidies).

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Wood Tracking Information Systems to Confront Illegal Logging

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A B S T R A C T

This paper examines the current wood tracking information systems used in international wood trade aiming to prevent and control illegally logged timber and wood products trade. Moreover, innovative log tracking mechanisms and technologies are also described and assessed. Wood tracking can add value to the wood product, by establishing an information system aiming to recognize and locate legal wood and wood products. Apart from the traditional punching and painting log-tracing methods, there are various digital wood traceability information systems for recognition, log tracking and monitoring, including barcodes, QR codes, RFID, microchips etc. Furthermore, various innovative wood tracking systems are also presented and discussed. The aim of the paper is to describe and quote those methods used in wood trade sector, to identify current trends and perspectives and to quote them as to their reliability, practicality, level of information provided and cost. Further it provides insight from log-traceability methods used in Greek Forests.

1. Introduction

Currently, the governance of natural resources has to face the increased diversity of connections between different environmental characteristics and decisions of local, regional, national, and international relevance, with high coordination and exchange between administrations and actors across the public/private and the expert/stakeholder divide (Andreopoulou et al., 2011). In the end of the 20th century, Non-Governmental Organization (NGO) initially became aware of illegal logging and the ecological impact of illegal forest harvesting and forest deforestation (Tacconi, 2007). Following the global forest governance identified the need to ensure timber legality in international wood trade sector, especially as trade in illegally logged timber along with forest illegal activities is a major problem for many timber-producing countries (Brack, 2005, Cashore and Stone, 2012). Illegal logging refers to a range of illegal activities related to forest ecosystems, forest industries and timber and non-timber forest products (Tacconi, 2007). In the first place, within the context of global environmental concerns it became acknowledged that illegal logging and related trade is a daily practice in many timber-producing countries and contributes towards forest degradation (Brack, 2003, Wiersum et.al., 2013). It is clear that several enterprises, in developed and developing countries, benefit from significant profits arising from illegal activities (Brack et.al., 2002, Brack, 2003). The initial step in controlling the international timber trade is the establishment of a digital system to identify legally produced logs and wood products. Information Communication Technologies (ICT) can be used within environmental governance in the interest of the natural environment and the natural resources regarding sustainability (Andreopoulou, 2013).

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The ability to perform and track the whole follow-up of products in industries is accomplished by implementing systems of automatic identification, which are capable to create a link between the product, the database of the product and its process. Tracking mechanisms are further complex by the composition of individual wood products and shipments of timber, which in general contains an extensive range of logs and processed products, with different species and sizes (Tzoulis and Andreopoulou, 2013).

Traceability information systems consist of processes to maintain records that expose the trace of a particular input from suppliers to final customers (Daff, 2007). Under EU law, "traceability" means the capability to track any product, throughout all phases of production, processing and distribution. This track refers to the recording through means of barcodes, RFID tags, QR codes and other tracking methods (EU, 2007). The elemental characteristics of traceability systems are: a) identification of units/batches of all inputs (Product traceability information), b) lot identification of processed product (Production records and batch labeling), c) information on when and where they are moved and/or transformed (Documentation) and d) a system linking this data (Reconciles product to documentation). Emerging traceability technologies function as a means for communication, making information accessible along the supply chain, thus deficient management among these links creates a crack in the information chain and a consequent loss of traceability (Tzoulis and Andreopoulou, 2013). A supportive traceability system relies on being able to track product one step forward and one step back at any point in the supply chain. There are reviews about key traceability technologies, such as DNA markers, electronic tagging, ways of storing and transmitting traceability data and the range of data carrier technologies in various studies their decisive factors (Ramesh, 1998), the need for verifiable traceability (Opara, 2003), the role of traceability systems not only in ensuring safety and combat fraud but in optimizing business performance along with novel techniques description (Smith and Furness, 2006, Bechini et.al., 2008, Mousavi et.al., 2005).

1.1. Wood Traceability/Tracking systems in Wood Trade

Forests offer an extensive variety of services to humans, including wood products, recreational opportunities and ecosystems services. Just about half of the wood products harvested for human use worldwide are used for fuel wood and the other half for industrial purposes such as furniture, building materials or paper products. Forest products are significant components of international trade. Processed products have developed in importance as a proportion of total wood product exports, and numerous countries have as well seen increasing production and export of secondary processed wood products, including wooden furniture, builders woodwork (doors, window frames, flooring, etc.) and a range of small products (tools, brooms, boxes, etc.) (Bourke and Leitch, 2000).

Each system designed to control illegal timber trade requires harvested logs to be identified, inspected and documented, and then followed through processing and packaging to export with subsequent cross-checking with cooperating importers. The aim of wood traceability is to prevent the movement of illegal timber, and to explore ways in which the export and import of illegally harvested timber can be eliminated, including the possibility of a former notification system for commercially traded timber. By establishing an information system to avert illegal products, value is added to the product (FAO, 2002)

A chain of custody estimation is necessary in following this process and revealing whether illegal timber is entering legal commerce during harvesting, processing or at the point of export. (Bourke and Leitch, 2000, Brack, 2005). Various wood tracking technologies for tracking logs from the forest to the mill have been already described and they vary from simple painting methods to bar coded labels, mechanised coding systems, and radio-frequency identification transceivers (Brack et.al., 2002, Dykstra et.al., 2003, Tzoulis and Andreopoulou, 2013).

The worldwide traded timber should come from sustainable managed forests. Two certification systems of sustainable forest management have been developed: a) FSC: Forest Stewardship Council and b) PEFC: Programme for the Endorsement of Forest Certification schemes (ACE UK, 2012). A nation can trade in round wood and export paper produced, and the relevant information is where the wood was grown, as a traceability application. This information is then used to trace the origin of main products behind consumed products along international supply chain (Kastner et.al., 2011). Wood traceability information systems make sure that wood derives from sustainable sources and supply a successful technique to fight illegal logging. These Information systems cover data on the source and movement of wood throughout harvesting area until its final destination. It is important to acheive detailed tracking of the log production and movement of timber and wood products aiming to guarantee the legality of the product (Brack, 2003).

It is important that wood for trade should not arrive a) from illegal cuttings, b) areas of natural value, c) gene-modified trees, d) areas with social conflicts, e) natural forests transformed to other use (Korsnas, 2012). In the wood industries, the achievement of common identification and information systems used in other industries presents implantation problems, mostly because of the nature of wood and the particular features of the manufacturing process. It is highly acknowledged that wood presents high changeability in its structure and features such as knots and cross grain can be found in different degrees in wood As a result the exceptionally changeable nature of wood helps the existence of exclusive characteristics that can be used as a model of recognition (Charpentier and Choffel, 2003). However, traceability information systems of high technology require additional costs (Brown, 1997). If an effective legal information tracking system can be developed and became obligatory across an entire country, then illegal timber can be defined as any timber that is not included in that system and exists outside. Nevertheless, it is more likely that such an information system would initially develop, on a voluntary and pilot basis, probably in certain countries and certainly in a non-universal basis, with timber not covered by the system simply being of 'unknown legality', not positively identified as legal, but not automatically illegal.

Wood entrepreneurship gains an increasing interest, globally given the current trends in the modern society in wood and wood products because wood is the raw material for different industrial products of primary processing such as poles, sawn timber, veneer, plywood, particleboard, fiber boards, pulpwood, etc., which are materials to produce other products such as secondary treatment furniture and paper (Tzoulis et.al., 2013)

The aim of the paper is to study the emerging traceability technologies and tracking information systems used in wood trade sector in order to fight illegal logging and trade and in that way to add value to the product itself. This would be beneficial both for companies and the consumers, and of course the trade between countries, providing better quality for wood and its products, from legal sources. There will be presented the features and feedback for every method assessing reliability, practicality, cost and level of information provided. Further insight from the contemporary log tracking system for the case of the University Forest of Pertouli, in Greece, will be presented.

2. Methodology

Initially, various systems of wood traceability and other tracking systems used as implements for quality wood trade, in order to fight illegal logging and add value and reliability to the commodity will be identified, registered and studied. For the identification and registration of the tracking systems, a literature review has been performed in relative studies and research (Choffel, 1999, Brack et.al., 2002, Brack, 2003, Charpentier, 2003, Dykstra et.al., 2003, Johansson et.al., 2003, Mousavi et.al., 2005, Brack, 2005, Fuentealba, 2006, Smith and Furness, 2006, Bechini et.al., 2008, Niblaeus, 2009, Lyne, 2009, Ntalos et.al., 2010, Water, 2012, Hansen, 2012, Varallyai, 2013, Tzoulis and Andreopoulou, 2013) and relative sources in the Internet (IK EU, 2010, GIZ, 2010, FSANZ, 2012, Adazon, 2013). There is a discussion for traceability technologies for log tracking and monitoring are qualitatively criteria such as their reliability, practicality, cost and level of information.

Aiming to have insight from the contemporary log tracking system in Greece, a field study was carried out during summer of 2013 in University Forest Pertouli, in Central Greece.

3. Results

The main types of wood traceability that were retrieved are: Punching/Brand hammers, Marking Logs With Paint/Chemical tracer paint, Barcodes/Bar-coded tags and scanners, QR Codes, DNA Fingerprinting, RFID Transponders, The French CIRAD-Foret system, Microtaggant tracer Paint and microscopes, Satellite-borne sensors, Unique Reflector Identifiers, Ground video surveillance cameras and automatic activation devices.

3.1.1. Punching/Brand hammers

All those methods of wood tracking systems that constitute technical means of wood identification and log tracking mechanisms are presented with information for their reliability, practicality, cost and level of information. It is a plain and low-cost method where the logs' ends are punched with a hammer and it requires a minimum training level. Marking logs with a hammer is a plain technology and is the oldest method to point out ownership or considered use of the log. It's a practical method, quick and easy to apply in cut trees only, but with low security and reliability as it is very easy to make copies of the punchers. This method verifies a huge quantity of symbols, usually locally identified. Nevertheless, for comprehensive traceability, a unique cipher is used, representing a code that is applied to the log automatically in the harvester head. This code can be connected with trade and physical data about the log, stored in a database. Even though punching can be detected by a camera and a vision system, environmental difficulties such as mud and ice can disturb successful reading (Niblaeus, 2009).

3.1.2. Chemical Paint Marking

Marking logs with paint, where the color is the code, is one of the oldest and also low cost methods (Dukstra et.al. 2003). The marking can be completed automatically or by hand and is comparable to punching. Medium in reliability, it provides information, not log origin. Can give false readings if paint degrades or reacts similarly there are problems in marking with paint in wet log-end, with snow and mud and change of color. It is practical as there is no need for specific training. The aim is to find a cost-efficient solution. For this reason LNP (Luminescent Nano Particles) is used. These nano particles are added to the fluid paint, that becomes unseen in regular light, but when illuminated by a laser it becomes visible. The major advantage is the enlarged frequency range and the detail that the wavelengths can be alienated with high accuracy, meaning further unique identities. Additional significant findings are that LNP is more insolent to snow and mud and it is more difficult to fake (IK EU, 2010).

3.1.3. Barcodes

Barcodes have become a regular part of modern life, adopted in international trade and nearly all products contain a barcode on it, it dominated the market for 40 years (Varallyai, 2013). The barcode consists of a machine-readable code in the form of numbers and a pattern of parallel lines of varying widths, which is printed on an item or product. It's a practical method with a good reliability and security level. Following, an optical reader or scanner picks up the barcode translate the information included, such as production location, production date, transportation details, entrepreneurs name, etc aiming to further control wood stock (Oxford dictionaries, 2013). The barcode traceability system is plain and low cost while it is difficult to be massively applied in wood trade and wood traceability, because of wood texture. Still, there are several barcode wood traceability applications, using plastic or metal labels with printed barcodes to maintain track of logged trees. As soon as the tree is cut, workers use a handheld barcode scanner to scan processing and export data into a database (Adazon, 2013).

3.1.4. QR Codes

QR code, which is short for "Quick Response" code), is a two-dimensional barcode that can be read using a QR barcode reader, camera or smart phone application. It is called a 2D barcode since a QR code is capable to carry information both in vertical and horizontal direction and it expands dramatically the data storage capability compared to simple barcodes. The QR Code is initially appeared in Japan where is widely used. It is a registered trademark of Denso Wave Inc. in Japan and it is now used in many countries (Lyne, 2009). Furthermore QR Codes can be printed and displayed in all places. The extended use of smart phones with QR reader application have made QR codes a common tool because they carry information, explanations and details of all kind, for consumers when applied in commodities, for visitors in culture areas, for science, entertainment, etc. It can also be used online (Waters, 2012). Even though the fact that originally was used to trail parts in vehicle manufacturing, QR Codes are now used over a group of applications, such as logs and generally in the field of environment and agriculture. Numerous fields in the agriculture are covered by QR codes (Hansen, 2012). By adding a QR Code near price tags, it can provide potential information to customers such as allergy information, preparation tips, directly. The most considerable objective in most cases is the traceability or monitoring of the system. In that way QR codes could be incredibly useful to the "chain of industry" in wood, for not only the source of the wood but also its technical facts (Waters, 2012). In the case of wood traceability, a QR code can be marked in a tree log by laser (Tzoulis and Andreopoulou, 2013).

3.1.5. DNA Fingerprinting

New experimental methods in research level have been offered in order to avoid fraud and other illegal activities in tracing logs. That log tracking method is based on annual rings which are unique for each tree and are further recorded in database with samples. The genetic composition of tree populations shows a spatial model, meaning that the timber origin can be detected and controlled by comparing the genotypes of wood samples with the genetic pattern observed in sampled populations, providing a wood DNA. It is a reliable method, as DNA cannot be faked (Smith and Burgess, 2006). These types of log tracking methods are not practical as they presuppose the existence of an adequate database, they are high-cost to establish and high-level specialist training is also needed. However, it is a reliable and secure method as it provides a high level of information.

In the other case of isotopic fingerprinting, isotopes differ in their specific masses. Diverse chemical elements are taken by the plants through water, nutrition from soil and by photosynthesis. The distribution of isotopes shows different patterns and by combining these patterns of different elements it is achievable to check the declaration of origin (GIZ, 2010).

Micro-wave sensor tracing technology is based on the use of a micro-wave sensor, that allows to acquire an internal mark of the wood products, initially used for finding wood features such as knots, cross grain (Charpentier, 2003) and mechanical characteristics of wood (Choffel, 1999). Microwaves act together with the material according to its dielectric properties (Fuentealba, 2006). The transmission of this type of waves through the wood is mainly influenced by the moisture content and the existence of features such as knots and cross grain, which are more changeable from one board to another, used for the automatic identification. The product circulates between the emitter and receivers, and then its mark is digitized on a computer (Johansson et.al. 2003).

3.1.6. RFID (Radio-Frequency Identification) tags

This is a high reliability and accuracy method (Mousavi et.al. 2005). The RFID tag is extremely small and can be affixed to an object and used to track and manage inventory, assets, wood, etc. (Várallyai, 2013). Radio Frequency Identity (RFID) tags can be planted inside a wood log and transmit data to receivers. These RFID tags can be read-only or read-write, and can be programmed in the field or in advance. They are passive; they only transmit data when become 'excited' by a signal from the RFID reader. These tags are very durable, they can live up to 8 years, they can be reprogrammed and they can be read under water. Aiming to automatic identification and tracking, radio-frequency identification (RFID) uses a wireless non-contact system with radio-frequency electromagnetic fields for data transmission from a tag, in a product (Mousavi et.al. 2005). There is comprehensively literature about RFID technology reviewed in recent research (Várallyai, 2013), where it is studied the use of RFID aiming to improve supply chain and inventory operations. RFIDs are simple to hide or fit in other items due to its small size. The RFID technology is the most promising method for marking logs at this moment, as, unlike barcodes technology, RFID allows acquiring information at a rate of 1000 tags per second and it is expected a growing acceptance of RFID technologies in the next years as basic components within traceability information systems (Bechini et.al., 2008). The readability in the real-life tests and demonstrations was close to 100%. Apart from the technical performance RFID represents a sophisticated technology that opens up for new business applications. A further advantage compared to other methods is that it is not easy to deceive (Dykstra et.al. 2003). Still there is a need for further development of this technology. The automatic application must be very tough with a minimum of production disturbances. The current trend is positive for the RFID technology and generally the cost per tag is expected to decrease (FSANZ, 2012). Traceability in wood packaging material can be secured with the suitable thermal handling, as the technology of radio gives today adequate solutions. Apart from the simple thermal handling in wooden packaging material, other information can be stored on the same label such as quantity and origin of wood (Ntalos et.al. 2010). The cost of the method is now high but it still decreases.

3.1.7. Innovative methods

Various innovative methods have been proposed in international level and other are still under research (Brack et.al. 2002)

a) The French CIRAD-Foret system

It is a low-cost and plain method of timber tracking in which the average diameters of the two ends and length of the log are recorded and a sketch is made of the growth rings at two ends and other characteristic features (e.g. knots, bolls, bends etc.). Each log has serial number matching form. The form contains all the necessary information but cross-checking and auditing is required.
It is a reliable method as counterfeit proof documentation and cross-comparison of records among felling and processing should make it difficult to substitute logs into the system. With this method counterfeit forms and hammer marks can get through checkpoints but will be detected by audit. The method is practically easy to learn and use forest management consultancy development alternatives' recent Log Monitoring and Log Control project in Cambodia noted that the CIRAD system has 'a proven track record under extremely difficult conditions and is known to international timber concessionaires', it is also used in Thailand and Laos (Brack et.al., 2002).Microtaggants are microscopic particles

It is a high-cost method with very high reliability, high level of information and it is virtually impossible to counterfeit. These particles are composed of layers of different colored plastics; millions of permutations are possible by combining several colors in different sequences. The coding sequences are then read with an x100 pocket microscope. It is the fastest marking technique and it is easy to apply with spray gun. The disadvantages are that it can be difficult to read in field, wet or muddy logs may not take marker well while installation costs are high. Furthermore operating costs for that method are kept low while it provides a very high level of information

c) Automatic cameras and remote sensing

Automatic cameras in satellites are used along with remote sensing techniques. This innovative method provides high level of information over a large scale while it is a high cost technique, but for a large amount of information. This method is not practical for monitoring movements for individual logs but provides valuable information across concessions and nationally.Automatic cameras and remote sensing are clearly large-scale technologies that are not designed to measure individual logs but areas of action and summative volumes of traffic, etc. For example in December 1999, NASA launched two environmental satellites (LANDSAT 7 and EOS TERRA) that should allow custom production of accurate forest maps and monitoring of many aspects of concession management and make sure the veracity of protected areas.

d) Reflectors

Reflectors are read by laser devices and may possibly be of value to aerial surveillance teams trying to spot concession boundaries, log trucks carrying illegal loads and the like, on the other hand satellite-based sensors can be read over enormous distances but are currently relatively weighty. Until now, technological developments in forest management have tended to go before policy rather than being driven by it. Even though the massive role for new information technologies, such systems will only be invented if policy needs for their use are clearly identified. Reading is fast and accurate and can be achieved remotely, from air, etc. The method provides very good reliability and security, it is a continually improving method but it is poor in practicality. It's a high cost method but the level of information is low while it can be modified to incorporate memory cards and unique identifiers.

e) Ground Video Surveillance Cameras and Automatic Activation Devices

Ground Video Surveillance Cameras and Automatic Activation Devices are used for log tracking. The reliability of the method is good as the signal can be transmitted remotely to enforcement personnel. It is not a practical system for monitoring movements of individual logs but good for monitoring major transportation routes. It can be activated by light-, by sound- or by motion-detectors. High-level information can be collected but it is a very high cost method (Brack et.al. 2002).

3.2. The case of wood tracking in Greece

In Greece until 1986 a government organization, named State Forests Exploitation (SFT), was used to function in order to manage and distribute wood and its products. Today, both State and Private individuals have access to wood trade. The University Forest in Pertouli, Trikala, in Central Greece is a public forest estate. It is located in the Pindos Mountain Range, and extends from the western slopes of Koziakas Mt. to the north-eastern slopes of Boudoura Mt. at an altitude of about 3,608.92 to 5,577.42 feet (latitude 39° 32′ - 39° 35′ and longitude 21° 33′- 21° 38′). It covers an area of 3,296.59 hectares, of which 2,361.83 hectares are wooded or partly wooded mostly with fir and pine trees, 168.22 hectares of bare and barren land, 583.71 hectares of mountain grassland, 114.00 hectares of flat grassland and 68.83 hectares of other types of land, such as fields, settlements, etc. Self-seeded hybrid fir trees dominate the area of the University Forest of Pertouli. There are also small clumps of beech trees, oak trees, maple trees, ostrya trees, juniper trees, cedar trees, lime trees, willow trees, etc. Black, scotch and leucodermis pine trees, spruce trees and thuja trees have been planted in the forest as well (AUTH, 2013). In order to manage the forest properly, the area is orographically structured and divided into 9 zones (Braiko, Vathi, Koromilia, Calderimi, Lyxa, Koziakas, Viga, Liopeika and Glapatsa). Forest products include pine round logs with intact bark or without bark (up to two meters long), round timber (two meters long), as well as firewood. A number of measures are taken to protect the forest, while one of the goals set is to achieve maximum sustainable yield and the contemporary mechanism used in the University Forest for wood tracking, as in all Greek forests is similar to punching.

Regarding the log-tracking system, a small metallic placket is set firmly on the wood log immediately after wood logging in the forest area. The placket signs and marks each specific wood log. With the following information concerning wood logs, such as quality of log, quantity of log and logging date information, etc. All these information are also registered electronically in digital forms and verified by Forest Service. Thus, these records are preserved in digital files that are kept and verified through the Local Forest Unit for further trade of wood to entrepreneurs. These records will follow wood logs till their initial exploitation in industry.

4. Conclusions

This paper has examined the physical constraints of establishing an information system to track legally produced logs and wood products. However, such a tracking information system can only work successfully if there is sufficient funding and political will. Aiming to guarantee legal wood in the market, it is necessary to establish a comprehensive universal monitoring of every stage of the chain of production, processing, transport, export and import of wood. There are many alternative-tracking options besides to the traditional system based on keeping paper records respective to punching and painting tracing. Within digitalization era, there are computer-based information systems for recognition, traceability, log tracking and monitoring, including barcodes, QR codes, RFID, microchips etc. The quoted and described wood traceability and log tracking methods vary in their practicality and reliability. Innovative log-tracking mechanisms, such as DNA fingerprinting and satellite surveillance tend to be high cost and difficult to apply. Older and widely applied methods, such as paint marking, punching and barcodes continue to exist and are effectively employed in wood supply chain. It is important that greater efforts need to be made in improving international collaboration on wood tracking data exchange within a global wood traceability information system with unique standards and features.

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Methodology for analyzing EU-conform label information content of meat products in Romania

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A B S T R A C T

This paper presents a proposal for the methodology to investigate the information content of meat product labels, which are found on the Romanian market. The analysis was performed taking into account information requirements of the European Legislation to the rules of 432/2012, 1169/2011, 1333/2008, 1924/2006. 193 for meat products. They were analyzed and results show that only 20% of them fulfill the requirements.

1. Introduction

Food labels are designed to help people in choosing foods for a healthful diet. By using the food label, we can compare the nutrient content of similar foods, can see how foods fit into our overall diets, and can understand the relationship between certain nutrients and diseases.

Health professionals agree upon the importance of the relationship between diet and health. Our eating habits can help or hurt our overall health and well-being. Good eating habits include being smart shoppers, selecting foods that reflect the Dietary Guidelines.

The project FP7-PEOPLE-2012-IRSES 318946 - NUTRILAB is a multidisciplinary and comparative Joint Exchange Programmed with the mission to identify and examine how nutritional labeling in European countries and out of Europe fulfills the actual legislation requirement. Starting in January 2013, with duration of 36 months, this project has the following aims:

- Bring together, review and analyze current research on consumer understanding of claims, and also labeling, where this would inform our knowledge of consumer understanding of claims;
- Gather information on how consumer understanding of claims varies across different population groups, to gain insight into the understanding of the 'average consumer';
- Draw conclusions from existing research to see whether there are areas where further information would be useful, and to inform the direction that any additional research conducted in future could take.

The participants of this project are: Institute of Microbiology and Biotechnology, Academy of Sciences of Moldova (IMB), Moldova; University of Food Technologies (UFT), Bulgaria; Fundatia pentru Cultura si Invatamant "IOAN SLAVICI", Romania; Universitatea Lucian Blaga din Sibiu (ULBS), Romania; Universitatea Politehnica din Timisoara (UPT), Romania, University of Rousse Angel Kanchev (UR), Bulgaria; Universitatea Transilvania din Brasov (UNITBV), Romania;

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2. Study on Nutritional Labelling European Legislation

Fulfilling the nutritional labelling criterions related to European regulation no 432/2012, 1169/2011, 1333/2008, 1924/2006, it is a difficult task, studied by numerous researchers from different locations in the European Union.

The project no. 318946 FP7 IRSES - NUTRILAB (NUTritional LABeling Study in Black Sea Region Countries) is looking forward to the accomplishment of the mentioned criterions in the countries around the Black Sea. In this direction, those regulations were fully studied and identified.

Regulation 1924/2006 contains information on nutrition and health claims, made on foods and, harmonizes the provisions laid down by law, regulation or administrative action in Member States. This relates to nutrition and health claims in order to ensure the effective functioning of the internal market, whilst providing a high level of consumer protection.

This Regulation is referring to nutrition and health claims made in commercial communications, whether it is in the labeling, presentation or advertising of foods to be delivered to the final consumer.

Regulation 1333/2008 harmonizes the use of food additives in foods in the Community. This includes the use of food additives in foods covered by Council Directive 89/398/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to foodstuffs intended for particular nutritional uses and the use of certain food colors for the health marking of meat and the decoration and stamping of eggs. It also harmonizes the use of food additives in food additives and food enzymes thus ensuring their safety and quality and facilitating their storage and use.

Regulation 1169/2011 contains information on the provision of food information to consumers, as follows:

Mandatory food information: Content and presentation, Weights and measures, Availability and placement of mandatory food information, Presentation of mandatory particulars, Language requirements, Name of the food, List of ingredients, Labelling of certain substances or products causing allergies or intolerances, Quantitative indication of ingredients, Net quantity, Minimum durability date, ‘Use by’ date and date of freezing, Storage conditions or conditions of use, Country of origin or place of provenance, Instructions for use;

Voluntary food information: Information on the possible and unintentional presence in food of substances or products causing allergies or intolerances, Information related to suitability of a food for vegetarians or vegans; Indication of reference intakes for specific population groups.

Also, at the end of this regulation there are specific mentions for different types of products, like: „meat products, meat preparations and fishery products which may give the impression that they are made of a whole piece of meat or fish, but actually consist of different pieces combined together by other ingredients, including food additives and food enzymes or by other means, shall bear the following indication:

in Bulgarian: ‘формовано месо’ and ‘формована риба’;

in Spanish: ‘combinado de piezas de carne’ and ‘combinado de piezas de pescado’;

in Czech: ‘ze spojovaných kousků masa’ and ‘ze spojovaných kousků rybího masa’;

in Danish: ‘Sammensat af stykker af kød’ and ‘Sammensat af stykker af fisk’;

in German: ‘aus Fleischstücken zusammengefügt’ and ‘aus Fischstücken zusammengefügt’;...” and so on for all official European languages.

Regulation 432/2012 from 16 May, 2012 is referring to the establishing a list of permitted health claims made on foods, other than those referring to the reduction of disease risk and to children's development and health.

The indications are set in a 30 pages tables with specific components, like:

"Linoleic acid

Linoleic acid contributes to the maintenance of normal blood cholesterol levels. The claim may be used only for a food which provides at least 1,5 g of linoleic acid (LA) per 100 g and per 100 kcal. Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 10 g of LA", or:

"Magnesium

Magnesium contributes to normal protein synthesis. The claim may be used only for food which is at least a source of magnesium as referred to in the claim SOURCE OF [NAME OF VITAMIN/S] AND/OR [NAME OF MINERAL/S] as listed in the Annex to Regulation (EC) No 1924/2006".

3. Data collection

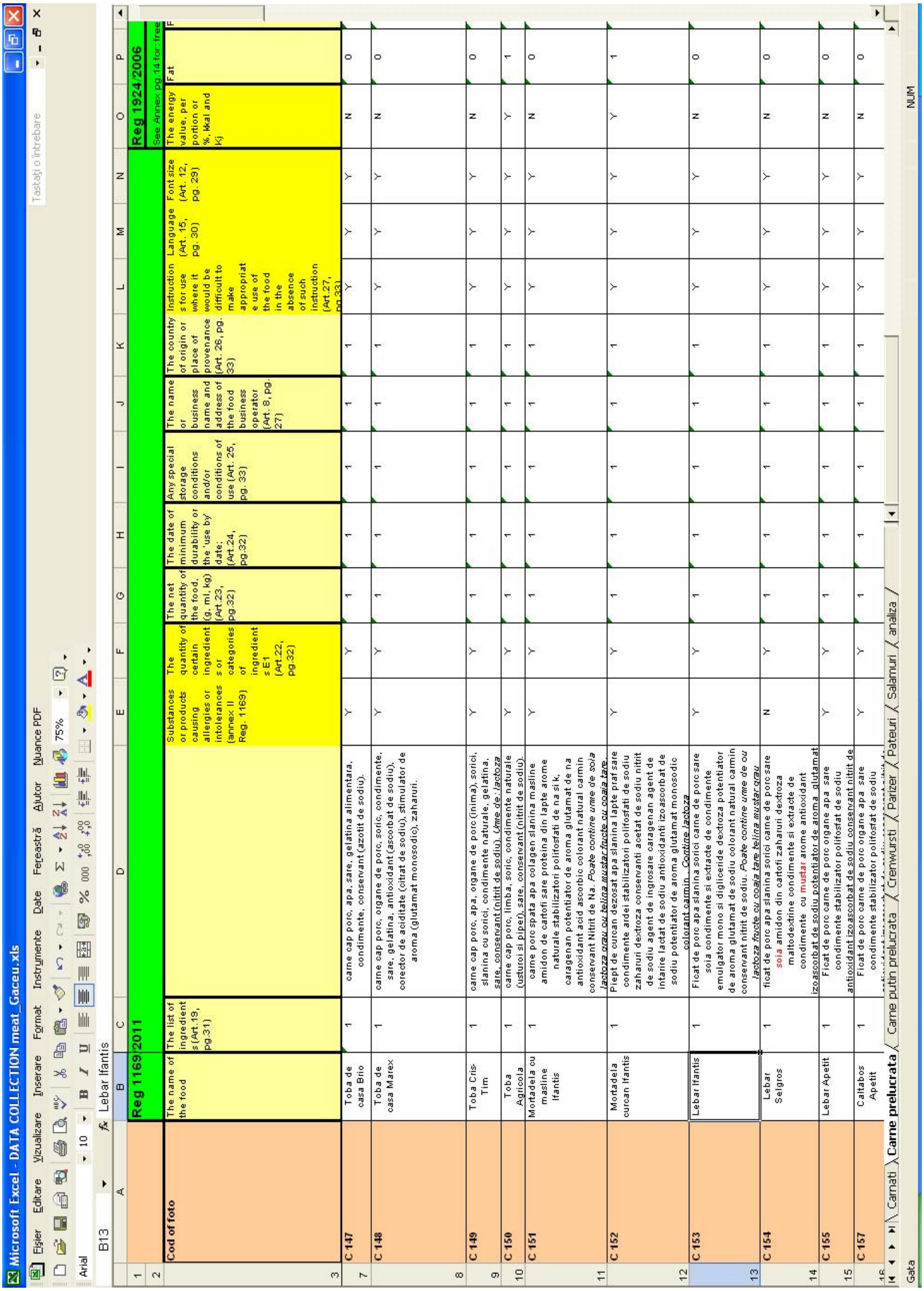
After analyzing regulations, a number of information categories were identified that have a very clear specification and can be statistically analyzed. These types of information are:

- the name of the food product, the list of ingredients,
- substances or products causing allergies or intolerances,
- the quantity of certain ingredients or categories of ingredients,
- the net quantity of the food, (g, ml, kg),
- the date of minimum durability or the 'use by' date,
- any special storage conditions and/or conditions of use,
- the name or business name and address of the food business operator, the country of origin or place of provenance,
- instructions for use where it would be difficult to make appropriate use of the food in the absence of such instruction,
- language, font size, the energy value, per portion or %, kcal and kJ,
- fat, protein, carbohydrates, saturates, sugars, salt, polios, starch, fibers,
- MUFA, PUFA, vitamins, minerals, conclusions, recommendations, notes.

Fig. 1 shows an Excel sheet for meat products according to the presented methodology. For a unified approach to the study in all involved countries with the chosen working methodology provides additional identification for each product label for a specific code resulted a set of 28 information categories.

These can be studied statistically in the Excel application in various ways, by considering the most important criteria.

In the example of meat, the products have been divided into seven main categories: sausages, processed meat, meat specialties, frankfurters, liver pates, baloney and salami.



Cod of foto	The name of the food	The list of ingredients (Art.19, pg.31)		Substances or products causing allergies or intolerances (annex II Reg. 1169)	The quantity of certain ingredients or categories of ingredients E1 (Art.22, pg.32)	The net quantity of the food, (g, ml, kg) (Art.23, pg.32)	The date of minimum durability or the 'use by' date; (Art.24, pg.32)	Any special storage conditions and/or conditions of use (Art. 25, pg. 33)	The name or business name and address of the food business operator (Art. 8, pg. 27)	The country of origin or place of provenance (Art. 26, pg. 33)	Instructions for use where it would be difficult to make appropriate use of the food in the absence of such instruction (Art.27, pg.33)	Language (Art. 15, pg. 30)	Font size (Art. 12, pg. 29)	The energy value, per portion or %, kkal and Kj	Fat
C 147	Toba de casa Brio	1	carne cap porc, apa, sare, gelatina alimentara, condimente, conservant (azotit de sodiu).	Y	Y	1	1	1	1	1	Y	Y	Y	N	0
C 148	Toba de casa Marex	1	carne cap porc, organe de porc, soric, condimente, sare, gelatina, antioxidant (ascorbat de sodiu), corector de aciditate (citrat de sodiu), stimulator de aroma (glutamat monosodic), zaharuri.	Y	Y	1	1	1	1	1	Y	Y	Y	N	0
C 149	Toba Cris-Tim	1	carne cap porc, apa, organe de porc (inima), sorici, slanina cu sorici, condimente naturale, gelatina, sare, conservant (nitrit de sodiu). *Urme de: lactoza*	Y	Y	1	1	1	1	1	Y	Y	Y	N	0
C 150	Toba Agricola	1	carne cap porc, limba, soric, condimente naturale (usturoi si piper), sare, conservant (nitrit de sodiu).	Y	Y	1	1	1	1	1	Y	Y	Y	Y	1
C 151	Mortadela cu masline Ifantis	1	carne porc spata apa colagen slanina masline amidon de cartofi sare proteina din lapte arome naturale stabilizatori polifosfati de na si k, caragenan potentiator de aroma glutamat de na antioxidant acid ascorbic colorant natural carmin conservant Nitrit de Na. *Poate contine urme de soia lactoza grau ou telina mustar fructe cu coaja tare.*	Y	Y	1	1	1	1	1	Y	Y	Y	N	0
C 152	Mortadela curcan Ifantis	1	Piept de curcan dezosat apa slanina lapte praf sare condimente ardei stabilizatori polifosfati de sodiu zaharuri dextroza conservanti acetat de sodiu nitrit de sodiu agent de ingrosare caragenan agent de intarire lactat de sodiu antioxidanti izoascorbat de sodiu potentiator de aroma glutamat monosodic colorant carmin . *Contine lactoza*	Y	Y	1	1	1	1	1	Y	Y	Y	Y	1
C 153	Lebar Ifantis	1	Ficat de porc apa slanina sorici carne de porc sare soia condimente si extracte de condimente emulgator mono si digliceride dextroza potentiator de aroma glutamat de sodiu colorant natural carmin conservant nitrit de sodiu. *Poate contine urme de ou lactoza fructe cu coaja tare telina mustar grau*	Y	Y	1	1	1	1	1	Y	Y	Y	N	0
C 154	Lebar Selgros	1	ficat de porc apa slanina sorici carne de porc sare soia amidon din cartofi zaharuri dextroza maltodextrine condimente si extracte de condimente cu mustar arome antioxidant izoascorbat de sodiu potentiator de aroma glutamat	N	Y	1	1	1	1	1	Y	Y	Y	N	0
C 155	Lebar Apetit	1	Ficat de porc carne de porc organe apa sare condimente stabilizator polifosfat de sodiu antioxidant izoascorbat de sodiu conservant nitrit de	Y	Y	1	1	1	1	1	Y	Y	Y	N	0
C 157	Caltabos Apetit	1	Ficat de porc carne de porc organe apa sare condimente stabilizator polifosfat de sodiu	Y	Y	1	1	1	1	1	Y	Y	Y	N	0

Figure 1 Data collection for meat products

There were used a total of 193 meat products, whose label were photographed in some supermarkets in the town of Brasov, in January 2013. Manufacturer's name will be removed from the table for reasons of confidentiality.

The fields corresponding to each category of information were provided for each product, with the following type of content:

- Product name: text information;
- List of ingredients: text information;
- Net quantity, the date of minimum durability…..: binary character 1 or 0 depending on the presence or absence of information on the label;
- Substances that cause allergies or intolerances….: binary character Y or N, depending on the compliance or non-compliance.

If in the list of ingredients there is present an allergen, but it is not marked with a particular font, is not distinguished by a different colour, as well as there is no separate mention of allergen content, the 5th field of the table is filled with "N" and the allergen is highlighted in red.

Likewise, the criterion amount of ingredients should note that it is mandatory when food ingredient appears in the name/title, being usually associated with that name by the consumer, therefore it should be accentuated on the label in words, or it is essential to characterize the product and distinguish from others with which it might be confused because of its name or appearance.

This analysis can be done within a product category or subcategory of products (within the same worksheet in Excel) or for all products in a given category (meat), in the particular worksheet named "analysis".

4. Analysis and interpretation of data

Interpretation of data in the table was made using "COUNTIF" for counting the symbols Y, N, 1 or 0, in columns 5 .... 29. The criteria on which the presence or absence of information reflect specific compliance or non-compliance from the Regulation, were filled up with 1 or 0.

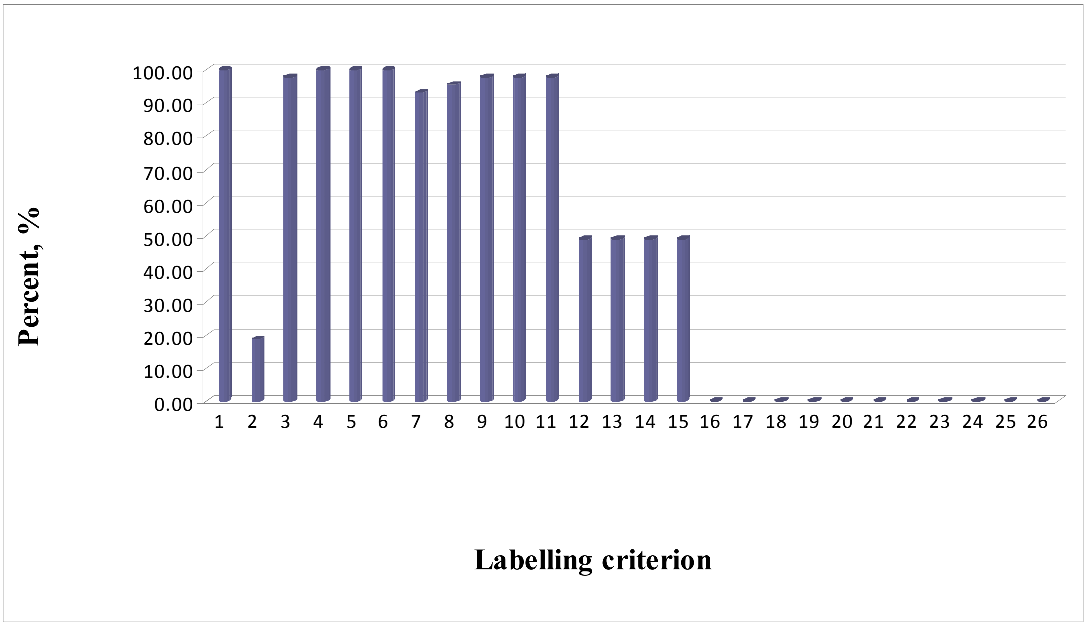
In cases, where the information corresponding to a criterion should be interpreted to assess the situation correctly fulfilled or unfulfilled, we used symbols Y or N, respectively. For example, in the case of allergens, there are situations such as:

- There are allergens (soy, mustard, lactose, etc) and these are indicated by a special mention (Y);
- There are allergens (soy, mustard, lactose, etc) and they are marked with special fonts (Y);
- There are allergens (soy, mustard, lactose, etc.) but only some of them are marked by special mention, or special font (N);
- There are allergens (soy, mustard, lactose, etc.), but they are not mentioned by a warning text and no special font either (N);
- There are no allergens and they are not mentioned (Y).

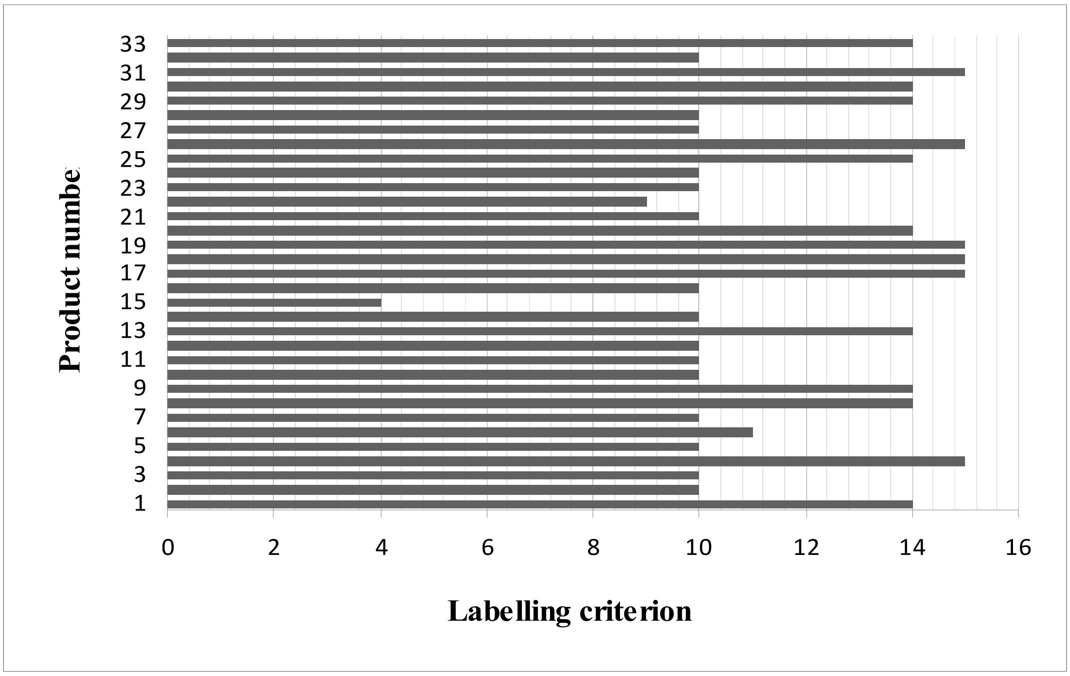
Similarly, the criterion amount of ingredients should note that it is mandatory when food ingredient appears in the name/title, being usually associated with that name by the consumer, therefore it should be emphasized on the label in words, or it is essential to characterize the product and differentiate from others with which it might be confused because of its name or appearance.

This analysis can be done within a product category or subcategory of products (within the same worksheet in Excel) or for all products in a given category (meat), in the particular worksheet named "analysis". This way allows evaluating the compliance of a particular criterion for a particular class of products. A particular interest is the determination of the percentage of products that simultaneously fulfils all eligibility criteria imposed by European legislation at the moment. For this, counting is done by symbols Y or 1 for specific mandatory information criteria fields tracked simultaneously. Query result horizontally for each product type is 1 or 0, meaning total or partial compliance of the applicable requirements.

By summing up vertically the results of evaluations conducted horizontally, it will obtain the number of products that fully comply with the mandatory labelling requirements. By reporting the total number of products, **determine the percentage of products that fulfill simultaneously all the criteria for labelling.**



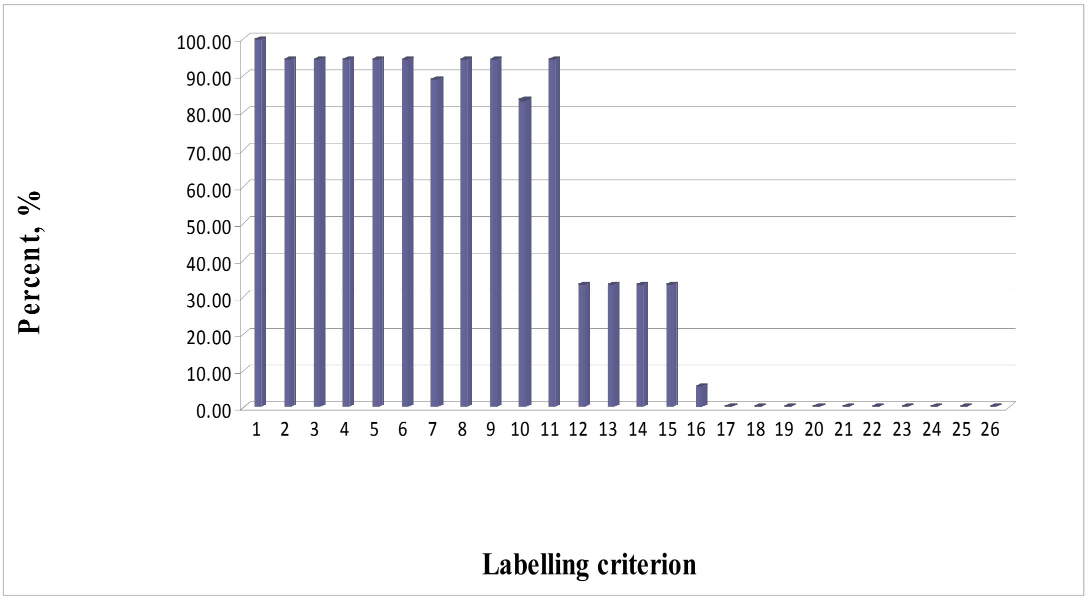
a.



b.

Figure 2 Evaluation results for sausages (a-percentage, depending on labeling criterion; b- product number depending on labeling criterion)

Fig. 2 presents the evaluation results for sausages (a-percentage depending on labelling criterion- how many products fulfill the requirement of a specific criterion; b- product number depending on labelling criterion – how many requirements are fulfilled by a specific product. It can be observed that most of the products fulfills the criteria # 3…11. Just 18% of products respect to the # 2 criterion (allergens) and no products fulfill the requirements of # 16…26 criteria.



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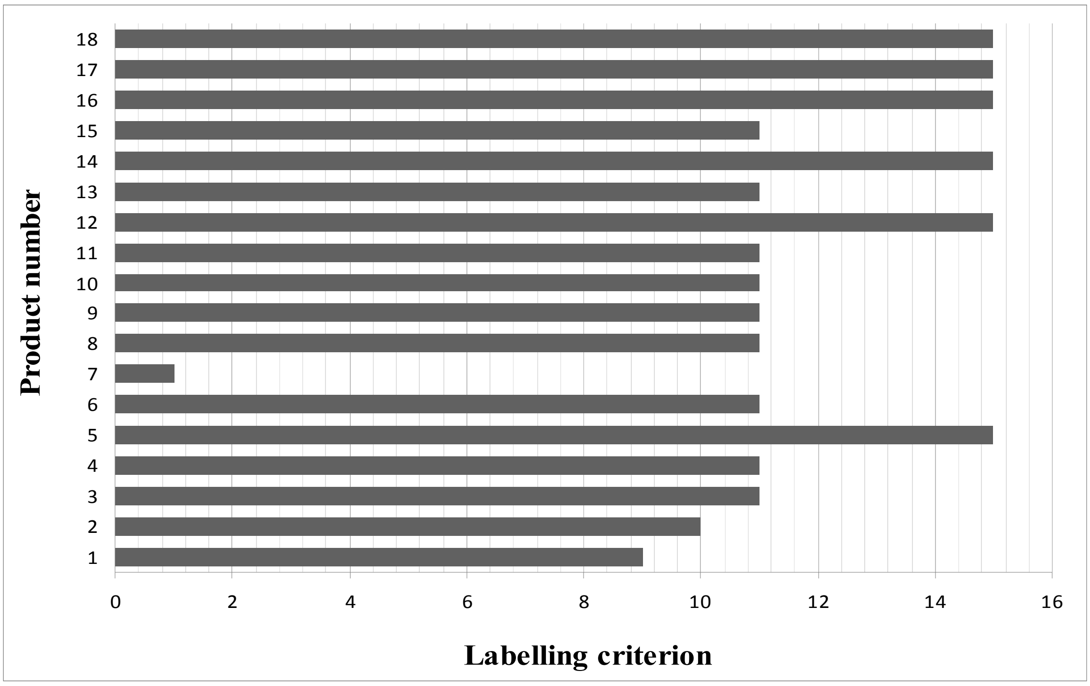

Figure 3. Evaluation results for meat specialties (a-percentage, depending on labelling criterion; b- product number depending on labelling criterion)

In the same manner, Fig. 3 presents the evaluation results for meat specialties (a-percentage depending on labelling criterion- how many products fulfill the requirement of a specific criterion; b-product number depending on labelling criterion – how many requirements are fulfilled by a specific product. Most of the products fulfills the criteria # 3…11 and 6 products fulfill 15 criteria. Just 30% of products respects to criteria # 12, 13, 14, 15 and no products fulfill the requirements of # 16…26 criteria.

The same analysis was performed for the next meat product categories: processed meat, frankfurters, baloney, salami, and liver pates.

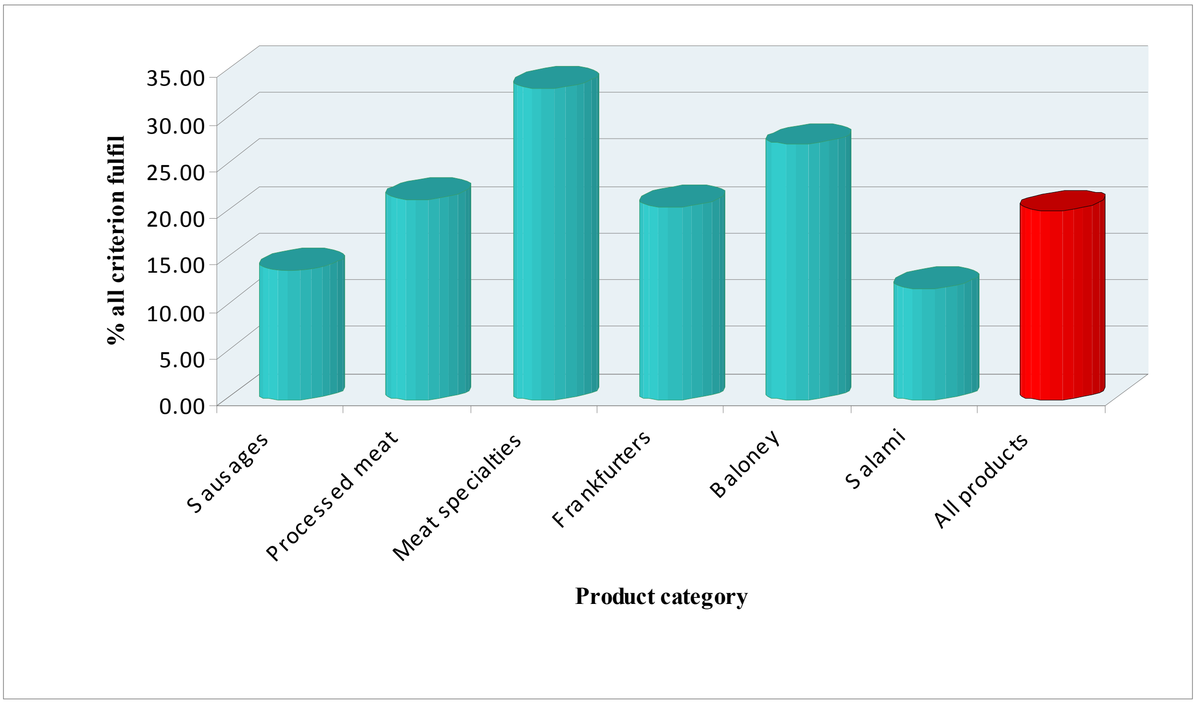

Figure 4 Simultaneous compliance rank of all criteria for each category of product

Fig. 4 shows the case of simultaneous compliance rank of all criteria for each category of by product. It can be noticed that the highest percentage is obtained by meat specialties and, the lowest by salami. The medium values for all meat product is 20.21% that fulfils all criterion requirements. Since there are just 2 liver pates products, these were not taken into account.

5. Conclusions

Nutritional labeling of food in the European Union is very strictly regulated by a number of important regulations, such as: 432/2012, 1169/2011, 1333/2008, 1924/2006. Simultaneous indication of the rank of compliance with all the provisions of these Regulations in a case of a specific product is a challenge for statistical analysis, due to numerous general provisions, exceptions, or particular cases related to the product or region. The proposed methodology aims to complement **information of 28 fields with information** type like text or binary characters 0, or 1, as applicable, and extracting useful information queries performed on rows and columns, using the "COUNTIF". Thereby it is possible to determine the rank of compliance with a particular criterion or the percentage of products that fulfills all of the criteria simultaneously. The proposed method has the advantage of flexibility in interpreting the data, because queries can be made for any number of specific criteria, thus it allows analysis by taking into account the recommendations of potential binding in the future.

Acknowledgement

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www.nutrilabproject.eu (Last accessed 01.15.2014)

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Complex Agricultural Risk Management System: a new information system supporting the claim adjustment process in the Hungarian agriculture

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A B S T R A C T

On annual basis the magnitude of weather-related risks of the Hungarian farmers approaches the 100 billion HUF. It is about 5 percent of the 2200 billion HUF annual gross output value of the Hungarian agriculture. It is a continuous tendency that climate factors are more and more significantly influencing the agricultural crop production. Therefore, reducing the weather risks is an important objective of the Hungarian agricultural administration. For this the agricultural administration is forming risk-management groups for producers by strengthening the liability for their decisions, and providing more significant support by the agricultural administration. This new system is based on two pillars: the first pillar is an extended mitigation system, and the second one is a business-based state-sponsored insurance system. First we describe the agricultural risk management in general, then the "paper-based" coordinated mitigation system launched in 2012, finally the integrated mitigation system being under development. Our study reveals in recent year agricultural risk management which is going through important changes, in particular a significant reduction in its administrative burden for farmers and public administration. The other improvement is the accuracy of agricultural meteorological risk evaluation based on agricultural risk database for public decision-making.

1. Introduction

The agriculture faces a lot of meteorological risks, like drought, hail, frost, flood and inland water. These risks cause losses in a volume of 100 billion HUF yearly on average for the Hungarian farmers (Kemény et al., 2011). The probability of the adverse climatic events will increase due to climate change, so the importance of the risk management tools in the agriculture is growing (de Bruin et al., 2009).

As a response to the challenge of climate change the expansion of the portfolio of risk management tools can be observed not only in the OECD countries (OECD, 2009; Székely and Pálinkás, 2009), but in the developing countries as well (Smith and Glauber, 2012). The development is fundamentally based on simple and complex insurance policies and on systems providing income stability. Canada is the best example for this (Antón et al. 2011). However, it is clear that if a security system is not adequate enough, and there are no detailed accounts of the insurance system performance monitoring, it does not reach the objective, and becomes a costly subsidy for the participants (Mahul and Stutley, 2010). If a risk management system wants to avoid the contra-selection and the shrinkage of the number of members of the risk community it is necessary to build an information technology system with which it is possible to follow the cash flow not only at national or county level, but at the level of small regions, even at parcel-level (Kemény et al., 2013).

The aim of this paper is to describe the situation and the development of the Hungarian agricultural risk management system and the major innovations of the planned new information system, which

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assists the operation of the risk management scheme and establishes the creation of a database that satisfies the above mentioned expectations and ensures the growth of the insurance risk community in Hungary.

2. The major elements of the Hungarian agricultural risk management

Before 2012 the Hungarian agricultural producers could handle the weather risk in two ways: using commercial contracts offered by market insurance companies, and/or using the state-organized National Damage Mitigation Fund (NDMF).

The commercial Hungarian agricultural meteorological risk management market consists of 3-4 insurance companies.

At that time the next four state organizations worked together to operate the NDMF:

- the Ministry of Rural Development (MRD) responsible for the general management of the Hungarian Agricultural Risk Management System (supervision, analysis and planning);
- the National Food Chain Safety Office (NFCSO), as responsible for the general damage assessment;
- the Regional Government Offices (RGO) as an executive member for the field damage assessment, serving NFCSO general activity;
- the Agricultural and Rural Development Agency (ARDA), as responsible for operation of NDMF, the management of compensation contributions and the determination of compensations, payment and accounting of compensation or/and insurance subsidies.

Technical support from other professional organizations, like the General Directorate of Water Management (GDWM), the Hungarian Meteorological Service (HMS), the Institute of Geodesy, Cartography and Remote Sensing (IGCRS) and the Research Institute of Agricultural Economic (RIAE) contributed to this activity only in special cases.

It can be identified that the annual average loss caused by meteorological risks amounted 100 billion HUF, which is ten times more than the volume of the premiums paid to the farmers and of the sum of the NDMF (Figure 1). So only 10 percent of the produced crop was insured or covered by the mitigation fund.

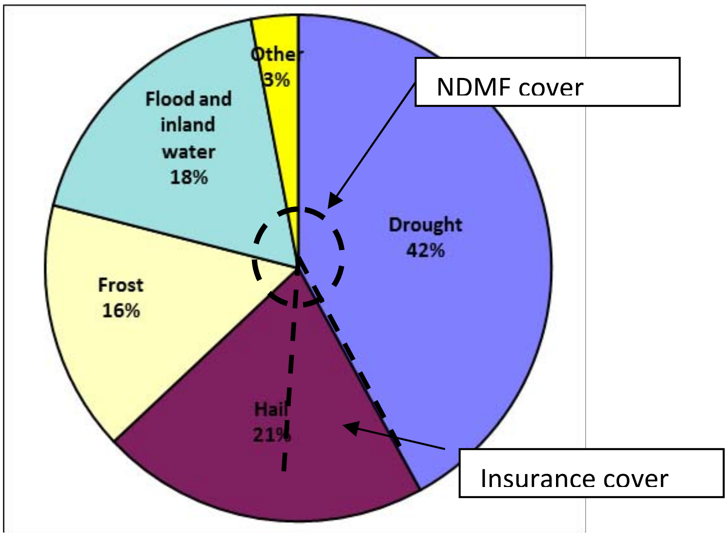

Figure 1. The differences in coverage between the Market Insurance and the National Damage Mitigation System in Hungary *Source: MABISZ, VM*

The market insurance and the NDMF system used different operational principles. NDMF provided protection against all kinds of risks (such as drought, hail, frost, flood and inland water, storm), but it did not guarantee to cover all the losses since the fund always had to be balanced. So when unexpected, major damages occurred, the fund could only reimburse pro rata, in some cases only 10% of the damage could be reimbursed, which did not provide significant assistance to the farmers.

In contrast, insurance companies claimed that they would guarantee to reimburse 90 percent of the damages listed in the contract in any circumstances. Thus the agricultural insurance activity often became unprofitable in a given year. Although this meant valuable assistance for the farmers, due to the indemnification obligations, insurers could not undertake the insurance of risks of great damages, such as drought, flood and inland water.

Therefore a mismatch formed between the distribution of losses caused by risks and the distribution covered risks. The insurance policies covered only the damages caused by hail, but the most important risk was the drought (Figure 2).

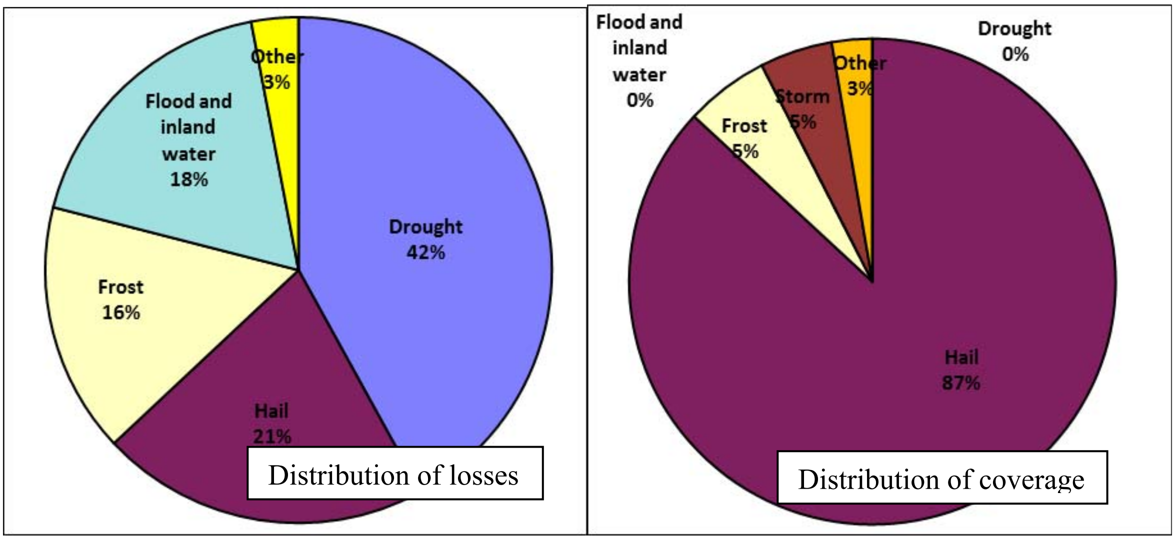

Figure 2. Distribution of losses and coverage of risks by insurance companies in Hungary *Source: MABISZ, MVH*

The data can be interpreted as the underdevelopment of the Hungarian risk management market, so the farmers' income was not enough for purchasing better insurances, and the insurance companies offered mainly hail insurance policies because the other climatic events have a systemic nature which cannot be covered by insurance (MABISZ, 2013).

Because of the unsynchronized operation of the NDMF and the market insurances, the farmers who had covered their risk by buying insurance did not receive any benefit from the NDMF. The risk definitions used by the mitigation system and the insurance policies were also different (MVH, 2013).

All producers could join the compensation scheme voluntarily. The producer had to send the entrance application to ARDA and at the same time had to pay a fee per hectare, which was called payment of mitigation contribution. The damage notification and the damage claim notification had to be reported in person or by mail to the NFCSO or to the RGO. After the reception of the damage notification of losses an official controller visited the site and assessed the actual damage. Based on the site control an official certificate was issued regarding the actual damage. At the end of the year all participants of the mitigation system could submit by mail these official certificates along with damage compensation claim form to NFCSO. The yearly damage compensation claim was a self-assessment of loss of the producers, and it was supervised and checked by the officers of NFCSO. After the official control an additional official certificate was issued about the audited compensation request which was forwarded to ARDA. At ARDA the whole file was checked again, the yield-loss calculations were recalculated, and it was verified that the producer was a registered participant of the mitigation system and that he paid his fees. This was followed by an aggregation, which had to be submitted to MRD. Then in MRD it was decided what percentage of the claim would be paid to the producers, depending on the overall claims submitted and on the amount of the collected mitigation fees. Then ARDA sent the decisions to the producers about the rate of compensation they might expect.

To sum up, the operation of the system was based on overlapping manual administration, the state mitigation system created the duplication of work at ARDA and at NFCSO, it was based on paper administration, the damage assessment was handled by human spot checks, and its operation was not coordinated efficiently by the commercial market insurance policies. As a result this system could be improved in several ways.

3. The items and the operation of the Coordinated Risk Management System after 2012

The reform introduced in 2012 linked the state mitigation and the market insurance together. The new rules were implemented in the Agricultural Risk Management Act.

The first step was making the NDMF (first pillar) membership compulsory for the farmers above 5 or 10 hectares, so the risk community increased to 75 000 members. The size of the mitigation fund has doubled, the mitigation payments of the fund have been linked to the actual meteorological or remote sensing indices characterizing adverse climatic events (Figure 3).

The second pillar is an insurance premium subsidy, depending on the type of covered risk: the multi-peril insurances named “A” covering the drought and frost. The most important risks have priority and are covered by a guaranteed 65 % premium subsidy, the one-risk insurances named “B” and “C” are subsidised from remained sources only (Figure 4).

The two pillars are linked by the unified risk definitions, by the minimal request of meteorological indices on the site of crop losses, and by the disadvantage of not insured farmers in the first pillar by a halved mitigation payment. Due to this and the favorable weather conditions observed from 2011, the producer compensation claims fell significantly.

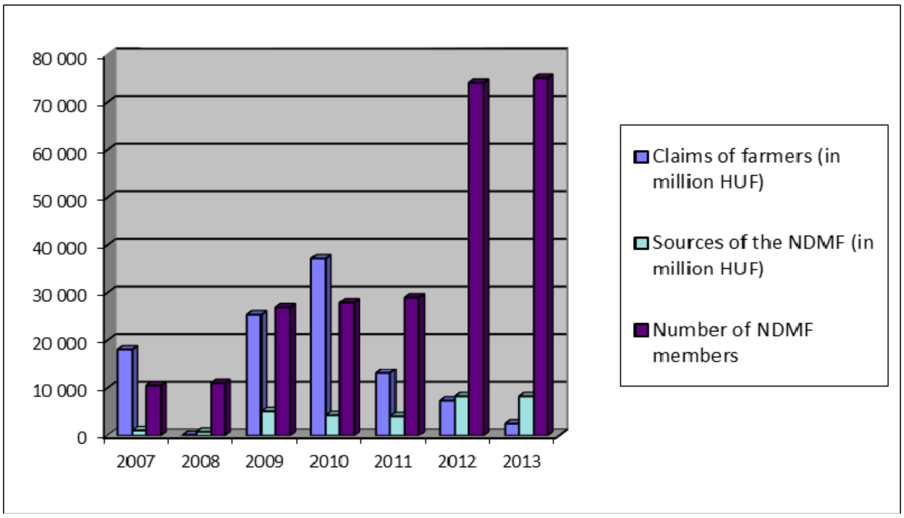

Figure 3. Changes in the claimed damages, the sources of the NDMF and the number of members of the first pillar of the risk management system between 2007 and 2013, *Source: MVH*

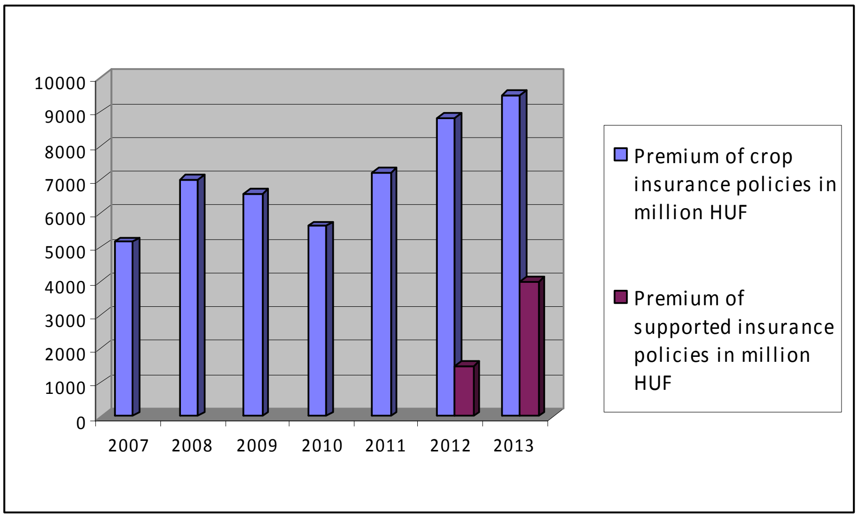

Figure 4. The amount of market insurance premiums and the premium supports of the second pillar of the risk management system between 2007 and 2013, *Source: MVH*

The reform succeeded; the membership of both pillars increased, like the number and premium of insurance policies and the sources of the mitigation fund. In addition the precision of the mitigation payments increased; consequently only the real crop losses were mitigated. The procedure was still based on manual operation and the cooperation among the institutions had to improve (Figure 5).

From 2012 the operation of the mitigation information system has improved significantly: the following professional state organizations GDWM (Basic data services of inland water), HMS (Basic meteorological data services), IGCRS (Remote sensing data services), RIAE (Professional monitoring and analysis of the agricultural production and market) provided accurate continuous service for the damage determination.

It meant further progress that the insurance companies informed ARDA electronically (via email) about the existence of an insurance contract after it was signed with a producer. Insurance certificates for mitigations were also forwarded electronically to ARDA. A major step forward was that the producers could login to the state mitigation system parallel with the generally used Single Application system when filling their claim electronically. In spite of the automated agricultural damage assessment the claim reporting system remained unchanged. The procedure of damage notification, the damage claim notification, and the official damage determination remained “paper-based”, with all its disadvantages. There was no central database, and there was no detailed integrated information about the farmers’ production, the damages and the interrelation between the damages and the weather conditions. Thus, there were only estimations whether the system was working properly and which participants were the winners and losers of the system.

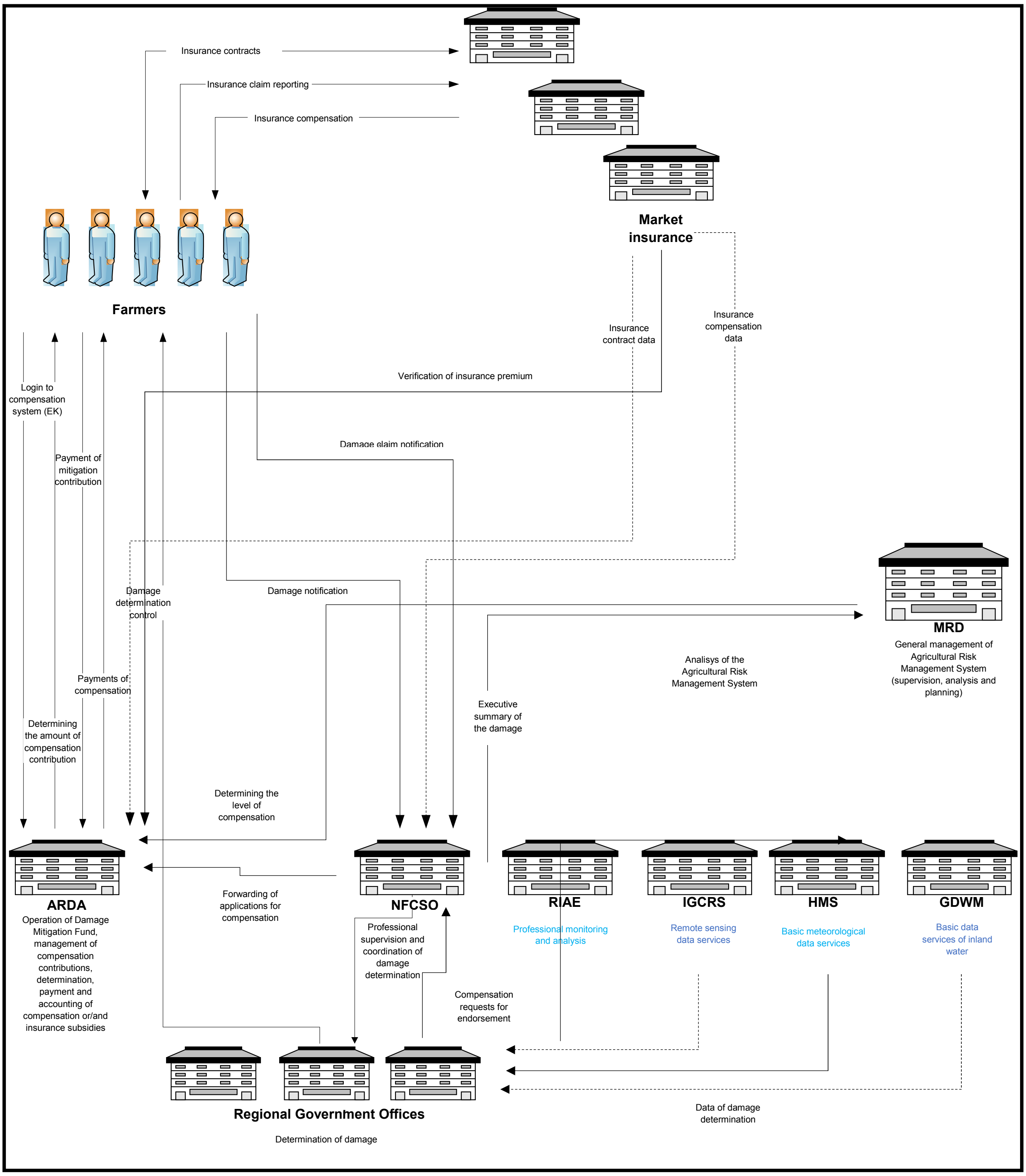

Figure 5. Flow chart of the Coordinated Agricultural Risk Management System (Blue text shows the new activities which support the claim adjustment of the meteorological damages.), S*ource: MVH*

4. The operation of the Integrated Agricultural Risk Management System

The above mentioned Agricultural Risk Management Act described an intensive communication among the different state institutes, the farmers and the insurance companies. Naturally there was significant cooperation among the participants of the system, but the communication was paper-based, without central database, which was characterized by many errors delays and high expenses.

A further improvement could be the introduction of the Integrated Agricultural Risk Management System which could connect the members of the risk management system by a new central information system. The Hungarian agricultural administration tendered to realize this project and won in the Electronic Government Operation Program financed by the European Union.

The project numbered by EKOP 1.1.12-2012-2013-0001 got the name Complex Agricultural Risk Management System. The leader of the consortium has been ARDA which is the paying agency of the Hungarian agricultural sector.

The members of the consortium are MRD, GDWM, HMS, IGCRS and the NFCSO (responsible for damage assessment) and RIAE (responsible for research and development of the agricultural risk management). The consortium cooperates with the Hungarian Chamber of Agriculture (HCA) and RGO, their task is the site inspection of crop losses claimed by the farmers.

The time scale of the project is from July 1, 2013 to June 30, 2014. The financial source is 1.250 billion HUF, the state subsidization intensity is 100 percent.

The project is aiming to develop a central information system operated by ARDA. This system will be linked to the Agricultural Parcel Identification System (operating in ARDA), and all the information sent by the members and farmers will be linked to the same parcel database. The common ground of information will be the geo-informatics, and the information linked to the same parcel will support the official control of crop loss assessment, damage mitigation and compensation paid by insurances and paid by NDMF (Figure 6).

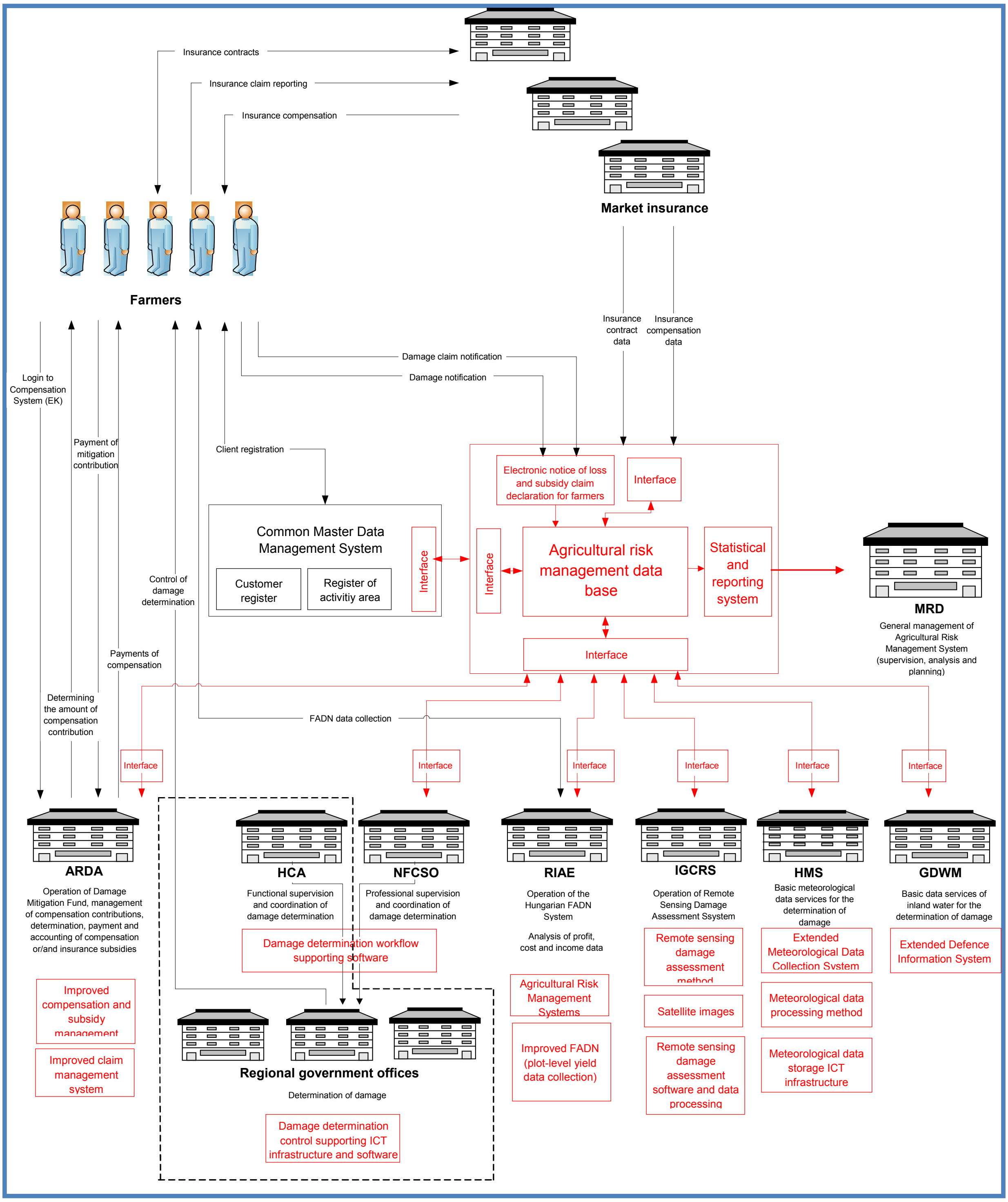

Figure 6. Flow chart of the Integrated Agricultural Risk Management System (Red text shows the new activities and databases of the claim adjustment), *Source: MVH*

The most important elements of the project are:

- Electronic notice of loss and claim declaration for farmers (contact between farmers and ARDA)
- Electronic insurance premium subsidy claim for farmers/insurance companies (contact between farmers/insurance companies and ARDA)

- Electronic notice of official decisions about the damage mitigation and the insurance premium subsidy (contact between ARDA and farmers)
- Business intelligence unit for the members of the consortium (contact among ARDA and other partners, especially between ARDA and the ministry)
- Integrated electronic claim adjustment support with meteorological, remote sensing and water management indices (contact among GDWM, IGCRS, HMS and ARDA, as well as among ARDA and NFCSO and the regional offices)
- Claim adjustment substitution by agro meteorological crop estimating models and by remote sensing maps about inland water (contact between IGCRS and ARDA, as well as among ARDA and NFCSO)
- Site inspection verification by electronic and GIS technologies (contact among NFCSO and the RGO and HCA officers)

After the successful implementation of the project on June 30, 2014, the following results can be expected:

- Significant increase in the number of functional areas covered by informatics (target: complete electronic coverage, only special cases are handled manually)
- Reduction of the required human administration (target: 50 % reduction in administration-time spent)
- Objectively documented, flexible system using retrospective data built up over several years,
- Strengthening the electronic and data cooperation among the professional and state organizations

Accurate assessment of the real improvements can be and will be checked at least after one year of operation in November 2015.

5. Conclusion

The Integrated Agricultural Risk Management project will result in three important changes in the process of risk management in Hungary. Firstly, the administration burden and administrative costs of the farmers, and institutions will decrease. Secondly, the precision of the mitigation system will increase – only the real losses will be compensated. Thirdly, a new database will be created by the Complex Agricultural Risk Management System, which can be the basis of the data needs of the future scientific research in fields of climate change, risk management, water management, irrigation, as well as the data needs of the state regulations.

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Modeling Soil Heat Flux in R

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ABSTRACT

Knowing of soil heat flow properties of a crop field inform the farmer about temperature conditions of seeds germination. Soil heat flow is either measured or modeled. In our study we rely on the procedure developed by Sang-Ok Chung and Robert Horton (1987). With the R language version of their heat flux model we studied on data collected by Gábor Szász (director of the Agro-meteorological Observatory of Debrecen in May 2001.). Soil temperature data were collected in 5, 25 and 50 cm depths in 15 minute intervals from a loam texture chernozem soil covered with short grass. The upper boundary layer at 5 cm and the lower boundary at 50 cm soil temperature data contain 2976 time periods. Using the R programmed heat flux model the 25 cm depth soil temperatures were simulated and compared to the measured ones. Since the simulated and measured soil temperatures differed significantly we assumed necessity of coupling heat and moisture flux for describing time change of soil temperate.

1. Introduction

Information of the heat flow is very important in research of agricultural soils because seed germination, tillering of cereal crops, plant mineral supplementation, plant root growth and respiration, soil microbe life, decomposition of plant parts, soil structure formation, moisture (liquid and vapor) transportation in soil, and soil decay depend on the temperature of the soil.

Soil heat flow today is either measured or modeled (Sándor and Fodor 2012a, Sándor and Fodor 2012b, Sándor, et al., 2013). The first computer models of heat flow in the soil were constructed in the 1970ies (Hanks et al., 1971). In our publication we rely on the procedure developed by Sang-Ok Chung and Robert Horton (1987). The original program was published in FORTRAN language in September 1986 (Hanks and Ritchie, 1991). Although this program incorporates a water flow model too, the procedure description suggests that when the temperature of the intermediate soil layers is to be modeled, this water flow model can be ignored in case measurement data on the temperature of the upper and lower boundary soil layers are available. We translated the original heat flow model into R language (R Core Team, 2013), and examined the model's correctness.

2. Material and method

In the model we used the following thermodynamic terminology (specific heat capacity, density, volumetric heat capacity) and their values (Table 1).

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Table 1. Thermodynamic parameters of certain soil contained materials

Materials	Specific heat capacity ($Jg^{-1}°C^{-1}$)	Density (gcm^{-3})	Volumetric heat capacity ($Jcm^{-3}°C^{-1}$)
Water	4.2	1	4.2
Air	1	0.0012	0.0012
Sand	0.84	2.5952	2.18
Clay	0.92	2.7173	2.5
Mould	1.7	1.6	2.72
Ice	2.1	0.8952	1.88

Under normal conditions, the volumetric heat capacity of the soil is determined by the compositional proportion of its components of which solid components and moisture content are the most decisive.

2.1. Volumetric heat capacity of wet soils

$$C_V = \rho_m 0.84 Jg^{-1}°C^{-1} + N_V 4.2 Jcm^{-3}°C^{-1} + L_V 0.0012 Jcm^{-3}°C^{-1} \quad (1)$$

where:
C_V : volumetric heat capacity (($Jcm^{-3}°C^{-1}$))
ρ_m : bulk density of the soil (gcm^{-3})
N_V : volumetric water content (cm^3cm^{-3})
L_V : volumetric air content (cm^3cm^{-3})

or if air is disregarded

$$C_V = \rho_m \left(0.84 Jg^{-1}°C^{-1} + N_m 4.2 Jg^{-1}°C^{-1}\right) \quad (2)$$

where:
N_m : water content (gg^{-1}).

In view of the above, the Q_q measure of exchange heat in „V" volume is determined by T_1 initial and T_2 final temperatures.

$$Q_q = C_V V (T_2 - T_1) = C_V V \Delta T \quad (3)$$

Volumetric heat capacity is the mathematical product of specific heat capacity and density. For calculating volumetric heat capacity under normal soil conditions, the bulk density of the soil (ρ_m) instead of soil density (i.e. ρ, which expresses the density of the solid parts) is to be considered.

As seen in Figure 1, volumetric heat capacity of the soil grows linearly with the growth of soil moisture content. This value is higher in compact soils (e.g. stubble) than in loose soils (e.g. plow land soil).

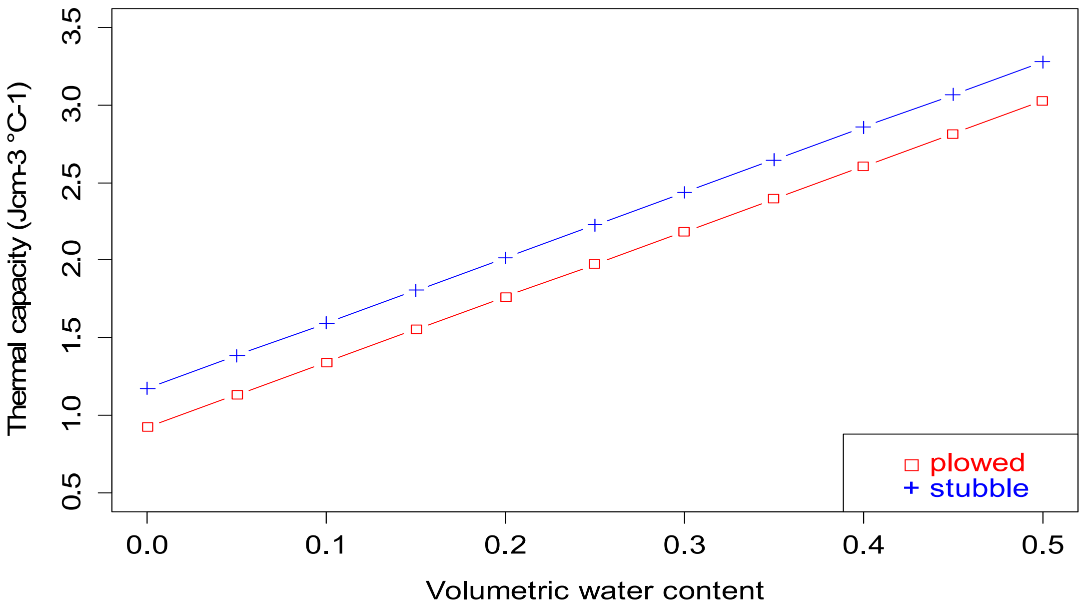

Figure 1. Soil volumetric heat capacity in function of soil moisture content

Soil heat transfer means heat transmission from molecule to molecule with material parts remaining in place.

$$Q_q = -K_q At \frac{\Delta T}{\Delta z} \tag{4}$$

where:
Q_q : quantity of heat (J)
K_q : thermal conductivity (W m^{-1} °C^{-1})
A : surface (m^2)
t : time (s)
ΔT : temperature difference (°C)
Δz : soil layer thickness (m)

The thermal diffusivity of the soil is the ratio of thermal conductivity and volumetric heat capacity, as used in the model.

2.2. Modeling heat flux

Modeling the thermal regime of the soil has two major phases:

1. Energy distribution on the soil surface.
2. Modeling heat distribution and flux in the soil profile.

In this publication we are dealing with the later only.

Heat fluxes in the soil can be described by the following equation:

$$G = -K_q \frac{\Delta T}{\Delta z} \tag{5}$$

where:
G : heat flux (positive, downward) (MJ m^{-2} d^{-1})
K_q : thermal conductivity (W m^{-1} °C^{-1})
ΔT : difference of temperature (°C)
Δz : soil layer thickness (m)

Variable G is determined by the unknown soil surface temperature. To be able to calculate soil surface temperature, the right side of the equation has to be expressed numerically. For this Chung and Horton (1987) recommend the following formula:

$$G = -K_q\left(\frac{T_2 - T_s}{\Delta z}\right) + (T_s - T_1)C\frac{\Delta z}{2\Delta t} \tag{6}$$

where:
G : soil heat flux (positive, downward) (MJ m^{-2} d^{-1})
K_q : thermal conductivity (W m^{-1} °C^{-1})
T_s : soil surface temperature at the given time period (°C)
T_1 : soil surface temperature at the previous time period (°C)
T_2 : temperature of the second soil layer at the antecedent time period (°C)
C : volumetric heat capacity (J m^{-3} °C^{-1})
Δz : soil layer thickness (m)
Δt : time increment (s)

The temperature of the soil surface can be numerically calculated for every time step. For the calculation of the energy balance, James et al (1977) recommended to use the method of algorithmic root-finding.

2.3. Heat flux model in R

The model to be described here represents one dimensional vertical heat flux. The analytical description is as follows:

$$C\frac{\partial T}{\partial t} = \frac{\partial}{\partial z}\left(K_q\frac{\partial T}{\partial z}\right) \tag{7}$$

where:
C : volumetric heat capacity (J m^{-3} °C^{-1})
T : soil temperature (°C)
K_q : thermal conductivity (W m^{-1} °C^{-1})
∂t : time increment (s)
∂z : soil layer thickness (m)

The thermal conductivity of the soil (K_q), however, is not a constant value; it is greatly influenced by the water content of the soil which, in addition, varies by depth and time.

For the estimation of the volumetric heat capacity of the soil we used the 2. equation, whereas McInnes (1981) algorithm was applied for the definition of thermal conductivity. According to the algorithm, thermal conductivity is determined by the bulk density, by the sand content, by the clay content and by the water content of the soil.

To solve the tridiagonal matrix, in their original publication the authors used the Thomas algorithm which is an algorithm applicable to all programming languages, anyway. In our research and calculations we used this algorithm in *R language.* It proved to work perfectly. The algorithm is as follows:

```
thomas=function(w, b){
  n=nrow(w)
for (i in 2:n){
    ff = w[i, 1] / w[i - 1, 2]
  w[i, 2] = w[i, 2] - ff * w[i - 1, 3]
  w[i, 1] = ff
}

#   This is the elimination, the b is the input vector in the right
side, this is the solution vector also.
for (i in 2:n){
```

```
    b[i] = b[i] - w[i, 1] * b[i - 1]
}
# 'Substitution
  b[n] = b[n] / w[n, 2]
for (i in 2:n){
  j = n - i + 1
  b[j] = (b[j] - w[j, 3] * b[j + 1]) / w[j, 2]
}
return(b)
}
```

In an R environment, however, it makes no sense to use the Thomas algorithm, because the built-in linear algebraic equation solving algorithm (solve( )) produces the very same result, once the coefficient matrix is expressed in the form of real tridiagonal matrix.

The testing of the model was carried out on the basis of data of May 2001 acquired from the Agro-meteorological Observatory of Debrecen (director: Gábor Szász). In the Observatory the measurements are made in a soil with short cut grass at three depths (5, 25 and 50 cm) in 15 minute intervals by an automatic measurement and data collecting device. We had soil temperature data compiled from the three soil layers at a total of 2 976 time periods (31 days * 24 hours/day * 4/hours). We used temperatures at the upper boundary layer of 5 cm and the lower boundary layer of 50 cm depth layer. The temperature of the 25 cm depth layer was modeled and compared with the actually measured values.

The soil texture is sandy loam with bulk density of 1.4 gcm^{-3}, 60% sand, 20% clay, and 20% silt content for each soil layer. Based on this, the thermal diffusivity of the layers by McInnes (1981) was found to be $8.7E^{-7}$ m^2s^{-1}.

3. Result

Modeled and measured data are demonstrated in Figure 2.

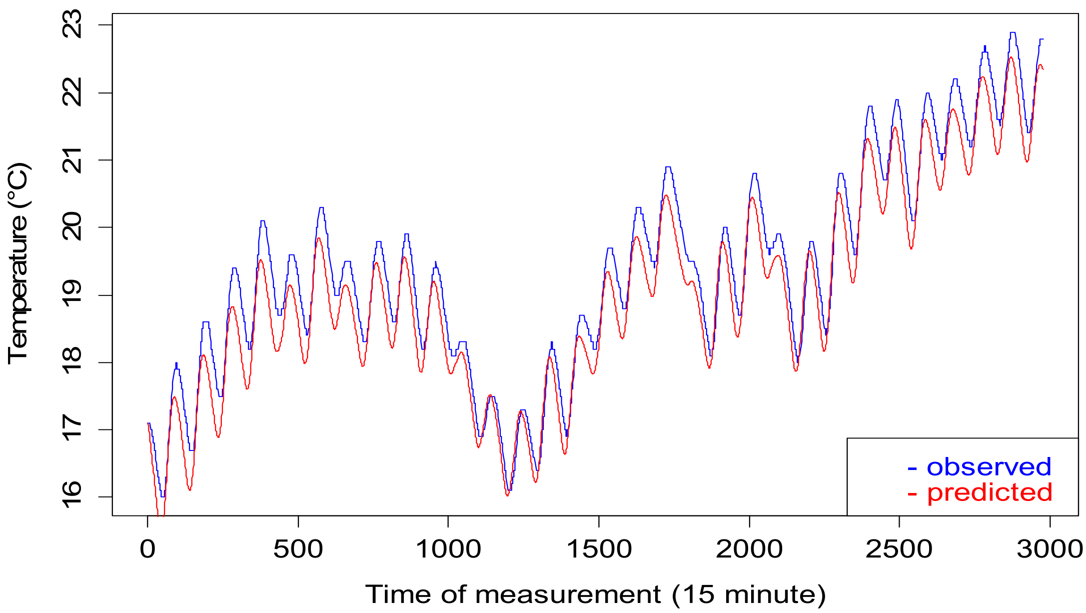

Figure 2. Modeled and measured temperature data of 25 cm depth layer. Debrecen, May 2001; measurements instrumented at 15 minute intervals

The modeled data fit for the measured data well, but the modeled data often underestimate the actual values.

3.1. Correctness of the model

The correctness of the model was defined by the simple statistical analysis of the residuals between measured and modeled temperatures

Deterministic models are considered to be correct, if the residuals between measured and modeled values are

1. Independent;
2. Have normal distribution zero expected value;
3. Are homoscedastic (variances are all uniform).

Figure 3 shows the errors against time. There is a type of fluctuation seen, which is likely to originate from the alterations of the soil humidity levels that keep altering the thermal diffusivity of the soil layers. Since there was no humidity measurement data available, the model was run with a deemed value of 20 vol. % humidity.

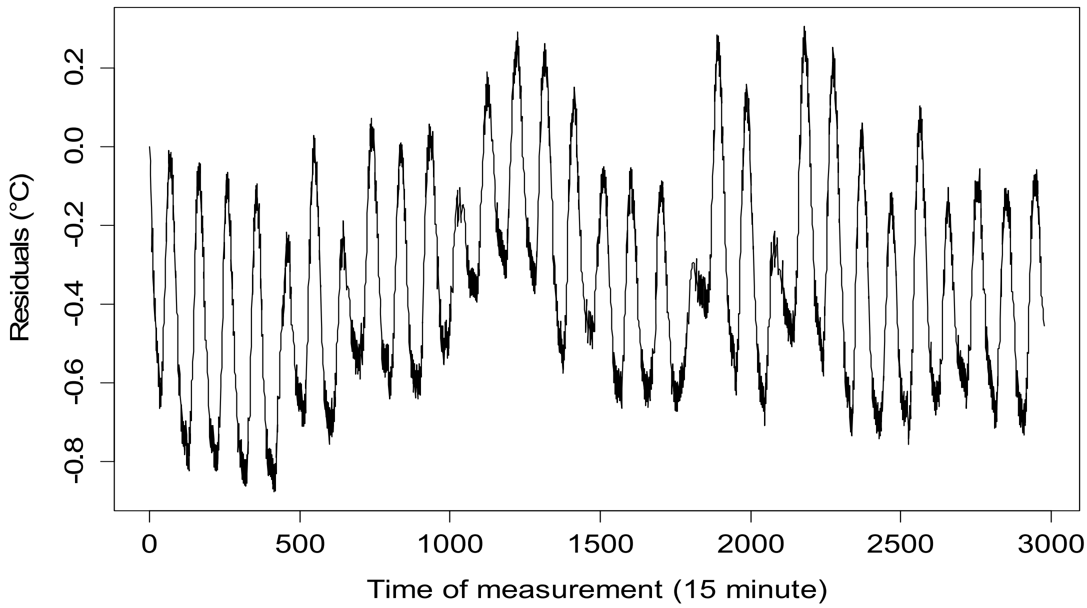

Figure 3. Differences between modeled and measured temperature data of 25 cm depth layer. Debrecen, May 2001; measurements instrumented at 15 minute intervals

The measure of the residuals keeps altering against time, which indicates that the first condition has not been fully met. In addition, there is a daily regular fluctuation pattern observed, which shows a sine rhythm repetition day by day (Figure 4). As a result, during the measured period there were 31 peek points identified.

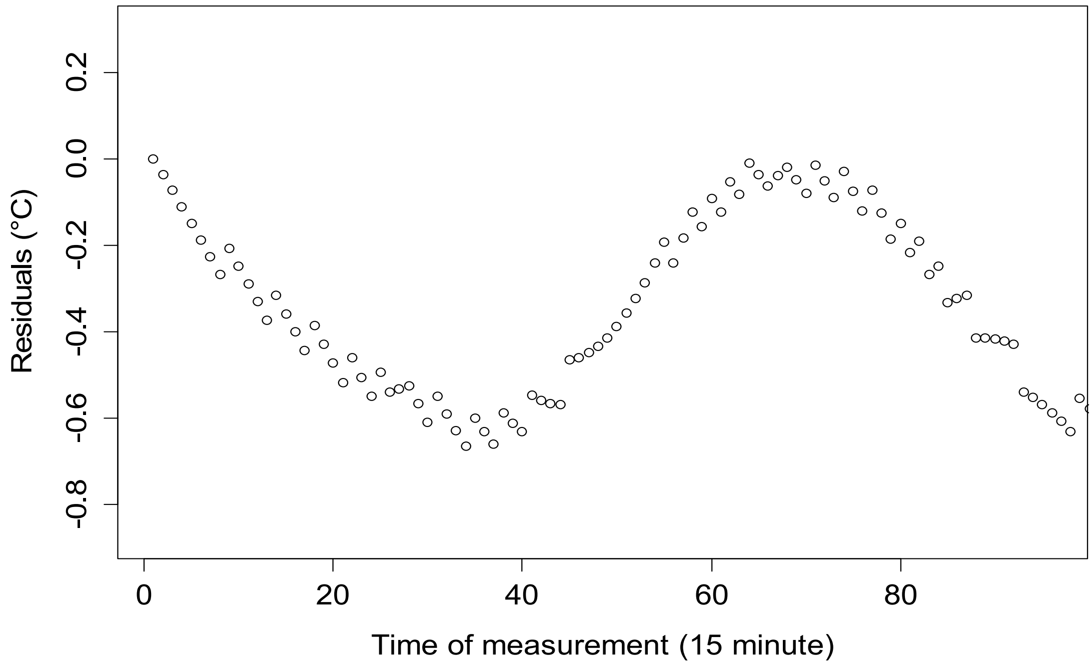

Figure 4. Errors of modeled temperature data of 25 cm soil depth layer.
Debrecen, 1st of May, 2001; measurements instrumented at 15 minute intervals

Axis x in Figure 4 shows 15 minute intervals of measurements; Zero and 40 indicate midnight and 10 am, respectively. The graph reveals the errors of the estimations: the estimated values do not correspond to the measured values in general, in particular the differences between them tend to increase in the time interval between midnight and 10 am, and decrease between 10 am and 16 pm. This is a systematic fluctuation of values.

The histogram of the residuals is demonstrated by Figure 5. Majority of the distribution values fall in the negative field, which is in tune with the above said.

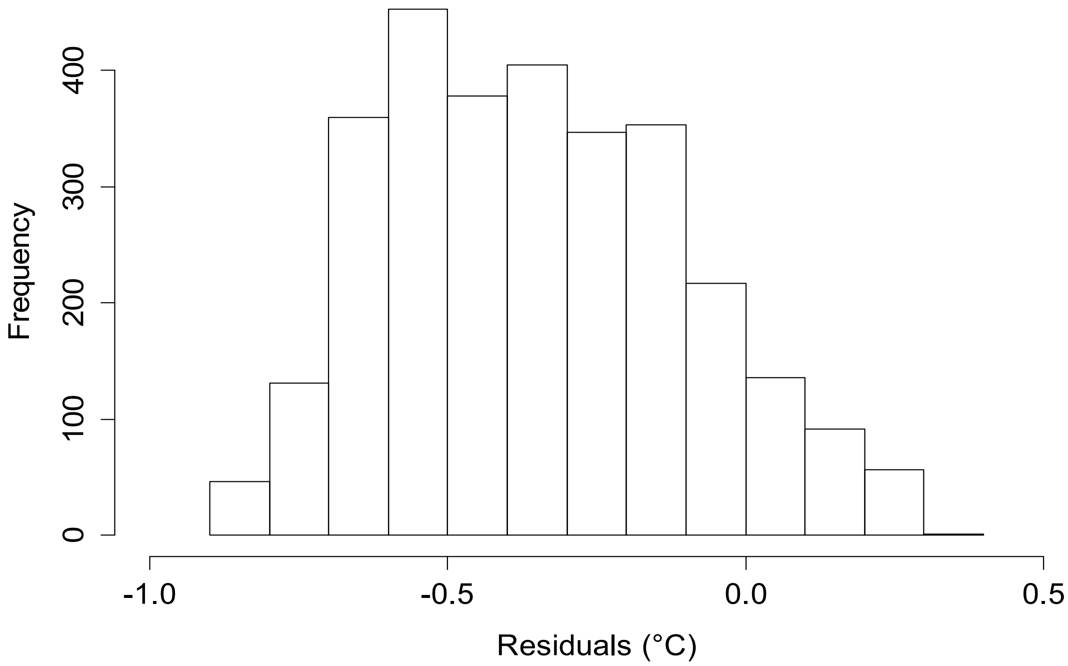

Figure 5. Errors of modeled temperature data of 25 cm depth layer. Debrecen, 1st May, 2001

Single-sample Kolmogorov-Smirnov test shows a non-normal, definitely asymmetric distribution of the residual. The expected value of the residuals is -0.35 °C.

To eliminate these errors, we modified the mode of estimating the average thermal diffusivity, which in the original model was a simple algebraic average. In their publication Horton and Chung notice that geometric methods may be more apt to estimate average thermal diffusivity between two layers, yet, they actually do not apply this method in their model. We tested the geometric estimation method, but it was not found better than the simple algebraic one; it kept having the same errors.

The homoscedasticity of the model is shown in Figure 3. The measure of the fluctuation of the residuals is not a constant value, it is time-dependent.

4. Summary

In our paper we examined the Chung and Horton (1987) model of heat flow and, following the recommendation of the authors, we run it with the exclusion of the water flow model. The original program developed in FORTRAN language was translated into R language and was modeled in an R environment. The temperature of the intermediate layer of a three-layer soil profile was estimated on the basis of the known temperature values of the upper and lower layers. The correctness of the model was tested with statistical methods. The heat flow model ignoring the water flow model produced the following results:

- The differences between observed and predicted temperature values depend on time (changes of soil moisture content), and show a regular daily sine rhythm. The daily rhythm is likely to be caused by the solar elevation and by the movement of moisture in the form of vapor.
- The residuals averages do not show a normal distribution with zero expected value; instead, they show a heavy asymmetry to the left direction. Hence, the instances of underestimation are much more frequent.
- The measure of the fluctuation of the residuals is not constant, either; it is also time-dependent.
- When estimating average thermal diffusivity, no difference between algebraic and geometric averages was found.

The program translated into R language turned out to be much shorter. The Thomas algorithm can be ignored if the coefficient matrix is expressed in the real tridiagonal form; in this case the R solve() function can be used.

Our final conclusion is that because of the strong correlation between water flow and soil temperature, it is essential to make simultaneous estimations of them both when modeling soil temperature.

This model can be used for estimating the temperature of the soil when the installed, vertically placed thermometers get out of order and it is necessary to replace the missing data. In this case the measured data can be used as boundary conditions and the middle temperature can be estimated with less error than any calculated mean.

By this model substituting of missing or erroneously measured data is also possible.

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Creating a Virtual Learning Environment

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A B S T R A C T

Creating a virtual learning environment may be useful to acquire knowledge in some circumstances. A Learning Management System is essential to manage a virtual learning environment. There are numerous steps of creating an e-learning curriculum. In the described three-year international project the goal was to develop an e-learning system with the following logical development scale: (1) Specification of the needs of the target group; (2) Development of the on-line toolkit; (3) Development of the training material; (4) Training of the e-tutors; (5) Development of the methodology to test the training material; (6) Pilot testing on the target group; (7) Accreditation of the modules; (8) Dissemination and promotion activities. This paper contains a brief description of the above mentioned development process which resulted in an e-learning material that can be used to prepare agrarian specialists to prepare for today's modern world and to be a successful member of the information society.

1. Introduction

This paper gives a short summary about three years of e-learning development in an international cooperation. The main goal of the project was to create an e-learning material and its learning management system for e-workers and e-managers which enables them to successfully integrate into the information society.

Learning materials assisting the acquisition of knowledge are created nowadays in several scientific disciplines which are either stand-alone or available through a Learning Management System. Agricultural sciences are no different.

E-learning materials with their learning management systems – mainly based on open-source software – are implemented (Nauris, 2010), examined (Alecu et al., 2011) and used in several agricultural higher education institutes (Herdon, Lengyel, 2008). Since training is essential for the future employee (the worker) and employer (the manager) to become competitive in a rapidly changing environment, the development efforts are backed by EU programmes and funding, like the Leonardo NewCAP project (New European Standards in the Context of Reformed EU Common Agricultural Policy) and the AVARES project (Enhance Attractiveness of Renewable Energy Training by Virtual Reality) (Palkova et al., 2013).

In recent years papers were published about the benefits of the involvement of computers and the internet in education. (Sideridis et al., 2010). Some of the main benefits are as follows: it is student-centred, self-directed and self-paced, interactive and hands-on, flexible, provides consistent and effective training (DNA Analyst Training, 2013). To be able to transfer the necessary information and to achieve success, the range of different technology should be carefully selected by weighing several factors (Gaceu et al., 2010).

It should also be clear that this modern technology is not a panacea, as – for example – the summarizing paper of Workshop on Virtual Learning Environment (Dillenbourg, 2000) states: It has

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some potential effects, although it is difficult to turn it to actual ones, or at least to measure the positive effects. So, there is hardly any scientific proof of the superiority of the modern technologies.

Nevertheless, creating a virtual learning environment may be useful for students to acquire knowledge in some circumstances. What can be considered a virtual learning environment? According to Dillenbourg (Dillenbourg, 2000) it is a designed information space which is not restricted to distance education; it is a social space which integrates multiple tools where the space is explicitly represented, it also overlaps physical environment where the students are not only active, but also actors.

A Learning Management System is essential to manage a virtual learning environment. The task of this system is to identify, to record and to follow the students participating in the educational process and to connect the users to their respective courses according to their roles and competencies (Gaceu et al., 2009).

When creating the learning materials and their learning environment, the learning management system, it is suggested to follow some rules or standards which may more likely lead to success. Depending on the goals to be achieved, the type of the e-learning material, the aspiration level of the tutors (or the development team) and the available technical and financial possibilities there are basically two methods:

- Agile development: In this case the elements of the information systems are created separately and combined, integrated later into a larger system (Munkhtsetseg, Uyanga, 2013).
- Waterfall development: A more preferred method is based on the information system lifecycle processes introduced in IEEE/EIA 12207 "Standard for Information Technology – Software Life Cycle Processes" (Lee et al., 2002). The software development life-cycle can be described in five steps by the waterfall model: (1) Project planning; (2) Requirement definition; (3) Design and development; (4) Integration and testing; (5) Installation and maintenance. The standard defines processes covering the entire life-cycle of a software system from the concept to retirement. The steps are well-tried to develop complex, integrated information systems (figure 1).

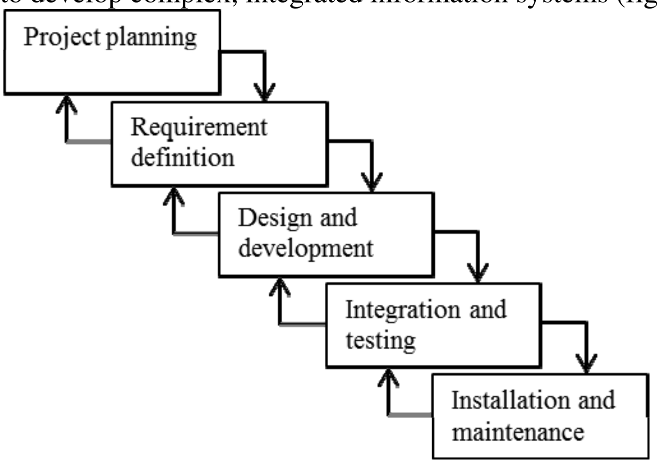

Figure 1. Waterfall model of the software development life-cycle (source: Paulins, 2010)

The ADDIE model (Analysis, Design, Development, Implementation and Evaluation) is a framework training e-learning developers may also use. The model which is a recognized and proven instructional design methodology (Delf, 2013) describes guidelines useful to build effective training and performance support tools (Morrison et al, 2010). The guide to e-learning methodologies published by the Food and Agriculture Organization of the United Nations (Ghirardini, 2011) also recommends the ADDIE model as a suitable methodology to develop e-learning materials (figure 2). Ghirardini draws attention to the importance of the professional roles, the required technology and media related skills of the participants taking part in the development.

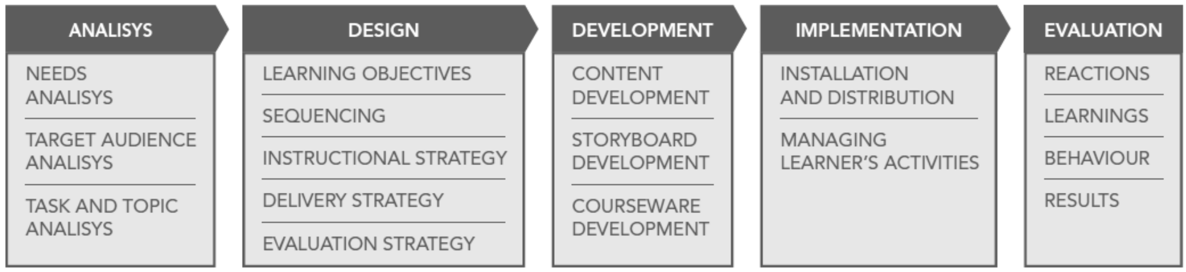

Figure 2. The ADDIE model for e-learning (source: Ghirardini, 2011)

Since we are talking about software, ISO 9126 standard assuring software quality (functionality, reliability, usability, efficiency, maintainability and portability) can be taken into consideration (Al-Qutaish, 2009). Other useful tools and criteria are also available to maintain the quality of e-learning programmes, including the Heuristic Evaluation Instrument and Protocol for E-learning Programs (Benson et al., 2001) or the LMS Evaluation Tool User Guide (3waynet, 2004).

2. The e-material development project

The main goal of the international development project financed by the Leonardo da Vinci programme was to provide practical and useful support for the preparation of small and medium-sized enterprises for working in a virtual environment and to be able to be useful members of virtual teams.

The participants of the international consortium were

- Inno-Motive Nonprofit Ltd., an accredited education institute from Szeged (Hungary) with wide experience in co-ordinating international projects and promoting alternative employment, competency based training and education;
- Bit media e-Learning solution GmbH & Co KG from Graz (Austria) with experience in developing e-learning material and learning management systems and also in providing e-learning content through the web;
- West Lithuania Business College from Klaipeda (Lithuania) with experience in creating, converting and using e-learning materials in higher education;
- Inovaformação – Prestaçao de Serviços de Formaçao Profissional Lda from Matosinhos (Portugal), an international company experienced in promoting innovation, training and supplying advisory services for SMEs and higher education institutions.

The e-learning development concept was based on a logical scale defined by the consortium members built on the waterfall model of software development, but also including the experiences of the Austrian partner in this field (Inno-Motive et al., 2010):

(1) The specification of the needs of the target group;

(2) The development of the on-line toolkit;

(3) The development of the training material;

(4) The training of the e-tutors who help the students to acquire the knowledge;

(5) The development of the methodology for testing the training material;

(6) A pilot testing on the target group;

(7) The accreditation of the modules;

(8) Dissemination and promotion activities to promote the finished e-learning material;

Mainly due to the inclusion of EU funding sources, the project followed a timetable which included several personal meetings and web conferences of the project staff involved to disseminate information, documenting and reporting of progress to stakeholders and, of course, a strict budget. The total budget of the project was 406 753 Euros and the EU funding was 75 percent. The detailed description of these falls outside the scope of this paper.

2.1. The specification of the needs of the target group

After specifying the main objectives, defining the partners involved in the project, budgeting, obtaining the financial support of the EU and the distribution of the different tasks between the project staff, the first thing to do was to conduct a survey.

The aim of the survey was to identify the necessary competencies of the target groups in the participating countries and to explore and summarise the coherence with national training needs of the target groups. The survey involved 200 small and medium-sized enterprises from Austria, Hungary, Lithuania and Portugal. Each partner conducted the survey in its own country. The results were synthetized in a sectorial survey report (figure 3) by the Portuguese Inovaformação. Their findings provided input to determine the specific content of the e-training materials.

Based on the survey results, important competencies could be identified which showed what skills have to be assessed by the on-line toolkit and then developed by the e-learning material. The development of the curriculum was highly based on the survey results.

Competencies of e-workers				
How do you assess the importance of the following competencies of e-workers to work in an e-working environment?				
	Irrelevant	Relevant	Important	Very important
ICT knowledge	0	2	21	27
Quality Awareness	0	2	28	20
Continuous Improvement	0	6	21	23
Customer/Project Orientation	1	9	19	21
Cooperation	0	6	18	26
Reliability	0	0	14	36
Initiative	2	16	21	11
Planning	1	20	19	10
Managing Change	5	14	21	10
Internet Communication	0	2	18	30
Lifelong Learning	2	9	18	21
Independency	0	3	11	36

Competencies of e-workers				
How do you assess the importance of the following competencies of e-workers to work in an e-working environment?				
	Irrelevant	Relevant	Important	Very important
ICT knowledge	1	5	23	21
Quality Awareness	0	6	12	32
Continuous Improvement	1	8	24	17
Customer/Project Orientation	4	4	17	25
Cooperation	0	7	23	20
Reliability	0	2	6	42
Initiative	2	17	26	5
Planning	2	16	30	2
Managing Change	0	11	16	23
Internet Communication	0	2	12	36
Lifelong Learning	0	13	16	21
Independency	0	6	17	27

Figure 3. Sample of survey results of Hungary (top) and Austria (bottom) from the Sectoral Survey Report. Numbers show number of answers. (Source: Inovaformação Lda., 2010)

2.2. The development of the on-line toolkit

The e-learning material has to be tailored to the students' needs and skills, so it is necessary to identify whether he or she possesses the right competencies. To achieve this, a "Competency Tool-Kit" was developed in the co-operation of the Hungarian and the Austrian partner. The tool allowed the identification of the missing competencies: by using the toolkit at the beginning of the e-learning course, a self-assessment can be conducted and the personal development plan can be created, specifying the training needs of the participant (figure 4). Originally the plan was to create an entertaining, game-like tool with graphics, animated cartoon characters and sound, but unfortunately that did not fit into the budget, so eventually the team had to be satisfied with a text-only version.

Figure 4. Sample question and results of the on-line toolkit
(first test version during software development)

2.3. The development of the training material

Twelve e-learning modules were proposed based also on the survey results which would help workers to thrive at work and in life. Three modules, including leadership, change management and performance appraisal were planned explicitly for managers, another three modules were planned for workers which were time management, decision making and problem solving and the other six modules including e-communication, team building, quality awareness, motivation, conflict handling and life-long learning were proposed as shared learning materials for both groups. This task was carried out by the Hungarian coordinator and approved by the project partners.

The curricula were created in accordance with the steps devised by Bitmedia:

Step 1: Shaping up the rough concept: The target of the rough concept was to determine the course structure (table 1), the main principles, aims and the methodological, didactical approach (table 2).

Table 1. The element and the description of the learning modules

Elements	Description
Navigation elements	Bottom left
Layout design	According to style guides
Extras (book marks)	To be defined
Notes-drawer	Yes
Glossary-drawer	Yes
Topics-drawer	Yes
Video-drawer	Yes
Speaker	English
Audio on/off button	Yes
Types of interactive elements	To be defined after finalization of first rough concept
Graphics	Will be delivered by responsible person, processed and animated by Bitmedia
Animations	Approximately 1 animation per module
Self test	At the end of each module
Help	To be activated by a button

Source: Bit media e-learning solutions, 2009

Table 2. Principles, aims and didactical approach of the learning development project

Principle	Aim	Methodical / didactical approach
Practice oriented	The learners are brought up to speed and sensitized to the subject using examples from their everyday work situations.	The learners will be made aware of the relevance and application of the learning material to their everyday work through the implementation of the material in everyday situations etc.
Action orientation	The learners are motivated by interactivity in the learning process which develops their active competence in the application of the material.	Exercises are not only used for checking learners' knowledge, but also for transferring it by simulating situations where decisions and choices have to be made on the basis of actual case studies.
Multimedia stimulation	The learners are stimulated optically and through multiple channels in order to appeal to the different types of learners and to assure their learning success.	Application of graphically attractive and didactically effective visualizations (static graphics and animations and audio).

Source: Bit media e-learning solutions, 2009

A comprehensive time schedule was also set up which contained all essential phases to complete the learning material.

Step 2: Elaboration of the detailed concept: As it represents an intermediate state between the rough concept and the script, this was a time consuming process. The position of the planned screen page within the learning programme, the unit title, the learning steps (screen pages), the design of multimedia elements, the content description (i. e. the learning goal) and the reference on external sources were designed. Developing the rough concept and the detailed concept was performed in collaboration by all members of the consortium on face-to-face meetings and virtual seminars, video conferences. Due to budget constraints and possible cultural differences of the participating countries the partners have eventually decided not to include video recordings of role plays, but have not fully abandoned the idea. Later, in case the learning material proves to be successful, the videos can be created and integrated into the next version.

Step 3: Creating storyboards (script) and visualisation: The script described the structure as well as the set-up of all screen pages of the learning programme. It also contained all the texts on-screen and the description of all the multimedia tools that had to be produced (figure 5). This task was distributed among all consortium members.

<table>
<tr><td>ID: **x_y_z**</td><td colspan="2" rowspan="2">**Title of the page: xxxxxxxxxxxxx**</td></tr>
<tr><td>Template: **Infopage**</td></tr>
<tr><td colspan="2">Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text

Description of graphic/animation: Description / Scribble

Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text Text

Etc..</td><td>Instruction:

The page can be designed arbitrary with text, graphics or animations.

Didactic advice: Do not include too much subject matters -> “appropriate for the screen“.

If there is not enough space for the description of the graphics or animations, use the graphic template.</td></tr>
</table>

Figure 5. Sample from the script template for script writers
(Source: Bit media e-learning solutions, 2009)

Step 4: Transforming the material into electronic format (creating the prototype): The technical realization of the curricula. Since they had the most experience in this field, it was reasonable to entrust the task to the Austrian partner. During the prototyping a drawback has emerged: Bitmedia’s proprietary system was used which would probably make it difficult to disseminate the finished e-learning material in the future. This is problem still needs to be solved.

Internal evaluation and content checks of the materials were carried out in all four steps. The project members evaluated each other’s work. To achieve this, an evaluation handbook (Hampel, 2010) based an e-learning content guidelines, was also accepted beforehand by the partners. The evaluation criteria feedback forms helped the evaluation of the modules before the testing and the finalisation (figure 6).

The multi-language modules were first prepared in English and then they were translated and localized into the languages of the partners: German, Hungarian, Lithuanian and Portuguese. While the translation seemed relatively simple, the developing team had to overcome some difficulties during the localization of the learning material which arose from social and cultural differences of the participating countries.

2.4. The training of the e-tutors who help the students to acquire the knowledge

All project partners have conducted local e-tutor trainings, where the goal was to introduce the concept and to show the developed tools and their use. Twenty tutors were trained, five from each participating country. The teachers became familiar with the tasks of an e-tutor and with methods to use while tutoring the e-learners. After the training the e-tutors were in the possession of the knowledge to assist students while learning the e-modules. This was important because e-learning on its own is usually less effective than “blended learning”.

2.5. The development of the methodology for testing the training material

A good way to test a training material is to measure how well students perform in real-life situations in a simulation after they have learned the content of the course. Therefore, different situations, scenarios were created from real-life cases by the project partners. The generated problems were to be solved by collaboration and by making decisions in a virtual environment with the use of online communication tools.

Evaluating e-content – Questionnaire for the developers and the project management (Page 2 of 4)

Apply a rating from 1 to 5 for each statement below, with 1 indicating total disagreement, and 5 indicating total agreement.

Statement	Rating
1. The content covers all of the objectives of the course, and is it all related to the objectives.	1 2 3 4 **5**
2. The content reflects the real world.	1 2 3 4 **5**
3. The presented information is relevant concerning the target group.	1 2 3 4 **5**
4. The content is accurate and self-contained.	1 2 3 4 **5**
5. The content is practice oriented.	1 2 3 4 **5**
6. The content is action oriented.	1 2 3 4 **5**
7. The tasks are problem-based.	1 2 3 4 **5**
8. The different types of information carriers (text, sound and graphics) are appropriately used.	1 2 **3** 4 5
9. The content is appropriate considering gender, age, race, religion and learning ability.	1 2 3 4 **5**
10. The page layout is consistent and well designed.	1 2 3 4 **5**
11. The text is large enough to be easily read at most common screen resolutions.	1 2 3 **4** 5
12. The used colours are appropriate.	1 2 3 4 **5**
13. The audio and video is understandable.	**1** 2 3 4 5

Figure 6. Sample of the evaluation forms (Source: Hampel, 2010)

2.6. A pilot testing on the target group

A pilot testing was conducted on the prototype of the learning material. The participants were volunteers, representatives from small and medium sized enterprises and educational institutions from the countries of the consortium members. The twenty volunteers (five from each country) formed four groups. First of all they had to identify their own competencies and skills to be developed with the on-line toolkit, which gave them feedback regarding their preparedness. With this input, the participants have learned the material using the e-learning modules before the simulation. The actual simulation started only after completing all the above mentioned tasks.

All the participants of the pilot testing had to make obligation for seven working days and allocate 2 hours of their time every day for online work and some time for homework. During these hours they had to do specified tasks connected to a marketing case of an international company.

After each online meeting every team members had to fill in an online evaluation form. The e-tutor evaluated their performance and made comments regarding the techniques learned in the e-learning material.

After completing the pilot testing, an evaluation was done by the volunteers. Their feedback, the remarks and the experiences of the pilot testing were built into the final e-learning product.

2.7. The accreditation of the modules

Once the local language versions were available, the developed e-learning modules were embedded in the local training plans of the partnering institutions. From that point, all adult educational institutions can officially make the content available in their portfolios. This allows the future expatiation and also provides an opportunity for building new programmes and projects based on the completed curriculum.

2.8. Dissemination and promotion activities to promote the finished e-learning material

Big effort was made to spread the e-learning material after the product was finalized. The necessary information was available in the languages of the project partners. Traditional promotion materials like announcements, newsletters and flyers were designed and were continuously distributed to all sector stakeholders, involving small and medium sized enterprises, educational institutions, human resource managers, vocational education representatives and research and development institutions. Local dissemination seminars were organised by the partners in their countries across all administrative levels and through the associated partners. The project partners also participated in local fairs, conferences and in events organised locally or by the EU Lifelong Learning Programme.

3. Conclusion

It is a known fact that our world is rapidly changing. The economic crisis has a great effect on the business world today. The new, emerging learning methods backed by ICT are essential to effectively acquire knowledge. Using them can prepare learners to accept the fact that modern ICT is essential to acquire information and succeed in business, too.

Creating an e-learning curriculum and presenting it through a learning management system as a virtual learning environment is a time consuming and resource hungry task. It requires a lot of experience from different fields and coordinated work of many people from the very beginning until the dissemination of the finished product. The product is of course, in reality, never finished and has to be improved from time to time.

Professionals working in the agriculture of the future have to be aware of the new requirements and must comply with the challenges of today's modern world. The online toolkit, the e-learning material and its learning management system, which has been developed for three years in an international partnership, may be useful to prepare agricultural specialists for our knowledge-based information society.

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