CHRISTIAN IDENTITY AND QUALITY OF MATRIMONIAL AND FAMILY LIFE

PROJECT OBJECTIVE:

Key points: Croatia takes part in the integration process into European system, it has been its cultural part and part of its spiritual value since ever, but at the same time it’s partaking in the whirl of all globalization processes. Croatia belongs to the group of transitional countries too. Transition refers to the change from traditional to “modern” and “postmodern”, from totalitarian into democratic society. There is a whole range of contradictory attitudes at the same time at the same place. Decreasing nuptial, increasing divorce, low birth and high mortality rate have brought Croatia to the point of extinction. Hypothesis: All processes and changes of values crack on the institution of marriage and family. As family continues to be the first and the most important value with Croats and as church wedding is the most wanted ceremony, following questions are completely justified: does, how does and what kind of religion affect(s) marriage and family in Croatia, and how does it affect the dynamics of its development? How does the graded religiosity cope with the aforesaid social processes? Fundamental assumption is that a conscious and coherent Christian identity positively affects the quality of family life. Objectives: It is necessary to enquiry the quality of matrimonial and family life through cohesion of spouses on values, emotional and existence level.

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On the level of values the religious system takes an important part, respectively it saturates all dimensions of marriage and family. The objective is to learn the cause-effect relationship of the religious coherence and the quality and stability of marriage; childbirth and raising children; causes for the divorce, state of children in the process of divorce; violence partners and against children, adoption. Expected results: a) upgrading and development of scientific expertise of the researchers; b) theoretical intensification and empiric verification of the state of the family regarding the religious coherence c) inclusion of postgraduate into the research work d) devising a family study. Ways of verification: The results will be published and available to public. Importance of research: a) in creating possible quality of the family policy in the society b) church activities family pastoral c) in the search for demographic measures d) it will offer data on the relation of religion and the quality family life to the scientific community e) it will serve as the starting of the developing of a scientific nucleus for Family Institute.

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PIG AND POULTRY GROWTH CHARACTERISTICS AND QUALITY OF PRODUCTS

PROJECT OBJECTIVE:

The objective of the proposed project is to enrich poultry meat and eggs with desirable omega-3 acids and selenium, as well as to preserve them in products through vitamin E. Main research objectives are changing of fatty acid profile, lowering of omega-6:omega-3 ratio, increasing of content of desirable LNA, EPA and DHA, as well as enriching of poultry meat and eggs with vitamin E and selenium. Gained knowledge and previous research results will be used in creation of functional products of pig and poultry meat. In order to fulfil all research objectives, it is necessary to select pig genotypes and poultry hybrids with good growth potentials and high meat yield. It is also necessary to examine growth capacities during fattening, to evaluate biological growth maximums and find out mathematical models corresponding to each animal genotype. In case of applying generalized logistic model, separate research will be carried out into gamma coefficients of asymmetry for different breeds and hybrids. The newest scientific achievements regarding usage of pig genotypes for meat production, and poultry hybrids for meat and egg production are aimed at creating animal products of improved nutritive quality. Feeding of pigs and poultry with selected forages and preparations will result in creation of so called functional food that is highly recommended in human nutrition. Meat and eggs enriched with polyunsaturated omega-3 fatty acids, such as linolenic (C 18:3n-3), eicosapentaenoic (C 20:5n-3) and docosahexaenoic (C 22:6n-3), is preferred by consumers because of its nutritive advantages and health benefits, as stated fatty acids are classified as essentials, thus stimulating functional processes in human organism.

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Meat and eggs enriched with selenium have beneficial effect on human health and are also classified as “functional food”. Although there is no official definition, functional food is explained as food (nutraceutics and «designer food») that influences human health status more efficient than its basic nutritive value (nutraceutics). Furthermore, the aim of this research is to examine antioxidant effect of adding organic selenium and vitamin E in diets fed to laying chickens on their health and on physical characteristics and egg freshness. The amount of selenium contained in eggs will be also examined in order to determine whether there is a potential of producing such enriched eggs for wide consumption.

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EARLY PREDICTION OF PIG CARCASS AND MEAT QUALITY

PROJECT OBJECTIVE:

Pork market today puts in front of pig producers two main goals. One goal is the production of high lean carcasses for retail (as final product) and the second is the production of high quality meat, which can be processed into dry-cured meat products of high market value, such as Slavonian kulen or Dalmatian dried ham (proscutto). Intensive selection directed to fulfilling the first aim has leaded to inability of fulfilling the second one and vice versa. The optimal fattening period of pigs can be determined by prediction of muscle tissue growth. Pigs can be classified into subgroups of slaughtering fatteners on the basis of predicted meat percentage. In that way production return can be improved. Considering the fact that variations in meat quality of pig populations constantly exist, determination of their reliable predictors is a constant occupation of the scientists and producers. Meat carcass and quality traits are linked to polymorphisms at specific quantitative trait loci (QTL); there are also numerous reports about their interactions.

The aims of suggested researches are establishment of coefficients in prediction models by which optimal slaughter time could be determined, i.e. the age of pig when fattening should be terminated. The second aim of suggested researches is classification of pork into quality condition groups on the basis of meat quality traits of live animals (biopsy, QTLs, ultrasound) and early post mortem (pH and EC values, drip loss, color, glycolitic potential, IMF content). Additional aim of proposed research is to establish influence of interaction between selected loci on pig carcass and meat quality.

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Classification of pig carcasses before slaughter can be made by establishment of relation between measures on live animal and shares of particular tissues in pig carcass during growth. These informations can then be used for classification of fatteners into different subgroups and for programming the fattening until adequate (optimal) live weight for slaughter is achieved. The losses in production of pork products which demand raw material of highest quality will be reduced by early classification of pig meat into quality condition groups on the basis of investigations of quality traits on meat samples taken ante mortem and early post mortem. Determination of breed and QTL influence on pig carcass and meat quality traits as well as interloci interactions enable planned production of fatteners for different purposes.

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CORN HYBRID TOLERANCE TO WESTERN CORN ROOTWORM LARVAL FEEDING

PROJECT OBJECTIVE:

The aim of this project is to investigate tolerance of maize hybrids to WCR larval feeding. Field trials would be settled at two locations, with history of high insect pressure, namely on territory of Osijek-Baranya county. In order to determine economic threshold, traps will be used to monitor WCR appearance and abundance. Root damage will be evaluated according to Iowa State Node Injury Scale (0-3), also root size and root regrowth as to the scale 1-6. Plant lodging will be recorded prior to maize harvest. The main objective is to evaluate different maize hybrids and lines grown in monoculture, for tolerance against WCR larval feeding. Recognized tolerant hybrids will be recommended to Croatian farmers, and to maize breeders for further testing.

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Western corn rootworm (Diabrotica virgifera virgifera LeConte), as a new pest of maize in Croatia, was determined for the first time in 1995. Maize producers are unaware of complexity of the problem and not familiar with pest biology and control measures. USA farmers already spend 1 billion $ per year for WCR control measures, mostly on application of soil insecticides. In 2002, at some farms economic damages were recorded up to 70%. Future research work of Croatian scientists should be directed in developing WCR resistance breeding programs. Creation of tolerant plants is considered as one of the main acts in integrated pest management and all for the purpose of production of food with reduced amounts of pesticide residues and environmental protection in general. Identification of tolerant maize hybrids represents priority in maize production in areas with high insect pressure whereas most of the producers are unable to rotate crops therefore growing maize in monoculture shows great economic importance. Research will be conducted in collaboration with breeding scientists in order to develop new tolerant maize lines and hybrids to western corn rootworm.

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IDENTIFICATION OF ECONOMIC ACTIVITIES IN A FUNCTION OF RURAL DEVELOPMENT

PROJECT OBJECTIVE:

Croatian economy, being one of the strongest and, in market terms, one of the most developed economies in the South-East Europe, has the potential for transformation of overall economy into a modern and development-oriented whole through transformation of economic activities. Even better conditions for further economic development have been created by obtaining the status of a candidate country and by starting negotiations for EU accession. Starting from the known orientation of Croatia toward international integrations and international surroundings, main guidelines of the current trends dictated by the CAP and rural policy of the EU are important cornerstones that should be respected while developing the strategy for integrated rural development.

Although agriculture is the main activity in the rural area, because its main purpose is – food for population and supply of other agricultural products and raw materials, underdevelopment of this area cannot be based only on this activity.

In order to test and confirm this hypothesis, the project will research issues like:

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How social and economic changes on farms, in addition to their negative effect, also provide opportunities for smaller number of vigorous farms for modernization of agriculture; and modernized agriculture, in spite of improvements and decreasing number of people employed in this sector, still creates new jobs in its immediate environment, rural regions.

One of the possible development alternatives is to stimulate growth of the so-called new farming. Such alternative on farms possessing labor and capital can more quickly develop processing and trade in immediate relations with buyers. Such type of management in agriculture would employ more people than primary production, and it would result in greater material benefits. Rural tourism, which has been in its infancy for long time, has similar effects, although in more prosperous times it could provide an additional development opportunity for many. Such approach can also be treated as a support of integrated development of rural areas, and it involves overall economic, social and cultural progress of a certain rural area and community living in that area, including also preservation and improvement of environment.

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One of the crucial functions of the plant cell is its ability to respond to the changes of environmental factors. The abiotic stress causes disturbances in normal physiological processes in all plants, including economically important crops. Stress in plants generated by the adverse environmental influences is based on the oxidative stress, due to the increased production of free radicals that lead to lipid peroxidation, protein and nucleic acid damage, resembling the animal cells. As a result, a productivity reduction and damages of various intensities occur in non-tolerant organisms. A wealth of knowledge and expertise of the laboratories and scientists in this scientific field respected on European and world level, clearly indicate the potential to use molecular tools as early warning signals of possible damage to plant species exposed to adverse environmental conditions. A lot of functional metabolites that activate and/or accumulate in tolerant plants as a stress defence instrument, have equal importance in human health and become increasingly interesting quality factor (as for example protein and lipid content and composition, synthesis and activity of antioxidative components, microelements concentration).

The research of the mechanisms in plant response to unfavorable abiotic factors in the environment shall comprehend the plant reaction (from molecular to crop level) to the osmotic and salt stress, extreme temperatures, toxic components in the environment (heavy metals), light intensity and quality, mineral nutrition disturbances, in the controlled and field condition as well. The stress intensity level shall be defined by the proportion and functionality of assimilative area, the organic matter accumulation, mineral and organic plant composition. The analyses of the specific metabolic changes during stress (the activity of antioxidative enzymes: peroxidases, catalase, glutathione reductase; the lipid peroxidation level), the accumulation of primary and secondary metabolites (amino acids, glutathione, vitamins and other secondary metabolites relevant to plant resistance and human health) as well as free radicals detection and signal transduction in stressed plants should make a contribution to our better knowledge of plant stress tolerance potential. The results of proposed investigations could be utilized in a targeted selection of resistant genotypes and implemented in crop yield and quality increment.

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MODEL FOR ASSESSING THE LAND SUITABILITY FOR PERMANENT PLANTATIONS

PROJECT OBJECTIVE:

Model for assessing the soil suitability for permanent plantations is based on geographical determination of natural conditions and physical-chemical soil properties. On the territory of the east Croatian vineyard areas (Baranja, Erdut-Dalj-Aljmaš, Virovitica-Slatina, Daruvar-Pakrac, Đakovo, Kutjevo, Požega-Pleternica, Fericani-Našice, Nova Gradiška and Slavonski Brod) the soil samples will be taken with pedological sonde on a number of locations (number of locations depends on approved financial assets), of different exposition and over 110 m of above sea level height, by the depth of 5-7 m, to determine the solum depth, ground water stream level, as well as physical-chemical properties of the rock substrate. The parcel’s geographical position and its above sea-level height will be determined by GPS. On each location samples from two depths (0-30 and 30-60) will be taken with the sonde with 25 thrusts for each soil sample which will be analyzed for following physical-chemical properties: humus, acidity (actual, exchangeable and hydrolytical reaction), CaCO3, AL-P2O5 and AL-K2O, Fe, Mn, Zn, Cu, Mo, Ni, Cd, Hg, As, Co, Pb and Cr, CEC and BS%, mechanical content, density and hydropedological indicators (pF 0.33, 2.5 and 4.2, soil retention capacity, and also water infiltration).

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Climate data will be gathered from the nearest meteorological stations and the erosion risk will be determined, depending on inclination, soil texture and structure, solum depth, climate data, as well as on variety and type of the permanent plantations and their requirements for water. Relational base will be created and, by the means of the computer programme developed for this purpose, the requirement will be determined for meliorative fertilization, regulation and other land restructuring measurements, or, in other words, for each parcel/terrain/position the suitability for permanent plantations and their requirements will be determined for meliorative fertilization, together with suggesting the required measures and advices for removing the limitation factors. Proposed model for determining soil suitability is congruent with the model of developing vineyard land-registry of Republic Croatia (in making), and it also supports processing digitalized ortophoto snapshots, digitalized land-registry plans and other basis, during which a proposed GIS system can be linked to Grape and vine producers registry.

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THE EFFICIENCY OF TECHNICAL SYSTEMS AND ENVIRONMENTAL PROTECTION

PROJECT OBJECTIVE:

The use of highly sophisticated agricultural machinery is one of very important factors in the sustainable agriculture. The proper use of agricultural machinery and a quality organization of service preventive maintenance significantly decrease the costs of agricultural machinery within the total production costs. They also increase the reliability of machinery, the quality of the final product and on the other side reduce the negative influence on the environment. The proposed researches follow the above mentioned in the search for the design of new organizational models of service preventive maintenance, monitoring the engine condition through the oil analysis, the biodiesel use, the model of organization and management of waste oil and this all with a minimum of negative influence on the environment.

The aims of the proposed research are as follows:
- higher reliability, efficiency and a longer lifetime of agricultural machinery
- less oil consumption
- biodiesel use by present designs of diesel engines when the limit values should be defined for the blend which will have no aggressive impact on the parts it passes through
- lesser emission of harmful substances in harmful gases
- lesser energy consumption
- lesser dependence on the export of energy resources
- environmental protection
- preservation of natural resources

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The research is expected to provide a better organization of service preventive maintenance, reduced oil consumption and consequently a lower amount of used oil. It is expected to introduce the exploitation of biodiesel fuel by the present diesel engine designs, in which case the percentage of biodiesel within the blend with a fossil fuel should be determined; this percentage of biodiesel will have no harmful impact on the parts it passes through. The aim is also to achieve a lesser emission of harmful gases. Furthermore, the purpose of the proposed project is to control, organize and manage used oil in the way of environmental principles.

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SOIL CONDITIONING IMPACT ON NUTRIENTS AND HEAVY METALS IN SOIL-PLANT CONTINUUM

PROJECT OBJECTIVE:

The aim of agricultural production is economically efficient production of quality food on ecologically acceptable way. The main hypothesis of this scientific project is that organic fertilization and soil conditioning, with goal of reaching the optimal soil pH reaction and nutrient availability, significantly increase the soil fertility, decrease transfer of harmful elements into food chain, influence the product quality and yield level, contribute to the environment preservation and production efficiency. Research plan includes field experiments with combination of liming, organic and mineral fertilization, vegetative experiments in pots with Croatian wheat varieties, economic analyses of all experimental vegetation, and also the programming of computer models. After choosing the experimental sites regarding to soil analyses, different fertilizing experiments, including the organic fertilization, will be conducted during 5 years period on 6 sites overall in east and midland Croatia. Before starting, and after conducting certain experiments, the soil properties will be analyzed (acidity, CEC, organic matter, available phosphorous and potassium, micronutrients and harmful elements), and by analyzing plant material and measuring crop yield, the removal of the same elements will be determined. By experiments in pots the analysis of Croatian wheat varieties will be conducted, with regard to phosphorous use efficiency and accumulation of micronutrients and harmful elements in grain.

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All soil and plant data will be used in creation of computer model for predicting and analyzing nutrients availability in soil, concentration of the analyzed plant nutrients and harmful elements in above ground plant part and grain. Application of the planned research results can be expected in scientific and expert sense. The results of uptake and translocation of phosphorous, micronutrients and harmful elements could be used in breeding for creating varieties suitable for a certain types of soil and growing technology (organic or mineral fertilization). Liming and fertilization efficiency, with regard to soil properties and yield level, will be used for improving existing computer programmes for developing fertilization recommendations, but also for choosing the optimal wheat cultivars with the aim to achieve optimal concentration of micronutrients and minimal concentration of harmful elements in wheat grain as a significant contribution to healthier food production.

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ROLE OF WEEDS IN DISEASES
EPIDEMIOLOGY OF ARABLE
CROPS

PROJECT OBJECTIVE:

Weeds as parts of spontaneous flora, but also cultivated plants when not being competitively grown, are being objects of scientific interest. The interest in weeds is raised through gaining knowledge on their role in epidemiology of cultivated plants. Weeds can be transitive hosts and can enter a life cycle of a pathogen. They are also alternative hosts, and such term refers to each plant besides the main host. Besides main hosts, weeds as alternative hosts can be also infected and can develop reproductive organs, which significantly increases infectious potential of a pathogen during the vegetation of a host. They also develop reproductive structure, which enables survival of a pathogen independently of a main host which is not planted on a field. From epidemiological point of view, it is obvious that weeds as alternative hosts act as a connection among vegetation, hosts and locations. Previous researches proved that weeds host pathogenic fungi which cause diseases on wheat, barley, sunflower, soybean, and other cultures. Within the framework of sustainable agriculture and integrated biological plant protection, efforts are made to investigate micropopulation as a bioregulator (micoherbicide) of some weed species. Based on the gained knowledge, objectives of planned research are: a) to advance knowledge on micropopulation which is common for weeds and cultivated plants, b) to evaluate infection intensity on their habit

and to examine pathogenic impact of the most important species on alternative hosts and cultivated plants, c) to study fungi preservation in field and laboratory conditions, d) to continue with researches into Colletotrichum coccodes for the purpose of biological control. Results of proposed researches should provide information on the importance of weeds and disease occurrence on cultivated plants. They will also contribute to general knowledge on micropopulation in Croatia (biodiversity), and on pathogens that can be used as micoherbicides. Research results can be checked by other scientists if using the same scientific methods, and performing them on the same pathogenic fungi, same plant and weed species and in similar agroecological environment.

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FUSARIUM HEAD BLIGHT AND DON CONTENT IN GRAINS AND MEAL

PROJECT OBJECTIVE:

Fusarium head blight on wheat and barley is the most dangerous disease of these cultures throughout the world and causes great losses with respect to yield and quality. This disease is caused by a great number of Fusarium species, among which F. graminearum and F. culmorum are to be emphasized. Fusarium head blight occurs each year, having either stronger or weaker intensity, and causing decrease in grain number and mass. Moreover, consequences of head blight are decomposition of starch granules, protein and cell membranes, as well as contamination with micotoxins. F. graminearum produces 14 different micotoxins (Marasas et al. 1984), one of them being deoxynivalenol (DON). According to some authors, DON is the most spread and the most important micotoxin, and according to FAO evaluations, more than 25% of cereals worldwide are contaminated by DON. Feeding of animals with food with increased content of DON causes changes in their mouth cavity and growth disorders. In humans, intake of such food results in acute poisoning, being symptomized by nausea, vomiting, gastrointestinal changes and headache. All isolates of one species are neither equally pathogenic for particular plant or its part, nor do they produce micotoxins in equal amounts. Weeds are also sources of inoculum for cultivated plants. It is assumed the spectrum of weeds which host Fusarium species is much wider than yet known, as infected weeds do not exhibit macroscopically visible symptoms.

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Based on the previously obtained research results, project objectives are: to determine Fusarium species that cause head blight on wheat and barley in Croatia, to isolate and determine Fusarium species from weeds and corn residues, to check pathogenicity of F. graminearum and other isolated species for wheat and barley heads, to determine their influence on yield and to determine their capability of different F. graminearum isolates to produce DON, as well as differences in percentage of infection and amount of produced DON in natural and processed grains and in flour. Research results will provide information on Fusarium species as casual agents of head blight in Croatia, on alternative hosts and their role in disease occurrence, on toxicity of F. graminearum isolates, i.e. amounts of DON contained in cereals and wheat flour compared to maximum allowed DON content as of the Regulations on toxins, metals, metalloids and other harmful substances that can be contained in food (Official Journal 16/05).

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STUDY OF REDUCED TILLAGE AND NITROGEN FERTILIZATION FOR W. WHEAT AND SOYBEAN

PROJECT OBJECTIVE:

In our plant production conventional soil tillage based on ploughing prevails, and leads to high intensive plant production with high and stable yields and with high income per arable units. On the other side, that kind of plant production becomes ecologically hazardous, organizationally complicated, financially expensive and energetically consumptive, bearing a great deal of negative destructive processes on soil mechanical, physical, chemical and biological properties. Beyond reduced soil tillage in wide comprehension represents a general trend, and provides quite different technology and amendment of the ecological conditions in the soil, reduction of costs and energy consumption, shortcut of organization in agro technical practice, and avoidance of ecological risks. Recommended investigations of reduced soil tillage and nitrogen fertilization for winter wheat in crop rotation with soybean, had been implemented in our agro ecological conditions, in the area of Barania (lessive soil) and Slavonia. The trial is carried out in 2006/7 to 2010/11 period. The main factor A – tillage variants for the both crops:

A1) Conventional tillage–outumn ploughing (25–30cm), diskharrowing, seedbed preparation, sowing, for both crops in more-year sequence; A2) Diskharrowing for both crops, in more-year sequence, the others as A1; A3) Diskharrowing and chiselling (30–35cm) for both crops in more-year sequence, the others as A1; A4) Diskharrowing for wheat, and conventional for soy., the others as A1; A5) Conventional for wheat, and diskharrowing for soy., the others as A1; A6) No-tillage for wheat, conventional for soy., the others for soy. as A1; A7) Conventional for wheat, and No-tillage for soy., the others for wheat as A1; and A8) No-tillage for the both crops in more-year sequence. Subfactor B – nitrogen fertilization (kg/ha) in three levels for winter wheat: N1=120; N2=150; and N3=180, and for soybean: N1=30; N2=70; N3=110. Fertilization by P and K will be unique, as: 120 kg/ha P$_2$O$_5$ and 80 kg/ha K$_2$O, as artificial complete mineral fertilizer 10:30:20. The field trial is derived towards to split-plot design, by randomized blocks in four replications. The basic tillage plot is 540m$^2$, and the basic fertilizing plot is 165m$^2$ (5.5x30m), therefore, field trial is 8 ha. The prime goal of the experiment is to make a cheaper plant production and retain good mechanical, physical, chemical, biological soil properties.

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OVERCOMING LIMITS FOR MAIZE GROWING ON ACID SOIL BY FERTILIZATION AND BREEDING

PROJECT OBJECTIVE:

Soil acidity is one of the most prevalent problems in production of food because at least 40%, and by some estimates as much as 70% of the world’s arable land is affected. It is increased pressure to produce more food for the expanding population of our planet. For example, it is estimated until 2025 population 8,303,000 or 48% higher in comparison with status 1990. Also, it is needed to increase cereals yields from 2.5 t/ha (today status) to level of 4.5 t/ha. For this reason, need is to better using of existing arable land, including acid soils, and inclusion of marginal areas (limited by abiotic and the other stress factors) for food production.

The investigations are planned under field (fertilization experiments: liming and ameliorative fertilization with phosphorus and potassium; testing of maize genotypes on acid and limed soil) and laboratory (chemical analyses of soil, leaf and grain samples) conditions. It is planed testing maize properties as follows: grain yield, concentrations of 23 elements in soil and plant (phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, molybdenum, boron, cobalt, strontium, arsenic, cadmium, barium, mercury, lead, chromium, nickel, selenium, sodium and aluminium).

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In the 2006 is planned the field experiment including the experimental and commercial maize hybrids on acid soil (pH in 1n KCl about 4.0). Part of this soil will be limed to near neutral pH and maize genotypes will be grown in duplicate and four replicates for each treatment. After three years of testing the hybrids will be ranged in tolerant, moderate tolerant and susceptible to soil acidity based on criterion percentual yield increase on limed plot.

In the period 2006-2010 we have plan to continue investigations of the earlier conducted five field experiments (three experiments with liming and two experiments with ameliorative phosphorus and potassium fertilization). Because of need for rotation, maize is planned for growing on three experiments every year.

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CULTIVATION OF *GALEGA ORIENTALIS* – NEW FODDER LEGUMINOUS PLANT IN CROATIA

**PROJECT OBJECTIVE:**

Lack of proteins in stock-feed and a decrease of soil fertility are important issues in the world and in our country, and they seek for solutions. One of the new strategies is more rational production and use of leguminous plants. In our leguminous plant cultivation there is an unnecessarily high consumption of expensive mineral nitrogen fertilizers. However, precisely leguminous plants, which have significant amounts of proteins in their yields and because of that need greater amounts of N, can gratuitously obtain larger portion of that necessary nutrient from the atmosphere by means of biological fixation, provided that they live in symbiosis with an effective strain of their symbionts, N nodule bacteria. For above mentioned reasons, recent numerous and extensive studies worldwide include less known plant species which have the ability of symbiotic relationship with nodule bacteria. One of those is galega, new perennial fodder leguminous plant which lives in an effective symbiosis with *R. galegae*. It has been intensively studied worldwide, precisely for promising growing potential of its host – *Galega orientalis* Lam. Main advantage of cultivation of galega, compared to other fodder leguminous plants inoculated with highly effective strains of *R. galegae* is almost exclusive use of symbiotically fixated elementary N, and not N from mineral fertilizers or from little doses of «initial» mineral N up to 40 kg/ha.

Galega as a new leguminous plant, is interesting because of its longevity (7-15 years); it is a promising plant because of its endurance and resistance; it is one of the earliest leguminous plants, it comprises high quality proteins; presents an excellent choice of stock-feed, whether it is used in green form, as pellets or as hay; it provides exceptional quality silage, either ensiled alone or in combination with other leguminous plants; it can be used as a feed for every sort of domestic animals, including poultry; it is an excellent crop for pasturing bees; its grain yield is 3-6 times higher than lucerne’s; its fertilization and seed cost is exceptionally low; its production is simple and economic. The aim of presented research is cultivation galega inoculated with adapted highly effective strains of *R. galegae* with reduce or eliminated fertilization of mineral N, in exact field conditions on 3 dominant soil types and confirm economic and ecological advantages compared to a standard (lucerne), in sowing year and 4 years of intensive cultivation

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SUGAR BEET NUTRITION BY NITROGEN DEPENDING ON THE SOIL TRAITS AND GENOTYPE

PROJECT OBJECTIVE:

Quantification of ratio and term of the sugar beet fertilization by nitrogen addition is essential for achieving stable high yield of quality root. Too low nitrogen ratios lead to bad production results. Nitrogen excess, due to reduced efficiency of over-grown leaves, results in sugar beet yield and quality reduction. N-fertilization must be done exactly by the defined supplies of soil available nitrogen as well as plant requirements for certain yield formation. It should be taken into account that nitrogen up-taking abilities also depend on the soil traits, ability of the root system development and soil microflora responsible for mineralization process. Nitrogen that will be mineralized in summer or autumn can be neither included into amount required for food nor useful for the plant. Up-taking of nitrogen per plant is also affected by genotype, row plants arrangement as well as their number per ha. The researches aim to develop a model that will be used to precise application of soil analysis results in various production conditions by using different cultivars. The aforesaid will allow increase of root quality and yield, production costs reduction as well as decrease of underground waters eutrophication. Selection of site will be done based upon soil traits. Apart from using various cultivars, different nitrogen fertilization variants will be studied on the selected sites based on soil mineral nitrogen status and anticipated mineralization.

Mineral nitrogen offer, its amount up-taken by the plant (by analysis of sugar beet leaves in the maximal leaf area phase), physical soil traits, qualitative and quantitative composition of microorganisms responsible for organic matter mineralization process will be monitored during the sugar beet growing season. The end of the growing season will be characterized by the beet digging, root analysis needed for determination of the root yield, sugar concentration, K, Na and AmN. The above mentioned would be used for calculation of sugar extraction and yield. Importance of the project is in developing of the fertilization model that will suggest timely fertilization of accurately quantified mineral N-fertilizer. This will provide high sugar beet root yield and quality. Regardless evident economic effect, due to decrease of mineral nitrogen fertilizers and increase of beet yield and quality, reduction of the underground waters eutrophication will occur as a result of the timely adequate fertilization. It is of great ecological importance.

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Programme type: National
BIOACTIVITIES OF ESSENTIAL OILS
COMPONENTS IN STORED PRODUCT PROTECTION

PROJECT OBJECTIVE:

Stored grain pests cause significant losses during the storage period by affecting qualitative properties of the stored grain and by reducing its quantity. The damage is estimated to be 5 – 10% in continental climate, with 20 – 30% in tropical areas. In practice, pest control is mainly carried out by fumigants that, apart from positive properties, have many negative effects, such as ozone depletion, pest resistance, certain residues that remain in food, and contamination of the human environment. In the efforts to find new alternatives, some botanical insecticides from aromatic plants are worldwide investigated. Such plant species are known to have different effects on some pest species, including stored products pests. Their specific scent and flavor are result of the excretion of volatile essential oils as secondary metabolites that can be used as protectants and attractants. The objective of the investigation is to find out bioactivities of the compounds extracted from Croatian aromatic plant species from Lamiaceae and Lauraceae against the major stored grain pests: Sitophilus oryzae L., S. granaries L., S. zeamais Motsch., Rhizopertha dominica L., Plodia interpunctella Hbn., Tribolium castaneum Herbst., Oryzaephilus surinamensis L., Cryptolestes ferrugineus Herbst., in the stage of egg, larva, pupa, and imago.

Bioactivity is expressed in contact activity through the insect cuticle, and in fumigant activity through the respiratory system and digestive tract if treated food is applied in the diet. Efficacy of certain compounds and their most effective combinations will be tested in controlled laboratory conditions, and in the storage conditions. On the basis of the positive results of the analyses, new preparation based on the particular compounds would be patented, as a carrier of the toxic effect observed. The preparation would be applicable in the practice of stored pests control, as well as in the ecologically acceptable plant protection. Such investigations should stimulate breeding of the plant varieties that produce similar compounds in larger quantities, or production of the compounds should be an option to get enough material adequate for practical application in plant protection.

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NUTRITION ASPECTS OF MODELLING OF SHEEP PRODUCTIVITY AND METABOLIC PROFILE

PROJECT OBJECTIVE:

Croatian sheep breeds including Dubrovnik sheep and Tsigaia represent the main sheep raising in Croatia. That’s why much systematic work should be dedicated to improve their productive and reproductive traits by using primarily an adequate feeding. Sheep are supposed to be undernourished resulting in their lower productivity. Many producers are not even aware that significant economic losses and profitability decrease in sheep production occur due to not detecting errors in time. One of the possible ways of this problem solution is determination of metabolic sheep profile. It is supposed that adequately fed sheep are characterized by different metabolic profile compared to inadequately fed ones. This is the reason why indicators of sheep metabolic profile obtained by blood analysis in Tsigaia and Dubrovnik sheep breeds should be explained. They can be very good indicators of energy, protein and mineral supply of organism and healthy status of the sheep. Some stress conditions in the raising period (lambing, lactation and lamb weaning) when animals are most affected by ration amount and its quality should be specially considered. Various feeding supplements (organic selenium, probiotics, yeasts) and thermal processed fodders will be used in stress conditions during the sheep raising aiming to help organism in such conditions adaptation. This will result in better productivity and immunological system modulation. Both region of Tsigaia raising (Slavonia) and the one of Dubrovnik sheep (Dubrovnik vicinity) are traditionally known for mutton production.

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Productivity of these breeds will be determined by monitoring fattening and reproductive traits and meat quality. Also, antioxidative status (glutation-peroxidase and superoxide-dismutase activity) as well as thyroid hormones activity (T3 - triiodothyronine and T4 - thyroxine), showing relevant metabolic index in animals related to feeding status, will be examined in sheep. Based upon the research results, referential values will be suggested for the normal metabolic blood profile in Tsigaia and Dubrovnik sheep. So far, no relevant scientific publications indicating metabolic sheep profile affected by feeding Tsigaia and Dubrovnik sheep breeds have been found yet.

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CONTROL OF STORED GRAINS BY PHYSICAL MEASURES

PROJECT OBJECTIVE:

Stored grain protection i.e. control of harmful insects and mites has been so far performed by chemical control measures – insecticides and fumigants. Eventually, many of the harmful species became resistant to the effect of insecticides. Insects and mites mortality (in adult and development stages) proved unsuccessful in many cases which often resulted in reinfection causing huge damages to stored grains. The aim and hypothesis of this research is the application of the non-pesticide measures, i.e. ecologically acceptable grain protection, such as high and low temperature (application of Grain frigor system), aeration with cold air of low relative humidity, exploration of the most favorable inert dust - diatomaceous dust, application of the controlled atmosphere with CO2, investigation of the most effective insecticide of plant origin, investigation of pheromones and attractants as pest baits in order to decrease number of pests and prevent pollution of products and environment. Key words: cereal, stored pests, physical measures, plant protection

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Project duration: 2007-2011
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NEMATODES AS BIOINDICATORS OF THE ECOLOGICAL HEALTH OF SOILS

PROJECT OBJECTIVE:

Soil quality is closely connected to human life, whether soil is considered to be place for living or place for food production. It is necessary to keep it clean within the meaning of quality and ecological health. In that sense, it is essential to include in investigation biotic as well as abiotic factors, since those factors best reveal the ecological health of soils. Soil nematodes exist in water films on particle surfaces in soil and every change in soil properties may be reflected in changing of nematode communities through their permeable cuticle. They are ubiquitous organisms and possess several characteristics that make them better ecological indicators than any other organisms. The intention of this project is to improve the knowledge about functioning and vulnerability of the soil ecosystem in order to sustain biological productivity and environmental quality. The aims of the project are detection of succession in nematode communities upon change from conventional to organic farming, evaluation of effects of liming and amendments of mineral and organic fertilizers as well as effects of heavy metals on nematode communities in soil, and ultimately, on the base of all obtained results, determination which of the investigated parameters (trophic groups, different indexes, etc.) is best indicator of soil health. Overall aim is to develop computer regression model for differentiating soils on the base of ecological parameters obtained by nematode communities. Investigations would be carried out in Istria, central and eastern part of Croatia, through five years. Field and laboratory experiments will be setup and samples will be collected depending of experiment model. Total number of nematodes and genera in all trophic groups, would be analyzed statistically through clusters i.e. the similarity between specific treatments, localities and other investigated parameters would be revealed. Simple linear correlation between soil properties obtained by physical and chemical analyses and nematode measurements will be done. Regression computer model will provide information of soil health; enable and simplify selection of soil protection measures, in order to sustain the land use and environmental quality.

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Programme type: National
GENOTYPE AND STRESS CONDITIONS IN PRODUCTION OF QUALITY WHEAT AND BARLEY SEEDS

PROJECT OBJECTIVE:

Research work on wheat and barley will be conducted during five years and on four locations in Eastern Croatia: Osijek, Požega, Nova Gradiška and Tovarnik. In total it will be examined 14 wheat genotypes, 10 recognized varieties: Žitarka, Srpanjka, Super Žitarka, Barbara, Golubica, Janica, Panonka, Alka and Soissons, and four winter wheat breeding lines. Examined genotypes will be sown with two sowing rates (700 and 350 germinable seeds/m²). Trial will be sown according to RBCD method in four replications on microparcel 7.56 m² big. On the basis of laboratory seed testing recommendations will be given for the most efficient seed production and seed processing with the high financial gain. Different reactions of genotypes are expected for stress growing conditions (drought, high temperature, soil acidity, herbicide leftovers, and toxic heavy metals in seed). With adequate selection of genotypes risk factors should be very low. Intensive usage of mineral fertilizers in wheat production can result with the higher concentration of heavy metals in seed. Research work will show if there is resistance in genotypes to higher heavy metals uptake. Research work on barley will include 15 genotypes of winter and spring barley (Barun Trenk, Gvozd, Bingo, Lord, Princ, Titan, Grof, Esterel, Matej, Fran, Robi, Patrik, Scarlet and breeding line Osk 5.181/3) sown on four locations, same as wheat.

Genotypes will be sown with two sowing rates: higher with 450 and lower with 300 germinable seeds/m². Trial will be sown according to RBCD method in three replications on microparcel 7.56 m² big.

Research results will point out high yielding and high quality genotypes. They will also show genotypes resistant to logging, genotype reaction on different sowing rate, influence of sowing density and location on seed quality. We will see from the research results influence of growing year on important production traits in different agroecological conditions. Research work will indicate more economical way of wheat and barley production in East Croatia with the adequate selection of genotypes, locations and application of low input technology. This research work includes 29 genotypes and it is very important to use their genetic potential and adaptability for growing in different agroecological conditions.

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PROJECT OBJECTIVE:

The main goal of this project is to improve the potentials of organic way of growing soybean (Glycine max) and pop-corn maize (Zea mais ssp. Everta), needed, yet desired crops for organic human food, through the implementation of catch/cover crops. The emphasis of this research would be at ability of post-harvest crops to uptake nutrients by their growth ("Catch crops"), especially nitrate-nitrogen, preserve them from leaching and deliver to the next crop as a green manure. The green manure can be additionally enriched by legumes catch crops, that not only to sequester nitrogen during the winter, but additionally fixate nitrogen from the air during late autumn and early spring, thus providing more nitrogen for following main crop. Furthermore, post-harvest crops are covering soil ("Cover crops"), thus protecting soil surface from erosive processes. Additional cover crop vegetative mass, both shoot and root, can improve the soil structure by building up soil's organic mass which contributes toward humus accumulation, and through the mulching effect can preserve more soil moisture, which can be crucial for the main crop survival in conditions of more and more frequent extreme droughts (global warming effect).

Also, it is very important the competition effect of cover crop on weed growth, since the resources for early growth and development of spring weeds has been diminished. Cover crop can additionally stimulate the friendly soil fauna development, especially earthworms, very important soil biogenity component, especially in organic farming. With all previously said, the green cover crop mass can be utilized as ideal early spring graze/fodder, particularly since there is not enough fresh organic graze in that part of year. This trial has been set up for both main crop as a split-plot in 4 randomized blocks with following levels: the main treatment "cover crop" (1=control, no cover crop; 2=rye (Secale cereale); 3=wheat (Triticum aestivum); 4=hairy vetch (Vicia villosa); 5= winter pea (Pisum arvense); 6=Phacelia (Phacelia tanacetifolia) ; 7= mixture of 2 and 4; 8=2+5; 9=3+4; 10=3+5; 11=6+4; 12=6+5), and sub-treatment "Cover crop usage" (R-early incorporation, K-late incorporation i S-removal of cover crop for fodder).

The following parameters have been observed: growth, biomass and yield of main and cover crops, nitrogen cycling, and selected soil physical-chemical-biological soil properties. Collected data would be used for further sustainability assessment.

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During the last 30 years huge progress has been achieved in winter wheat breeding. Wheat yield and quality are considerable increased. The improvement is mainly due to the efficient use of wheat germplasm genetic diversity. For the future wheat breeding detailed knowledge of genetic diversity on molecular level is necessary. Today, molecular markers are used for the estimation of wheat genetic diversity. Knowledge of the genetic diversity on the molecular level combined with data about yield and morphological traits can result in detection of marker-trait association and with more efficient parent selection. Molecular markers connected with wheat QTL’s are used in wheat marker assisted selection (MAS). On the other hand, conventional wheat breeding is prevailing in Croatia. Research work of wheat diversity on molecular level is very limited, and Croatian varieties are not involved in international projects for diversity estimations. Marker assisted selection is not used in wheat breeding. In the proposed research work microsatellite markers will be used for the estimation of genetic diversity of Croatian wheat germplasm and existing of some specific traits.

Results will show real genetic diversity on molecular level and diversity for traits such as dwarfing, spike compactness, free-threshing habit, frost resistance, leaf rust resistance, fusarium head blight, aluminium tolerance and other traits. Information about the level and type of genetic diversity, as well as information about existing of some specific traits, will point out the best parents for crossing and development of progeny with the maximum genetic variability for selection. Trait specific markers will enable marker assisted selection and progeny screening. That will result with shortening of selection procedure and with the creation of high yielding and high quality wheat varieties. Identification of specific markers for examined genotypes will have purpose in a protection of breeder’s rights and in the maintaining of genetic purity during seed production.

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MONITORING OF AEROALLERGENS AND MODEL FOR SUPPRESSION OF ALLERGENIC PLANTS

PROJECT OBJECTIVE:

Owing to significant contamination of air with allergogenous pollen and spore, the numbers of persons who suffer from allergic diseases are increasing. According to medical investigations in the Republic of Croatia, there are 12% of total populations who suffer from allergic diseases. Most of them are young persons, especially kids, with significant level of allergy to pollen of weeds, grasses and trees. North-eastern part of Croatia is the most imperiled part of State territory where are pollen of ragweed, nettles, grasses, birch and willow dominant aeroallergens presented during longer period of time. This alarming situation implicates the needs of development the forecasting model for pollination of allergenous plants, and essentially creation of effective model of their control. This is specially referred to weed species Ambrosia artemisifolia whose pollen is known as one of the strongest aeroallergen from moderate continental climate. During the last twenty years this species take the first place among the row crop weeds on our fields. Moreover it spreads to ruderal habitats, and is also significantly present in rural and urban areas. Ragweed emerges in our area in mid April, and flowering period starts on mid July (depending on weather conditions in each year) and finish its vegetation season with cold and rainy days in September. Because of its enormous pollen production (up to 8 million pollen grains per plant) and long flowering period, ragweed represents increasing public health problem in North-eastern Croatian territory.

Solving this problem needs very qualitative approach. Continued aerobiology monitoring of pollen grains in the air using volumetric method offer reliable picture of amount of allergogenous pollen in m3 of air and enables public sensitivity of beginning and finishing of pollination dangerous allergogenous plants. However, besides passive monitoring it is necessary to conduct series of activities to decrease the population of ragweed and other allergogenous plants to tolerant level. Therefore, continuous monitoring and reporting of concentration of allergogenous pollen in the air during the pollination season, mapping the vegetation and determine the areas highly abundant with allergogenous plants, and at the end their eradication are main prerequisites to help sick and sensitive people to avoid or overcome critical period of pollination this very dangerous plants.

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SELECTION OF RED CLOVER FOR NODULATION, YIELD AND QUALITY IMPROVEMENT

PROJECT OBJECTIVE:

Red clover (Trifolium pratense L.) is a perennial forage legume, which, unlike alfalfa, can be grown in a different environmental conditions and on a wide range of soil types, and gives good yields on soils characterised by sub-acid pH and/or excessive moisture. It may use atmospheric nitrogen by symbiosis with nodular bacteria (Rhizobium leguminosarum biovar trifolii) and leave large amounts of nitrogen in the soil. Plant infection, nodule development, and symbiotic dinitrogen fixation processes are under control of heredity factors of red clover plant and Rhizobium biotypes, and their interaction, which in final influence on plant vigour and biomass production. Yield and quality of forage can be improved by selection of genotypes with increased intensity of nodulation and symbiotic dinitrogen fixation. Therefore, the following aims of the project are defined: 1) to investigate the differences among red clover genotypes in intensity of nodulation and symbiotic dinitrogen fixation, 2) to identify, descript and evaluate the differences among red clover genotypes in yield and quality, 3) to evaluate the interaction of germplasm, nodular bacteria and environment 4) to develop red clover germplasm with improved agronomic and symbiotic traits well adapted to growing in different environmental conditions. Field trials will be set up at three different soil types (neutral, acid and alkaline) over five years.

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Experimental material involves breeding material, recognized Croatian, and foreign cultivars available at the market. Testing includes direct identification, physical comparisons, chemical and microbiological analyses, statistical analyses of data and validation of research by results publishing. Evaluation of basic genetic parameters for the most important traits and improved experimental methodology will ensure more efficient selection and development of new experimental populations of red clover (in two selection cycles) with improved feeding values and adapted to conditions of sustainable agricultural production. Development of improved red clover germplasm regarding to nodulation, yield, and quality will contribute to the development of the program for sustainability and competitiveness of family farms at the rural areas.

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MANAGEMENT OF WATER RESOURCE IN IRRIGATION OF EASTERN CROATIA

PROJECT OBJECTIVE:

Field inventarisation has been committed of existing situation in water resource. We have sort out and categorized water sources for irrigation: large natural water sources, canals and subsurface water.

According to current conditions on the eastern Croatia area, at the moment we are in the period of making a proposal for methods of water use for irrigation. Water samples from potential sources have been taken in order to make some laboratory tests. We have analyzed water samples according to parameters for water quality in order to determine if water is suitable for irrigation practice. Also, we have taken some questionnaire for the users of irrigation system. According to results, well is the main water source for irrigation, and river is the secondary source.

Less than half (50%) of irrigation system users have take analysis for testing a water quality. We have calculated water needs for the main cultures which are in sowing structure, but also for some new cultures whose are going to be added to present structure. This refers mainly to vegetable cultures (tomato, peppers, watermelon and potatoes). For perennial cultures (grape vine), especially in Kutjevo area, we have make some evaluation for water sources (Venje-Hrnejvac) needed for vine production.

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Water needs for cultures has been calculated with CROPWAT computer model. At this moment we are making some arrangements with geodetic institution to take some snapshots of the area from air with sophistic equipment so that we can show our results for the analyzed water sources and to give solution for new sources.

We are planning to tag the restricted area for irrigation (area under mines and protected area) on given snapshots. At this moment we are comparing our natural water potentials with the needs for irrigation practice. Given analysis and calculation results will be used as a part of foundation for making a base. This base will be used for making some classification of water resources but also to make some directions for sustainable irrigation practices.

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MONITORING OF INTEGRATED CROP PROTECTION FROM WEEDS

PROJECT OBJECTIVE:
Integrated crop protection from weeds in the Republic of Croatia follows European programmes, which suggest an improvement of chemical weed control as precision control - optimum doses of post-emergence herbicides with minimum residua. By introducing integrated crop protection, whose aim is environmental protection and application of different levels of agricultural practices including reduced soil tillage, mechanical weeding, lower pesticide inputs and manipulation of sowing date, Croatia will come up to European management system. Stimulated by these possibilities, in 1997 we started a systematic research at the enterprise unit Čačinci. Our proposed project is a sequence to these studies. Aims of the project are investigating of weed level in different soil tillage systems (conventional and reduced) as bases for the choice of herbicides and their doses. Winter wheat-maize, wheat-soybean and soybean-maize have been introduced as crop sequence. The trial was set on lessive pseudogley soil according to the split-plot design. Soil tillage (factor A) has been permanently conducted since 1996 in the following treatments:

1. conventional (ploughing, diskharrowing; 2. ploughing every other year alternating with diskharrowing; 3. diskharrowing every other year alternating with ploughing; 4. loosening of plough layer and diskharrowing; 5. diskharrowing only. Herbicide protection (subfactor B) will be performed for each crop comparatively in recommended and different percentage of the lower doses applying environmentally safe active substances, primarily post-emergence. Estimation of the number and coverage of weed species according to Braun-Blanquet and phenological observations will be made several times during crop vegetation. Weed samples will be obtained immediately before the harvest, within 0.25 m2, in 4 random spots at each replication (16 samples totally). Herbicide efficacy will be shown for each weed species through number and biomass of its sprouts compared to the untreated controls. Values for weed biomass, yields and yield components will be statistically analysed by variance analysis. The project highlights the investigation of ecologically acceptable and rational technologies for weed protection of main arable crops in Eastern Croatia.

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Programme type: National
BIOLOGICAL CONTROL OF EUROPEAN CORN BORER (OSTRINIA NUBILALIS HÜBNER)

PROJECT OBJECTIVE:

The European Corn Borer (Ostrinia nubilalis Hübner) is one of the most important pests of maize worldwide. This insect is present in Croatia in all areas with maize production but the intensity of attack differentiates, it caused damage at average of 7% loss of corn grain yield. This pest is known to feed on about 200 kinds of plants that are mostly considered as economical important cultures. Nevertheless, certain agro technical measures, important for suppressing this pest are left behind and control measures mostly are not used. Sustainable agriculture as well as environmental protection is global trend that considers application of biological control agents as it is Trichogramma spp., wasps that parasites eggs of maize borer. Parasitic wasps are used for more than 100 years as biological control agents against many economical important pests; nowadays there are firms that rear Trichogramma for commercial purpose. The investigations would examine direct applicability of parasitic wasps as well as possibility of their exploitation in suppressing the ECB in wide range commercial production of maize. In order to estimate the moment for Trichogramma field releases, an appearance of adult pest and oviposition would be observed. In the first years of investigation, micro-trials would be settled and several commercial maize hybrids would be investigated for the purpose of determination the target moment for field releases of Trichogramma and parasitism rate.

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On the base of the obtained results macro-trials would be settled followed with mass field releases of Trichogramma. Macro-trials would be carried out through two years of investigation. Percent of parasitism and hatched larvae, stalk damage and loss in grain yield would be assessed in each vegetation year. Parasitism would be determined on 3rd, 5th and 8th day after field releases of wasps. Dissection of maize stalks at the end of vegetation would reveal intensity of pest attack, i.e. the number and location of the larva and tunnels they made the length of the stalk damage, losses in grain yield. According to the results of investigations it would be possible to create IPM program for suppressing the ECB in maize. Potential of Trichogramma as biological control agents would have great significance in organic farming since mass releases of parasitic wasps have none or very little impact on other natural enemies, do not pose risks to field workers or leave toxic residues on the final product.

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ANALYSIS AND GENETIC IMPROVEMENT OF SPORT HORSE BREED IN CROATIA

PROJECT OBJECTIVE:

The EU experts consider that one of the possible strategies for development is horse breeding, but the problem is that pedigrees are not regulated and in not knowing parameters necessary for selection and in breeding of Arabian and trotting horses, which are not internationally recognized. The research would encompass breeding structure of Lipizzaner horses (about 1200, with date base of at least 5500 head of horses), Arabic horses (250 head with data base of 5500 head), trotting horses (1650 head with data base of 125 000 head) and the English thoroughbred horses (220 head with data base of 400 000 head). DNA analysis (200 samples) of the Lipizzaner from farm and stud breeding will be carried out in order to control the credibility of pedigree data and main register of Lipizzaner breed, i.e. if there are any disregards of breeding program of this breed. The central focus of the research would be genetic analysis and selection based on physical performance (the results of 30 000 trotting races, horse team races). The aim is to research the pedigree structure using different methods of genetic variability, to establish the level of inbreeding and genetic parameters. The aim of the research would be to establish the data base (pedigree, basic information about the horse, running characteristics, physical performance), to estimate the genetic variability in population and to define the most significant animals as the basis of long term successful selection.

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The genetic parameters of running characteristics (time, earnings and ranking) would be estimated such as heritability, repetition and genetic correlations between these characteristics. The negative effects, which influence the running characteristics would be estimated and defined as the basis for pairing program. The coefficients, that estimate the genetic variability (effective number of population founders, effective number of significant ancestors, effective number of genomes of population founders) would be calculated with PEDIG software program. Except for the specialized FORTRAN software programs, statistical software program SAS would also be used for analysis. The research would provide great deal of information about breeding, and it is exactly the lack of research and regulation written data of our breeding process that is the main obstacle to the possibility of it being acknowledged and included into the world register. Success of the research would be of great significance for the breeders as well as for equestrianism and the national economy.

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AN INNOVATIVE AND ENVIRONMENTALLY FRIENDLY SPRAY APPLICATION TECHNIQUES

PROJECT OBJECTIVE:

The chemical method of plant protection is the most efficient one in spite of intensive researches of alternative methods for plant protection against diseases, pests and weeds. This method has an important role in achieving high yield and quality of agricultural products. Since it is clearly obvious that this method will continue to be used in the future the use of pesticides should become more rational in order to reduce the level of chemicals application as well as the frequency of chemicals spraying. New generation chemicals are far more selective, less poisonous to people and animals and biologically more active (i.e. only a few grams per hectare is necessary). Due to the aforementioned the application of improved methods and modern machinery for chemicals application is beyond question bearing in mind the efficiency of protection. Today's agriculture disposes of machinery for chemicals application, which is very efficient as far as their capacity, level of direction adjustment to the target area and the balance of application and environmental friendliness. Still the pesticide application in Croatia is performed by machinery, which is out of date from the technical and technological point of view. Furthermore, the quality of measuring and regulation equipment is insufficient and the exploitation potential is low. The aim of the proposed project is to significantly increase the level of pesticide application machinery in agriculture, horticulture and viticulture and the lever of farmers' knowledge.

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The researches will try to determine the possibility for reduction of present pesticide doses with regard to the maintenance of the satisfactory plant protection. Laboratory and field experiments will encompass all the relevant application quality factors. The selection possibility, size control (diameter) and droplet speed are the most important factors. Continuous testing will be performed of the influence exerted by a nozzle design on the stream production. Drift is an unavoidable and unwanted off-target misdirection that reduces the protection efficiency and contaminates the environment. The researches will try to answer the question about the possibility for minimizing the chemical loss within and off the target area. All the chemicals demand an intense hydraulic mixing in the spray tank or atomizer regarding the evenness of the chemical concentration during the spraying procedure. For this reason the researches will be conducted regarding the dilution.

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OBTAINING HIGH-YIELD AND HIGH-QUALITY FIELD PEA (PISUM SATIVUM L.) CULTIVARS

PROJECT OBJECTIVE:

Area of field pea (Pisum sativum L.) is increasing in Croatia. In 2005 there was about 8000 ha. Domestic varieties are sowed to produce fodder, while crops for grain production are sowed by foreign varieties from France and Slovakia. These foreign varieties do not give satisfactory grain yield (above 4 t/ha). Agriculture Institute in Osijek has one registered variety for fodder production and one for grain production. Registered varieties are the result of a long-term research of field pea, which was extended in the last eight years. We handle with a gen-collection of about 10000 genotypes for the further research on this project. Selected materials give 6 t/ha of grain with protein content up to 27%. The aim is to obtain genotypes with genetic grain yield potential of 10 t/ha and protein content between 28 and 30%. In the year 2006 there will be sowed variety trials, test trials and plants selected considering certain properties. Breeding will take place at Agriculture Institute in Osijek.

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The aim is to obtain genotypes with genetic grain yield potential of 10 t/ha and protein content between 28 and 30%. In the year 2006 there will be sowed variety trials, test trials and plants selected considering certain properties. Breeding will take place at Agriculture Institute in Osijek.

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Project duration: 2007-2011
Programme type: National
STRUCTURE-ACTIVITY RELATIONSHIP OF FLAVONOIDS

PROJECT OBJECTIVE:

The flavonoids (flavones, flavonols, catechins, anthocyanins, isoflavones, etc.) are a broadly distributed class of plant pigments, which exist in substantial quantities in fruits, vegetables, and plant extracts, as well as in plant-derived beverages like tea and red wine. They are based on the structure of 2-phenylbenzopyrone and differ from one another in the degree of unsaturation and the pattern of hydroxylation, methylation and glycosylation. A diet rich in fruits and vegetables has been shown to help prevent the development of coronary heart disease, some type of cancers, and premature body aging. In addition, flavonoids exhibit wide range of pharmacological activities like anti-inflammatory, antimicrobial, antiviral, anti-HIV etc. Many of these activities of flavonoids are related to their interactions with several key enzymes and to their antioxidant properties, which can be due to their ability to scavenge free radicals, to chelate metal ions, and to synergistic effects with other antioxidants. Multiple activities of the flavonoids and their structural diversity make this class of compounds a rich source for modeling lead compounds with targeted pharmacological properties. The results described in the literature suggest the possibility that there may be other naturally occurring flavonoids or structurally related compounds with more potent activity.

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Our target is to build up the QSAR/QSPR models which link structural descriptors of flavonoids with their biological activities and properties. QSAR/QSPR modeling can be used to predict activity (property) accurately without using costly and time-consuming experimental methods. QSAR of flavonoids enable to predict activities of many other untested flavonoids, and to direct the synthesis of flavonoid compounds with higher potency for potential clinical application. Considerable attention has lately been focused on the mechanism of action of polyphenolic compounds. Once developed QSARs may shed light on the mechanism of action of flavonoids. It is known that the regular intake of moderate amounts of red wine can reduce the risk of coronary heart disease (French paradox). Determination of major flavonoids in red wines produced particularly from Croatian native grape varieties as well as assay of their antioxidant activity could be of interest.

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Programme type: National
SHORTENING OF BREEDING PERIOD OF CARP (CYPRINUS CARPIO) AND IMPROVEMENT OF MEAT

PROJECT OBJECTIVE:

Warmwater fish breeding in the Republic of Croatia dates back to the beginning of last century. Referring to the production area of 4500 ha and yield of 1140 tons, it is to conclude that production was relatively low in the period between two world wars. The production was increasing since the end of 50' s of the last century to reach its highpoint at the end of 80' s, with more than 1000 kg/ha produced on app. 12500 ha. Transitional period and the Homeland War had a negative consequences on warmwater fishery, reducing the production area to half and the production yield to one third of the pre-war period. Today's yield is compared with the one realized in 1946 (Čosić, 1996., Jahutka et al., 2005). There are many reasons for such condition in fishery, some of them being poor ichtyotechnical conditions, high amount of weeds, damages caused by ichtyophagous birds, unbalanced feeding of fry and commercial fish, low individual mass of one-year old fry, losses during hibernation (Stević, 1996, Bogut and Adamek, 2005). All of that resulted in low production, and insufficient market supplies. Our carp production is organized in three-year breeding cycle, sometimes even a four year. Fish is fed mostly with corn, which results in production of meat with high content of fat of unfavorable fatty acid composition.

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Shortening of a breeding period from three to two years, and reduce in yield losses are possible to be achieved through breeding of larvae and fry in controlled conditions and through early spawning. Technology of breeding of larvae and young fish in controlled conditions will facilitate production of a one-year old fry of individual mass from 150-200 g, thus directly influencing breeding period shortening from three to two years (Bogut et al., 2006.). Fish meat quality can be enhanced through feeding of commercial carp with pelleted diets supplemented with high concentration of omega-3 fatty acid. Such feeding regime should be applied one or one and half month before the end of a production period, when there is no more natural food in fish ponds. Research results are to be analyzed by analytical and statistical methods. It is expected that proposed research project will prove that applied breeding technology is efficient in reducing losses, shortening of breeding period for 1 year and enhancement of fish meat quality and production turn-over.

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THE PURE NUTRITIVE SUBSTANCES IN THE PORTION OPTIMISING OF THE MONOGASTRIC ANIMALS

PROJECT OBJECTIVE:

Taking into consideration the fact that the food beside the reproductive value, has also its health, physiological and economical values in each branch of the intensive farm animals breeding, the arguments of the nutritionists concerning the identification and the application of the new technological solutions in the direction of achieving larger production and the quality improvement of the products are the strong ones.

At the same time in the newly created circumstances with the full-provided high nutritive standards the modern animal feeding of today’s hybrid lines of the domestic animals studies larger number of the food portion parameters like:

1. The need of the body to satisfy the requirements for the individual nutritious substances,
2. The adjustment of their interrelationship,
3. The analyse of the chemical structure of the nutritious substances of the food, from which the different bio-availability in the animal organism results,
4. Determining of the anti-nutritive substances and the evaluation of their antago-nistic effects,
5. Determining of the hygienic usefulness of the fodder and of the whole portion.

In the practical conditions of the animal portion optimising the animal food market offers a large number (approx. 100) of the commercialised nutritive products, either as the individual pure nutritive substances or as the cocktails of them more.

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According to the recent concept of the optimal formulating of the food requirements of the animal, the appropriate fodder has been prepared in the usual way, and the deficiency of the portion base components have been compensated by various supplements depending on the animal species and the breeding direction. The nutritive supplements prepared structurally as the pure nutritive substances (proteins, amino-acids, fat acids, etc.) have the greatest effect in the sense of the quality and quantity. This approach to the food portions optimizing through adding biologically valuable nutritive supplements is particularly useful in feeding of young categories of the monogastric animals with the enzyme type digestion, where the biological value of the nutritive substances and their chemical structures have the crucial influence to the growth and the development of the organism. The intention of this research is to determine the nutritive, breeding and health values of the protein-energetic supplements and products contained in the food portions of both the chickens and the pigs at the various ratios respectively. The results of their breeding effects will be determined by measuring the quality of the final animal products.

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EPIZOOTIOLOGICAL RESEARCHES OF PARASITIC DISEASES OF WILDLIFE IN EASTERN CROATIA

PROJECT OBJECTIVE:

In eastern Croatia in the last decade occurrence of certain parasitic diseases is a more common phenomenon, both in domestic as in wild animals. Trichinellosis, as one of the most significant public health problems in Croatia, as well as invasions in certain development stages of Alaria alata fluke, represent a direct endangerment of human health, while the Fascioloides magna liver fluke invasion significantly disturbs the health status of deer and causes great economical losses in hunting economy. These diseases have spread from the original epizootiological focus and represent a constant threat for the domestic animals’ health. Researches of these wildlife diseases have been carried out partially but only the existence of parasites has been registered, whereas the data on ecology, epizootiology, distribution and significance of these parasitisms for Croatia are still spare. The main AIMS of the project are (1) through systematic parasitic monitoring determine the distribution of the mentioned parasitic disease of wildlife, (2) determine the intensity of invasion in certain animal species in various ecological habitat conditions, (3) detect and determine possible species and ecology of animal reservoirs i.e. mediators (rodents, snails, frogs, etc.) in the development cycle of a parasite, and (4) through genetic determination (usage PCR) determine the species of certain parasites in certain species of game. This also has a practical significance, especially for trichinellosis, in determining the genetic connection of wildlife parasites with the domestic animals’ parasites, as compared to the ones isolated in other countries, which would facilitate the determination of the origin and paths for the spread of disease. The HYPOTHESIS is that a systematic research of epizootiological and ecological factors that have an impact on the occurrence of these parasitic diseases, and genetic determination of species would complete the cognition of the possible risks for animal and human health, and the occurrence of the diseases would make predictable by the EXPECTED RESULTS, epizootiological areas of these diseases in animals would be determined, guidelines for the suppression, i.e. prevention of their further spread, especially on domestic animals and people, and genetic determination would be the basis for the phylogenetic analysis. The results will be published in relevant publications and in such a way comparable with the research results in other countries.

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ANALYSIS AND GENETIC EVALUATION OF LONGEVITY IN DAIRY CATTLE

PROJECT OBJECTIVE:

Longevity is related to productive life and has a great impact to profitability in dairy cattle production. Increasing longevity reduces replacement costs, changes herd and age structure with a higher proportion of mature cows which produces more milk. Also, long-lasting cows are less treated with medicaments so they produce milk which is safer for human health. The modern breeding programme directs to sustainable breeding strategy in which selection for longevity as well as for other functional traits is also included. According to current knowledge, longevity could be improved directly based on productive life data or indirectly by selection for traits correlated with the productive life. Direct selection for longevity is limited by long time required to accommodate data for evaluation as well as by low heritability. With development of new appropriated methodologies for longevity evaluation researchers around the world intensively investigate a possibilities of improving this trait and its including in breeding programmes. From genetic aspect, longevity was not investigated yet in our cattle population.

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With respect of new various approaches in genetic evaluation of longevity, the aim of this project is to study the traits which are in relation with longevity and to determine genetic and environmental effects as well as heritability and its genetic relationships. The purpose of this project will be develop and test various models and methods for genetic evaluations of sires based on longevity of their daughters. Results will be appropriate methods and compared among breeds. Analysis and genetic evaluation will be investigated using survival analysis methodology by Weibull proportional hazard model. Potential application of these results would be in cattle breeding programmes. Selection of dairy cattle for improving longevity could be positively connected with improvement of health, fertility and production of more safety and more quality milk products.

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AMMONIA EMISSION IN CATTLE AND PIG PRODUCTION AT EASTERN CROATIA

PROJECT OBJECTIVE:

Nitrogen fertilizers have the most distinct fertilizing effect in the modern managing system in the agriculture. However, in the herbal and livestock production system there are significant N losses which contribute to the local, regional and global contamination, such as NH₃, NOx (NO+NO₂) +N₂O. Main NH₃ emission from the ground in the atmosphere in 1990 amounted 54 TgN (Tg= million tons ). Four main sources participate in that amount: domestic animals 21,6 TgN, mineral N fertilizers 9,0 TgN, ignition of the biomass 5,9 TgN, degradation of herbal mass in herbal production 3,6 TgN. Global NH₃ emission from domestic animals in the period of three decades (1961-1994) grew to 54%, i.e. from 14,2-22,1 TgN annually. Ammonia is a very reactive gas, it contributes to the soil acidification, eutrophication of water, and the development of forest vegetation which is very sensitive to the stressful situations. Ammonia contributes to the forming of ammonia sulfate with SO₂ related to atmosphere process.

Ammonia with SO₂ and various nitrogen oxides (NOₓ)+N₂O are the three main components of the acid rains. In the last ten years in order to preserve the environment an inventory of NH₃ as a side effect in the breeding of various kinds of livestock was determined, as well as the manure storage and manure application in England, Denmark, Netherlands and other countries. Models for determining NH₃ emission (emission factor) were constructed. Heading in that direction my opinion is that in our country in cattle and pig breeding as dominant representatives in livestock breeding, inventory of NH₃ for eastern Croatia (Slavonia and Baranja) should be determined. On the basis of the set NH₃ inventory, a strategy for the emission reduction would be created because it has been proven that fertilizer managing has greater impact than the manure loss with different sorts and categories of livestock.

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Programme type: National
GIS TECHNOLOGY
APPLICATION IN CROP
PRODUCTION
- DIGITAL THEMATIC MAPS

PROJECT OBJECTIVE:

This project aims to develop geo-information system - GIS (soil, water, climate, land use) of Osijek-Baranya county that will be, via various services, used for production development requirements at farms as well as rational and sustainable planning of natural resources use. Methodology is based upon Land Evaluation and Land Use Planning by FAO and Rossiter (ITC). The latest updated planning approach of land use based upon raster GIS data modeling will be used. The smallest mapping unit is a field square or pixel (Julien et al., 1995). The main products are: a) digital maps or geo-information - land use fashion, soil and climatic characteristics of a field, optimal purpose map, land evaluation, production limiting factor maps and the like; b) instructions for GIS use and results interpretation for requirements of the authorized service employees as well as other users (manuals); c) multimedia products - CD-ROM, websites and brochures. Purchase and processing of air and satellite images as well as raster-based GIS modeling will be performed. AGIS centre has already done several projects of creating GIS maps of real and optimal land purpose, thematic maps important for credit financing and other purposes. This research and project proposal aim to develop information background for a comprehensive Geoinformation system which will be composed of several thematic layers grouped by the topics (soil, water, climate, land use in Osijek-Baranya county area).

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Geo-information products will be, in turns, used for the concrete needs via authorized services. It could be said that general basic purpose of GIS application in natural resources management is a production optimization (maximum profit alongside sustainability). It is based upon optimal making decisions and better understanding of nature phenomena. Expected total effects of GIS development are as follows: professional services, enhanced link between consumers and business subjects as well as economy modernization that will lead to anticipated total production increase. Testing of geoinformation use together with GPS and satellite images in agriculture showed that management rationalization can result in complex uses (EU standards, IACS and LPIS systems - subsidy controls). Ag base - expert system for growing arable and vegetable crops will be developed as a CD data base, like basic for the modern technology.

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UTILIZATION OF MANURE AND LEGUMINOUS PLANTS IN GENERATION OF ENERGY

PROJECT OBJECTIVE:

Considering that on particular farms, due to technological procedures, organic matter degradation process begins inside the facility because of poor manure removal system. Manure stays in channels for too long, significant amounts of methane are released and because of that manure loses significant part of its energy value. Furthermore, different technological procedures, like facility washing, channel irrigation, and also precipitation pouring into manure removal channels decrease organic and dry matter concentration, which impoverishes manure and also increases amount of organic waste and burdens the environment. Too low concentration of dry and organic matter makes manure unusable for potential biogas production. It is possible to improve manure's energy value with the addition of fresh organic matter. One way of improving impoverished manure to profitable level is addition of different leguminous plants. Investigation of different combinations of manure and different leguminous plants would determine the most advantageous mixture of manure and leguminous plant, with the aim of quantitative and qualitative biogas production.

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Also properties of compost produced from fermented mass would be determined. Realization of proposed project would stimulate greater utilization of renewable energy sources, which is at the same time responsibility of Republic Croatia as a candidate for entering EU. The aim of the research of this program is to determine utilization possibility of energetically impoverished manure (which chemically and microbiologically contaminates soil and water) with fodder leguminous plants (herbage mass) and sunflower enrichment according to amount and composition of biogas. Obtained results and insights that arise from this project will help technical-technological design and construction of biogas production plants and will give answers to potential investors about investment cost-effectiveness depending on biomass properties, and will greatly help implement new technologies in Republic Croatia. Aside from economical significance, project also has ecological and social character.

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INCREASE IN SUGAR CONTENT IN BEET CHOOSING GENOTYPE AND AGRICULTURAL OPERATIONS

PROJECT OBJECTIVE:

Sugar is mainly worldwide produced out of the two agricultural crops: sugar beet and sugar cane. Sugar beet is grown in continental climate, mostly in Europe. The importance of sugar in human diet is widely recognized, especially nowadays when this production becomes more important in overcoming power crisis by bioethanol production. Sugar beet growth should be seriously considered in this purpose. France and Germany have already made plans for sowing 42 000 ha, respectively, 37 000 ha this year. Beet sugar production is more expensive than cane sugar production, meaning that researchers, producers and manufacturers need to put further efforts to maintain sugar beet on favorable place in sowing structure in globalizing Europe. This primarily requires sugar yield increase per ha, and cut in expenses. An effective way to succeed in cutting expenses is to produce higher quantities of sugar by processing equal quantity of sugar beet. This is especially important for our country due to the low sugar content, distinctly below our capacities with only 14.60% obtained in the last decade, while countries of developed agriculture simultaneously obtained 17%. The producers are, therefore, required to produce sugar beet with higher sugar content to fulfill the needs of sugar industry asking researchers further information to reach the goal under existing soil and environmental conditions in our country. The first solution of the problem is selection of Z - type hybrid..

However, simply application of Z - type hybrids does not guarantee higher sugar content in sugar beet production. The same hybrid on one plot can obtain high sugar content with favorable production results, while the other neighboring plot separated by the road or a canal can show the opposite, with low or even very low sugar content obtained. The causes vary and are influenced by agricultural engineering, and / or soil properties. Irregular fertilization preferably with N, inadequate plant number and their arrangement, incomplete plant protection against diseases and soil conditions that affect root system development and nutrients uptake can significantly influence growth and sugar beet development as well as root quality. We assume that the proposed project could contribute to the increase in sugar beet root quality on the basis of the accurate findings about interaction among N fertilizer, plant number, and plant protection against leaf diseases with the use of certain genotype and in relation to the properties of the site.

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CHARACTERISTICS OF MILK FLOW AT MACHINE MILKING OF COWS

PROJECT OBJECTIVE:

As a response to bigger milk and meat demand on the market, it is necessary to add the secondary selective aims to primary ones, without changing the cattle quantity. Milk ability is generally considered as the ability of the cow to be milked quickly, equally and completely. This characteristic becomes very important when changing from manual to machine milking. Milk ability determines the udder characteristics and it is usually viewed and measured by milk flow during machine milking. This characteristic has also a great economic significance. Milking takes about 50% of the milk production work and about 80% of the expenses for labor, what is from the economic point of view very significant. Therefore it is necessary to long for uniform milk duration for all cows, what is especially important for milking at milking place. Researches in Croatia showed that only 56% of measured Holstein and 39% of Simmental cows had the milk flow in the span of 2.01-3.60 kg/min (Swiss standards for optimal milk flow). The milk flow speed depends on milk quantity in the udder, the intermilkgland pressure, the oxitocin activity, the sucking channel width, the muscles for closing the dug’s top and the milking machines function. A prerequisite for good milking is a healthy and undamaged udder.

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The connection between milking and health udder results from the physiological connection between the dug anatomies, milking and mastitis resistance. Cows with a larger diameter of the sucking canal have better milking, but from the other side it makes it easy for pathogenic micro organisms to enter the udder. Former selection for high milkiness led to fertility decline and resistance to different illnesses, including mastitis, which means a larger somatic cell count. Research of milking parameters represents a suitable way of genetic improvement of cows’ adjustment to machine milking. Therefore, the measuring of the milk flow curve during milking will be performed by modern milking measuring units in this research. Special attention will be drawn to particular milking parts and also the influence of particular milking phases on the udder health will be established. Expected result of this project is improving the milking characteristics of cows assigned to modern milk production. After studying the genetic and health characteristics of milk flow, the most important characteristics will be determined in order to make them a part of the selective programme of cattle breeding in Croatia.

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Contemporary intensive pig production implies efficient food usage, environment preservation and high meat quality. Growth of muscular and fatty tissue is regulated not only genetically, but also through energy balancing, feeding and metabolism of lipids. Emphasis is also put on stress, physical activity, diet composition, temperature, infection and diseases. Animal treatment and feeding regime are set according to production purposes. Influences of animal treatments on their physiology and meat quality are well investigated. As a reaction to stress, an organism tries to keep its homeostasis by activating the HPA axis (hypothalamus-pituitary-adrenal gland), thus increasing the level of circulating catecholamine and cortisol. Due to the activation of the HPA-axis, different stressors during a lifetime of an animal, such as weaning, grouping, transport, water and food withdrawal, cause numerous endocrine, enzymatic, metabolic, hematological and immunity changes, which results in productive parameters and changes in meat quality. The aim of the proposed research is to determine possibilities of reducing negative effects of physiological stress on the quality of muscular tissue, and of enhancing antioxidative status of pigs, as well as efficiency of vaccines through application of immunomodulators. Furthermore, the research objective is aimed at producing animals more resistant to common infections. For that purpose, there is a need to investigate the intake of specific food additives, especially from the viewpoint of possible negative effects of high dosaged antioxidants.

It is necessary to examine what kind of effects do known antioxidative matters (selenium), new potentially antioxidative matters (tribomechanically activated clinoptilolite, organic cationic clinoptilolite) and immunomodulators have on metabolic, antioxidative and immunity system in different pig categories. Growth of muscular and fatty tissue is determined genetically and hormonally, but it is also part of the immunity system (SLA), and as such it affects the meat quality. Furthermore, the project will focus on possibilities of transferring maternal and lacteal immunity on piglets, and on the effects of some combined food additives on achievement of maximum synergy in order to prevent oxidative stress and reduce consequences of physiological stressors (weaning, grouping, vaccination, marking, prophylactic interventions). Results obtained on young animals will indicate the most efficient antioxidants and immunomodulators, as well as immunostimulative preparations. Up to now, there were many partial researches into antioxidative and immunostimulating matters, however, it is our intention to determine their interactions regarding their antistress effects in order to improve swine production.

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Programme type: National
MARKET AND ECONOMIC ASPECTS OF ANIMAL PRODUCTS OF IMPROVED QUALITY

PROJECT OBJECTIVE:

When speaking of food consumption, preferences of consumers in western countries are referring to health prevention, food safety and food quality management. Feeding of domestic animals directly affects the quality of final products, i.e. of poultry meat and eggs. Controlled feeding regimes of domestic animals (enriching of poultry meat and eggs with PUFA n-3, i.e. changing of the PUFA n-6 / PUFA n-3 ratio, enriching with selenium and different vitamins) directly affect the content of antioxidants, neutralization of free radicals, preservation of consumer's immunity system, and consequently, such feeding results in improved and preserved human health. Market infrastructure in the Croatia has not clearly defined area for products of improved quality that can be differentiated from conventional food of animal origin. Increased price of final products of improved quality should be accepted by consumers. They should pay more money for such products. Through different marketing activities it is possible to influence consumers and parts of market chain in order to make such products recognizable and to make quality food production more profitable. The research will be carried out in three counties of Eastern Croatia, and will focus on the following:

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a) the research into consumers perception through survey on their readiness to buy and consume products of improved quality, analysis of producers' awareness and application of new technologies, as well as research into market chain; b) segmentation of agricultural producers; producers that apply new technologies will be selected and financial analysis of their business will be completed in order to calculate final product price; c) cost benefit analysis of agricultural production will be completed, market chain and marketing background will be created in order to place quality food products adequately on the market. The aim of the proposed research is to create a pilot project that will provide an insight into production of animal products of improved quality, as well as financial profit of such production. Research results will have multiple practical applications: they will provide a possibility of planning production and investments, decision making in agricultural politics, education of producers and consumers, planning of marketing activities and development of marketing service for this purpose, as well as completion of a computer model that will facilitate decision making at technological and marketing level.

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IMPROVEMENT POSSIBILITIES OF WORK OF SCENT HOUNDS

PROJECT OBJECTIVE:

In accordance with Hunting Act, authorized hunting officer is indebted to own trained and tested hounds of certain breed with credential for certain kind of game. The aim of good manager in area of hunting business is to obtain optimum number of noble game and predators at certain hunting area, which is possible by increasing the number of positive measures expressed with as less as possible losses on game. There is an assumption that during the hunting season 30% of game who had been shot are lost because of improperly trained dogs. The 60% shoted big game in Republic of Croatia are wild boars. Theirs trophy and meat represents important financial income for authorized hunting officer, so our aim is to determine the possibilities of improvement working abilities of certain hounds and through this find out what are the possibilities of increasing the income for authorized hunting officer. Also, we would like to prove that this is the way how to obtain the optimum number of game in one certain hunting ground.

The aim of project is to determine which dog breeds are useful for certain kinds of hunt and what are advantages of certain hounds comparing to the others.

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In the Republic of Croatia for hunting wild boars are commonly used Croatian hound breeds, namely Scent hound from the Savie valley, Istrian rough-coated hound, Istrian short-haired hound and some other foreign breeds of short scent-hounds. The goal of this project is to determine in what disciplines could be improved by analyzing stud book, field researches and testing the hounds at special dog searches. Total effect of hounds on the field depends on anatomy of the dog, level of training and dog’s condition and constitution. By using the x-ray analysis of hips, elbows and backbone we will be able to determine if there are some genetic malformations. Secondly, by using morphological and morphometrical measurement of certain body parts, bones position – angles between specific bones of locomotive system, it will be possible to determine the ideal proportions which allow reliable and good motion and endurance of hounds during the hunt. Also, will be able to examine motion disorders and eliminate those hounds which have motion defects (“camel motion”). This research would be used to determine which males within the breed “carry” certain genes for certain characteristics so we could “infix” it in new generation and eliminate unsatisfactory ones.

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Project duration: 2007-2011
Programme type: National
INTERNATIONAL JOINT MASTER DEGREE IN PLANT MEDICINE

PROJECT OBJECTIVE:

The project proposal follows the overall objectives to contribute to institution building in Higher Education (HE) at a Regional level, to sustain University networking partnerships, to enhance mutual understanding between the academic world of the Western Balkan countries and members of the EU, i.e. Bulgaria, Greece and Italy.

The project proposal is aligned with the European Commission priorities on the central role of HE system in developing a European cultural dimension, which is universally acknowledged as paramount to the development and reinforcement of stable, peaceful and democratic societies.

Even though a series of national reforms have been applied or are ongoing, nevertheless large participation of the Western Balkan countries in previous Tempus projects, the modernization of HE systems, the development of quality education and of life-long learning in the involved areas still need a careful reorganization in the perspective to participate in the process of international competitiveness.

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The first specific objective of the project is to design and develop the International joint Master degree in Plant Medicine (IPM) within the curricula of the Faculties of Agriculture at the Universities of Tirana and Korce (Albania), Osijek and Zagreb (Croatia), Pristhina (Kosovo), Skopje and Tetovo (Macedonia), Belgrade and Novi Sad (Serbia), which will receive the support and the integration of the Universities of Plovdiv (Bulgaria), Athens (Greece) and Bari (Italy). It will be started on the ground of the successful experience of the Master Degree in Plant Medicine at the Faculty of Agriculture of the University of Bari, which respects the EU requirements, and from the existing curricula in Plant Protection or similar degree active in the other Universities of the consortium.

In the realization of project, planning and development of the joint Master Degree Course, the consortium will have full respect of the diversity of cultures, languages, national education systems, University autonomy and strategy, experiences of all involved countries.

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Project duration: 2010-2013
Programme type: Tempus
MULTISECTORAL MODEL
DEVELOPMENT OF FAMILY
FARMS IN RURAL AREAS

PROJECT OBJECTIVE:

In terms of social and especially rural (under)development, Slavonia and Baranja region most obviously shows inadmissible delay in the process of post modernization, that is, modernization. What is more, the gap drastically increased and intensified paradoxes typical of us only, like agricultural over employment and demographical emptiness in larger part of the rural area of Slavonia and Baranja, and aging of agricultural population, then numerous, but fragmentized, non-specialized, natural and non-productive farms. Aggravated conditions of management in agriculture due to failure to adapt to new market conditions influenced processes of depopulation and degradation of original capital without any vision of further life and work in rural areas.

Based on traditional and historical traits as well as modern needs, it is necessary to encourage family farms to develop additional activities. In this regard the model will be proposed for economic and social revitalization of family farms through restructuring of agricultural production, that is, through consolidation of war-depleted areas. Namely, it is hard to expect growth of resources through land consolidation, unless at the same time the same effort is made to educate agricultural producers on possibilities of utilizing available labor resources.

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Therefore, it is necessary to stimulate local and regional production potential through reconstruction and activation of additional activities in order to allocate unutilized production resources.

By using the model of revitalization of production and economic system, family farms will start trends from production side toward those farms that have competitive advantages, from aspect of traditional as well as contemporary factors of agricultural production, applying principles of sustainable agriculture and respecting environmental standards as well as respecting the needs of the local and regional market. In addition to this model, a concrete production model will also be proposed, both for agricultural and mixed farms, which will also include possibilities of activation of additional activities, proposing also the model of creating clusters that would be adjusted to local and regional circumstances. The importance of this research is reflected in proposing the model that will make it possible to stop demographic and economic deterioration of family farms, and enable their revitalization.

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Project duration: 2007-2011
Programme type: National
POSSIBILITY OF IMPROVING THE PRODUCTIVITY OF SHEEP IN ORGANIC BREEDING

PROJECT OBJECTIVE:

The project should answer on the question with which the genotype of sheep and technological processes in organic sheep production, enhance productivity and increase financial income on family farms. In the research will be include registered organic farm. Productivity will be investigated and exterior characteristics of sheep and lambs, depending on genotype and nutrition and quality of sheep products-meat with regard to the nutritional, organoleptic, technological and linear properties. Influence of genotype will be investigated on Tsigay, Merinolandschaf and crossbreeds Tsigay x Merinolandschaf. Also, will be investigated and reproduction traits of sheep and their relationship with productivity, as well as health and metabolic status of sheep and lambs reared in organic farming.

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Will be investigated botanical and chemical composition and yield of plant mass in the pastures and meadows during the year, as well as the impact of the different composition of meals, on productivity and profitability of organic sheep production. Depending on genotype and applied technology of breeding, will be investigated the quality of meat.

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Funding scheme: Ministry of Agriculture, Fisheries and Rural Development
Project duration: 2008-2010
Programme type: applied project (VIP)
SYNERGY OF NITROGEN AND DROUGHT IN ENVIRONMENT AND PRODUCTION OF WHEAT AND BARLEY

PROJECT OBJECTIVE:

Changes in legislation, market demands for quality of agricultural products and climatic changes demand shift in technology of agricultural production toward adaptation and alleviation of harmful impacts on environment and economical power of family farms. In Croatia wheat and barley are produced on 230.00 ha and they represent reasonable income for family farms. Due to low yield of wheat and barley in some counties changes are needed in production technology. One of the possible ways for improvement is in introduction and development of seed production with the special emphasis on environment protection. To achieve this goal limiting factors such as cultivar, weather, agro techniques should be eliminated.

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Goal of this research is to develop solution, with integrative attitude, for development of seed production on family farms, and optimal fertilization with more adaptable wheat and barley cultivars. Special emphasis will be given to the impact of different production technology on environment and possible interactions with unfavorable weather conditions such as frequent dry periods. Project will result with economically strengthened family farms and growth of their competitiveness in the region.

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Project duration: 2007-2010
Programme type: applied project (VIP)
SUSTAINABLE TECHNOLOGIES OF CROP PRODUCTION AND GIS APPLICATION

PROJECT OBJECTIVE:

Apart from the former experiments (of conducted investigations), those being in the course of time (research on technologies improvement in crop and horticulture production and agriculture GIS technologies application) and the future ones, all relevant literature will be used. Also digital bases (AGRO BASE) of the most important crop and horticulture technologies (agro engineering), being applicable for broader area in Croatia, are being developed. This important material will be digitalized and placed on CD medium (html and other easily available formats), which will be transparent and user-easily available (advanced farmers, extension service and county-competent services). The user will, via the computer questionnaire (images and graphics), easily and fast get the important data on crop, assortment, pest, disease and weed protection as well as some crops growing technology (modern and sustainable technologies). In this way the user will be able to promote his own plant production (higher productivity and crop yield increase per ha).

Several thematic GIS maps will be also developed. Recording of the maps, geo-references and integration are performed by using world methodologies (registration in GIS program packet ILWIS3 and geo-references). The maps are united and converted into desired detail level. This method will be tested on Antunovac area of approximately 25 km² and later on the whole county area. The completed thematic maps (k.o – cadastre municipality Antunovac) will be, as a model applicable for the whole Croatia, used for making decision on loans or some other purposes.

Thematic maps (solvent) or maps of optimal land purpose in terms of a certain land use (maps of the productive capacity, restricting ecological factors, anticipating yields, mined areas or similar theme important for the modern agriculture) will be developed. It is of great importance to inform users of AGRO BASE and basic GIS tools on the main geo-informatics technology principles. In terms of the above mentioned and agreement with representatives of the competent services (of the county and Croatian Department of Agricultural Extension Service), presentations and courses on usage and application of the developed bases of the advanced crop and horticulture technologies and thematic maps will be held. The users will be precisely and simply trained for using and applying data bases and maps (GIS). The above mentioned services will be provided with the basic software ILWIS 3 which will enable reading out and using the maps.

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Project duration: 2008-2010
Programme type: applied project (VIP)
LACTATION YIELD PREDICTIONS IN DAIRY CATTLE

PROJECT OBJECTIVE:

Successful dairy production substantially depends on decisions made at various stages of the production period. Numerous genetic and environmental factors could make correct decisions difficult, therefore, some tools to support breeding and management decisions are needed. A mathematical formula describing the behavior of milk yield during a lactation, referred to as lactation curve, may be a good instrument in dairy cows production monitoring. The shape of the curve provides the farmer with some valuable information. For instance, cows with a very high peak yield are unable to take the amount of nutritional substances they need during the first stage of lactation, which is likely to lead to negative energy balance, reduced reproduction rates, and increased susceptibility to diseases. Conversely, cows with a flat lactation curve are more resistant to metabolic stress during the initial phase of lactation and have their energy demands more balanced, which in turn reduces feeding costs. Knowledge of the lactation curve allows prediction of total milk yield from a single or several test days early in lactation. With such knowledge, a dairy producer can make management decisions early based on individual production

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Besides facilitation of farm management decision, knowing the lactation curves could also facilitate breeding decisions, e.g., selection and culling. There are various mathematical equations describing lactation curves in dairy cows, from the more empirical equations that relate input to output statistically with little consideration of the biology of lactation, to the more mechanistic ones which describe the lactation curve based on the biology of lactation. Although the latter may produce parameters that have a more biological interpretation, they can be too complex for routine use outside research, and some of the mechanisms are, as yet, not fully understood. The aim of this project was to contrast methodological approaches followed in predicting dairy cow’s lactation yield, i.e. linear and nonlinear regression models as well as artificial neural networks to method used by an official milk recording system. Final goal was to determine approach with best predictive capabilities of lactation yield in terms of easily practice application

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Programme type: applied project (VIP)
GAME FARM BREEDING IN FUNCTION OF THE RURAL DEVELOPMENT

PROJECT OBJECTIVE:

The aim of the research is to seek out the optimal model for sustainable game breeding under the controlled conditions at farm. This comprise optimal keeping and feeding in order to adjust game feeding (with naturally available food) and nutrition (additives into main food during the shortage in nature, mineral-vitamin mixtures), as well as to control herd size. Additional aim is to establish a model of quality veterinary and sanitary care for the viably optimal health status of game population under the farm conditions. The project shall determine rational for the introduction of modern zoo-technical methods in the area of breeding and selection, thus making an important innovation in game breeding in Croatia.

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This shall primary enables significant growth of trophy value that implies development of hunting and rural tourism, respectively, as an important economic resource in eastern Croatia, which is currently set aside. From the other side, farm breeding of autochthonous game species contributes to the improvement of supply of game meat on domestic market, as well as for launching the potential production of processed meats in country. The project shall have a notable impact on the rural development in Croatia by affecting sustainable development of the family-owned agricultural husbandries, and increase of employment and income.

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Project duration: 2008-2010
Programme type: applied project (VIP)
SWEET CORN PRODUCTION AND COMPETITIVENESS OF FAMILY FARMS

PROJECT OBJECTIVE:

Sweet corn is a variety of maize with a high sugar content and prepared as a vegetable. It is physiologically high-quality vegetable culture with poor content of fat. Also sweet corn is good source of fiber, vitamins and nutrition’s. It could be eaten fresh, canned, or frozen before the kernels become tough and starchy. The research has been conducted during two years 2009 and 2010 on six locations in Osijek Baranja county, Vukovar Syrmia county, Brod Posavina county and Virovitica Podravina county. The main targets of project are to estimate influence of plant density on ear length, number of rows, number of grains per ear, sugar content in grain, thousand kernel weight, susceptibility on the most important diseases (e.g. Fusarium stalk and ear rot) and European corn borer. Chemical analysis have been used for determine mycotoxin content, kernel characteristics associated with eating quality (kernel moisture concentration, kernel tenderness, sugar content, antioxidants, tocopherols).

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To increasing the competitiveness of family farms (OPG) production and spread sweet corn in Croatia we must educate producers about: optimal use of agricultural measures, economic characteristics of hybrids, genetic variability and adaptability of new breeding populations of sweet corn and possibility of post harvest sowing.

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Project duration: 2008-2010
Programme type: applied project (VIP)
RESEARCH OF CAUSES AND EFFECTS OF FAILURE IN NECTAR PRODUCTION IN SUNFLOWER

PROJECT OBJECTIVE:

The potential that beekeeping provides to the agriculture, rural development and income increase of the family-owned farms is very large. Honey is a very valuable food, and additional source of income, while the wax is product which can be put on the market. The beekeeping does not interfere with other productions at farms, while the pollination by bees significantly increases a yield of the farm crops. Today, beekeeping is confronting with a great problem that affects its existence. Global problem of bee disappearance, which in more extreme form can bring beekeeping into serious crisis, was observed also in Croatia. Among the many supposed causes of this phenomenon is failure in sunflower’s nectar secretion, resulting in weak growth of the bee communities and poor preparation for the wintering. A lack of sunflower as the bee-pasture become evident in the past 4-5 years, and emerged not only as a local, but more wider problem. The aim of all planned measurements is to identify specific causes of failure in nectar secretion in sunflower, in order to prevent negative effects that have impact on honey bee. It is also important to enable secure crop pollination, as a precondition for yield growth that supports diversification of employment and rise of income at family-owned farms in the function of rural development..

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Project duration: 2008-2010
Programme type: applied project (VIP)
PIG CARCASS QUALITY AS THE FUNCTION OF IMPROVING COMPETITIVENESS IN PIG PRODUCTION

PROJECT OBJECTIVE:

The aim of this research is to evaluate carcass leanness according with exact elements for estimation of lean percentage that are used for trading and calculation in selling pigs and pork. Embedded tested coefficients are used within mathematical models in software for automatic and manual procedures of evaluation lean percentage in the carcass. These methods will finally take constant place in a way of confidence for pig producers and processors while offering objectivity in estimation of quality and economic value of barrows. Set out coefficients must be statistically within the terms assigned by EU regulation no. 3220/84 and 3513/93 if the company tends to deal within EU framework.

Additionally, this objective evaluation of lean percentage will gradually affect positively on improvement of carcass and meat quality together with improving competitiveness, especially on small family farms.

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Funding scheme: Ministry of Agriculture, Fisheries and Rural Development
Project duration: 2008-2010
Programme type: applied project (VIP)
REDUCED SOIL TILLAGE IN CROP PRODUCTION

PROJECT OBJECTIVE:

Winter wheat and soybean are one of the most important crops in Croatia, especially for the eastern part - Slavonia and Baranja region, which is producing, in average, 55% of total winter wheat and 30% of total soybean production in the country. The practice is mainly conventional, based on standard soil tillage including ploughing on 30-35 cm as primary tillage operation, which is the most expensive, slow, with high demands for fuel and labour. Also, it can be ecologically unfavourable and non-sustainable (strong soil compaction, soil fertility degradation, organic matter loss). Meanwhile, in the latest twenty years the knowledge about soil tillage in Croatia has been changed, as in many countries in the world, toward simplification, reduced, rational tillage. Diskharrowing, as a primary tillage operation, was not researched thoroughly enough, especially in the light of other reduced tillage systems, such as no-till, where equipment price of special no-till planters and heavier tractors can be limit for average Croatian farmers.

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In eastern Croatia regions, various systems of reduced tillage for different crops have been already tested, with main goals to decrease the costs of production, maintain agro sphere sustainability and to preserve high yield (characteristic for this region) despite the reduction of applied agritechniques. Along with the introduction of reduced tillage systems, the awareness has been raised of different approach toward fertilization, soil compaction, weed control and other problems connected with lesser soil agitation. The simplified soil tillage for winter wheat and soybean particularly raised the question of efficiency of fertilizers, especially nitrogen, in interaction with the tillage systems.

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Funding scheme: Ministry of Agriculture, Fisheries and Rural Development
Project duration: 2008-2010
Programme type: applied project (VIP)
SUMMER SECOND CROPPS
FOR FOOD AND BIO-ENERGY

PROJECT OBJECTIVE:

The research of summer second crops has been set up at representative soil types, and includes different soil preparation for sowing and fertilization of summer second crops for food (buckwheat, millet) and mass (sorghum, sudanese grass) which can serve as important source for bio-fuel production, grown after the most produced winter crops' harvest, barley and wheat, thus mitigating competition on agricultural land between food and bio-fuel crops.

The split-split-plot experimental design in four replications has been set up after each main winter crop, with the main treatment of "Soil Tillage", presented by three treatments: ST - standard treatment, based on plowing, RD - reduced processing, based on diskharrowing and NT - direct sowing of crops in the stubble. The subtreatment "Fertilization" has following levels: G0 - control, without fertilization; G1 - basic NPK fertilization - about 1/3 of total N requirement, nitrogen top dressing with granular mineral fertilizers (KAN-27% N) only; G2 - basic NPK fertilization, N side-dressing a 5% UREA (47% N) solution; G3 - basic NPK fertilization, side-dressing with foliar fertilizer "Profert Mara" with the half of the recommended dose; G4 - basic NPK fertilization, side-dressing with "Profert Mara" in the full dose; and G5 - basic NPK fertilization, side-dressing "Profert Mara" with double dose; and G6 - without the basic fertilization, "Profert Mara" as only source of nutrients.

Beside yield components and final grain and bio-mass yield amounts, the further analysis of the quality of raw materials for further processing in food technology (buckwheat and millet grains), and bio-fuel (buckwheat and millet straw, sorghum and sudanese grass whole mass).

Analysis of technology will give additional arguments for the improvement of agricultural production through better utilization of equipment and human labour through additional employment during the extended summer second crop growing seasons.

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Project duration: 2008-2010
Programme type: applied project (VIP)
MARKETING PREPARATION OF FRESH MEAT THE BLACK SLAVONIAN PIGS

PROJECT OBJECTIVE:

Fleshy modern breeds of pigs and their hybrids (hybrids) have high meatiness, but also all the poorer quality meat which is often manifested as PSE (pale, soft and exudative). Such meat is bad organoleptic (sensory) and culinary properties, which refuses to consumers. Less productive, indigenous breeds, such as the Black Slavonian pig meat, which give good quality, can play an important role in the improvement of the quality of pork. Meat from Black Slavonian pigs and crosses on the basis of this breed is a better quality of fleshy meat breeds of pigs. As such, it may be recognizable Slavonian (Croatian) brand in the tourist industry and the market, especially for customers with special requirements, and those with greater purchasing power. Production of such meat would increase the income of family farms, has contributed to the protection of origin of fresh meat from Black Slavonian pigs as well as survival of the indigenous Black Slavonian pigs, which are currently threatened with extinction. The project responded to questions during the fattening technology to produce meat of the Black Slavonian pig and its crosses, which are indicators of the standard quality of fresh meat from Black Slavonian pigs and their crosses as well as the position of meat from Black Slavonian pigs and their crosses on the market.

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The research results will enable the development of specifications of the food product label of origin, and then apply for registration of marks of origin. Economic benefits this project will be manifest in profitable production of fresh meat from Black Slavonian pigs and improve the standard of quality. Users found this project directly to the existing and potential breeders of Black Slavonian pigs, and indirectly, retail chains and tourist activity.

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Funding scheme: Ministry of Agriculture, Fisheries and Rural Development
Project duration: 2007-2009
Programme type: National
HARMONISE THE STRATEGIES FOR FIGHTING DIABROTICA VIRGIFERA VIRGIFERA

PROJECT OBJECTIVE:

The long term objective of the project is to establish a harmonised and sustainable control strategy for WCR populations both in the areas of continuous establishment and in the areas of discontinuously emerging populations. On the same time project aims at minimizing the impact of these measures on biodiversity and the environment. These control strategies should also be adapted to the situation of each country involved and should take into account the situation of the farmers and the economic chains build upon the maize crop. These control strategies could include integrated control, plant resistance traits, the adaptation of biotechnological approaches and cultural techniques. The outputs of the project will benefit the European Union by the following main results:

- An increased awareness and understanding of the problems caused by this pest species encountered by plants breeders, farmers, and plant protection services.
- A coordinated European Action Plan: harmonizing and improving control and prevention of Western Corn Rootworm populations in Europe.
- A coordinated European research plan: identifying the priority research areas and minimizing parallel research.

In the past few years the Western Corn Rootworm (WCR, Diabrotica virgifera virgifera) invaded central Europe more rapidly than expected in the past. The rapid spread of WCR together with the establishment of continuous populations will evidently result in severe problems to European high intensity maize production areas throughout Europe. Several research activities in the EU member states aimed at finding integrated strategies for reducing WCR populations below threshold levels. There is an urgent need for harmonising and concentrating these activities both on a scientific and administrative level to establish a community-scale action and research plan. Thus the goal of the project is to establish a harmonised and sustainable control strategy for emerging WCR populations. On the same time the project aims at minimizing the impact of these measures on biodiversity and the environment. Control strategies to be established should also be adapted to the situation of each country involved and should take into account the situation of the farmers and the economic chains build upon the maize crop, including integrated control, plant resistance traits, the adaptation of biotechnological approaches and cultural techniques. Furthermore, the project will evaluate short and long term costs/benefits of containment and eradication strategies at the micro or macroeconomic level (farms, regions, countries, Europe).

Diabrotica virgifera virgifera LeConte

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Project duration: 2006-2008
Programme type: FP6
DEVELOPMENT OF A NON-TOXIC, ECOLOGICALLY COMPATIBLE, NATURAL-RESOURCE BASED INSECTICIDE FROM DIATOMACEOUS EARTH DEPOSITS OF SOUTH EASTERN EUROPE TO CONTROL STORED-PRODUCT INSECT PESTS

PROJECT OBJECTIVE:

Stored products, particularly grains and related amylaceous products, are seriously damaged by pests, which can cause serious quantitative losses and qualitative degradations. For their control, two main categories of pesticides are used: residual insecticides and fumigants. However, their use in stored food is now reconsidered due to the fact that many of these substances are extremely toxic to mammals and leave dangerous residues on the food. In addition, it is now well established that many substances are very toxic for the environment, such as methyl bromide. One of the most promising alternatives to traditional pesticides is the use of diatomaceous earths (DEs) which are the fossils of diatoms. DEs, which contain chiefly SiO2, act on the insects’ exoskeleton causing death through water loss (desiccation); hence, they have a physical mode of action. Also, DEs are non toxic to mammals, and they are widely used in food industry for many uses, including their use as food or feed additives. So far, several DE formulations are registered for pest control in stored products and facilities. However, the currently used formulations have high application rates, which can affect some of the physical properties of the products on which the DEs are applied. Since newer and undiscovered DEs exist in many parts of the world, the occurrence of DEs that are effective at lower dose rates is very likely. Previous geological studies from the area of South Eastern Europe, especially from some parts of Former Yugoslavia, indicate clearly that these regions are extremely rich to DEs.

However, there is still inadequate information about the insecticidal value of these deposits. In the proposed research project, five laboratories (Greece, Serbia, Croatia, Slovenia and Germany) with extensive experience in the use of bio pesticides and natural resources for stored-product pest control, is planned to conduct specific series to tests to evaluate the insecticidal values of local DEs. The series of experiments are related with the assessment of specific physical and chemical characteristics of the given DEs. Also, during the proposed project bioassays will be carried our, against the major stored product insect species, in order to assess the insecticidal value of DEs. In this way, the DE sample(s) with the desired characteristics (highly effective at low doses, desired chemical properties) will be processed for further research, and potential industrial use. Moreover, the proposed experimental protocol and the results will be published to an International Journal, by establishing a standardised testing protocol for the evaluation of DEs which could be adopted by other researchers as well. Our pilot study consists the first screening of DEs as insecticides from the specific area. Apart from the discovery of new DEs, these data will simulate additional proposals and research on the local DEs, and also encourage farmers and industry for further development.

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Funding scheme: EC
Project duration: 2007-2008
Programme type: SEE-ERA.NET
EDUCATION, RESEARCH AND TRAINING FOR GLOBAL ENVIRONMENTAL CHANGES AND SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES IN WEST BALKAN

PROJECT OBJECTIVE:

The main objectives of the project are:
Development and implementation of curricula related to global environmental changes and sustainable management of natural resources on Master/PhD programs of participating universities of west Balkan;
Conducting research related to global environmental changes and sustainable management of natural resources in west Balkan;
Establishment of student support services (funding scholarships, libraries enrichment with literature related to the courses);
Exchange of knowledge and experience among project participants regarding education and research in global environmental change and sustainable management of natural resources;
Dissemination of project results (publishing scientific papers, participating in scientific conferences);
To maintain and to improve institutional collaboration between WBC Universities and Norwegian University of Life Science (UMB), by exchange of experiences among teachers and researches;
To build local capacities in the planning and management of natural resources;
Development of comprehensive environmental strategy on local level.

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WB lieder: Faculty of Agriculture, University of Belgrade, Serbia.

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Project duration: 2007-2010
SOIL CHEMICAL PROPERTIES IMPACT ON HEAVY METALS AVAILABILITY AND CONCENTRATIONS IN FIELD CROPS

PROJECT OBJECTIVE:

One of the aims of this project is the study of liming on soil fertility, crop yield and quality as well as investigating the movement of heavy metals into the food chain. Research plan includes ongoing experiments with combination of liming and mineral fertilization which have been conducted for 4 years on two sites. Besides continuation of these experiments, new ones will be established on 4 more sites in east Croatia including liming and organic fertilization. During 5 years of the experiments, the analysed soil properties will be: acidity, organic matter, availability of P, K micronutrients (Fe, Mn, Zn, Cu, Ni, Mo) and harmful elements (Cd, Co, Cr, Pb, Hg). Including soil data and by analysing plant material, measuring crop yield and agricultural production, the removal and transfer of the same elements will be determined. The analysis of wheat, and maize will be conducted, with regard to accumulation of micronutrients and harmful elements in grains. The Hungarian partner has 2 ongoing field experiments with heavy metal contamination that have been set up in 1991 and 1995. These experiments investigate of 13 elements in soils and plants (Al, As, Cd, Cr, Cu, Ba, Hg, Mo, Ni, Pb, Se, Sr, Zn). There is also an experiment on the effect of liming and fertilizers on acidic sandy soil. The data and results of these experiments will be evaluated with the data of the Croatian experiments.

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Objectives of the project are: conducting mutual liming, fertilization and heavy metal loading field experiments and assessing their data. Results of these experiments will be used by the national recommendation systems, farmers as well as by the environmental authorities. Gained data will be published both in popular technical and scientific forms, experiences will be built in the education and research.

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Funding scheme: Ministry of Science, Education and Sports
Project duration: 2007-2008
Programme type: bilateral project, Croatian-Hungarian intergovernmental S&T cooperation programme
PROJECT OBJECTIVE:

The results of previous studies use different systems of reduced tillage strongly suggest a lack of familiarity, and consequently the lack of applicability of these systems by farmers. For application of reduced tillage, almost regularly, the most common limiting factor in education of, and in its implementation often work errors, and the application becomes risky is unnecessary errors. Most developed countries were willing and open to acceptance of reduced tillage technologies. Such approaches make a great step forward in addressing its large and accumulated problems concerning the ecological, production, organization, energy and economic aspects. The same problems inevitably expected or already present in our country, especially in the Osijek-Baranja County, as one of the most important subjects of agriculture in Croatia.

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The basis of this request is to expand the research systems of reduced tillage on multiple sites with different agro ecological conditions in production, in Osijek-Baranja County. The benefit of a particular system of reduced tillage in the growing of our most important and most common field crops (winter wheat, corn, soybean and sunflower), establishing order based on the implementation of field experiments. Field research conducted at representative locations in our Osijek-Baranja County, on family farms, and nearby cities: Našice, Donji Miholjac, Đakovo, Beli Manastir and Osijek.

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Funding scheme: Ministry of Science, Education and Sports
Project duration: 2008-2010
Programme type: National (bilateral)
SOIL TILLAGE SYSTEMS AND FERTILIZATION IN CROP PRODUCTION

PROJECT OBJECTIVE:

Any system of field crops production can be valorised from various aspects, which are primarily in the field of physical, chemical and biological soil complex, but also organizational, economic and other aspects of all the more as the most important component of the complexity of the implementation of agro-technical measures mentioned and economic and environmental sustainability of the above systems. Reduced soil tillage and optimum fertilization of arable crops, is one of the possible ways to resolve the accumulated ecological-economic-production of social problems. In this respect, and designed the project, which aims to provide answers to the above and other issues in the existing projects in the interest of both sides, Agricultural Faculty in Osijek (Croatia) and the Institute of Maize "Zemun Polje" in Zemun (Serbia). Croatian research team engaged in a wide range of impacts of different systems of reduced tillage and fertilization in the cultivation of a variety of winter wheat and soybeans in crop rotation, and validating the research model is based on the complexity of the tripartite system: the plant-soil-environment. Serbian team of researchers also studied the impact of reduced tillage and fertilization, but for corn and soybean in the crop rotation.

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Therefore, a detailed analysis concerning conventional and reduced tillage with fertilizer, in finding the most effective economically and environmentally is the safest system of field crops production. Common interest through the bilateral project would be to exchange experiences, ideas and results, and creating positive conditions for mutual networking and joint action within their own countries and strengthening bilateral relations in the scientific and professional and other plans. It also would set up research teams with the goal of joint appearances by the third party interest or application, and work on international projects (SEEERANet, FP7, etc.). The special importance of the proposed project is reflected in the fact that we belong to the same Danube region, which means that we share the same or similar agro ecological conditions. In light of recent knowledge on climate change, and the causal relationship of climate and agriculture, the lonely individual state action, or may not have significant impact on the prevention of negative impact. Creating a positive cooperation in this framework, it is certainly a good start mutual work on improving the agricultural cultivation of field crops, and ecological consciousness and preservation of the common features of our region.

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Project duration: 2008-2010
Programme type: National (bilateral)
CONSERVATION, IMPROVEMENT AND UTILIZATION OF ANIMAL GENETIC RESOURCES IN SERBIA AND CROATIA

PROJECT OBJECTIVE:

The main selective cattle breeding trends were directed for many years either towards replacement of local autochthonous breeds with highly productive purebreds or towards crossbreeding of local breeds with purebreds aiming to produce animals of better quality. Such breeding trends have contributed to a continuous improvement of cattle production, but on the other side, they caused losses in genetic diversity of domestic animals. Over the time, population of some autochthonous breeds was rapidly reduced to the point of extinction of a given breed. One of important zoo technical characteristics of local autochthonous breeds is that they have not been subjected to selection in cattle breeding, so available biological variability in productive and reproductive traits offers enough possibilities for relatively fast recovery not only of one herd, but also of the whole population. Furthermore, for its robustness and toughness, local breeds are usually found in specific production systems set up to produce organic or traditional products that carry the Protected Geographical Identification label. It should be also pointed out that, besides its higher productivity, purebreds of domestic animals have also some unfavourable traits, such as greater sensitivity referring to feed intake, accommodation and health condition or lower quality of products, especially referring to the chemical composition. Taking into consideration all above stated facts and similarities in cattle breeding not only in Croatia and Serbia, but also in the whole region, the overall aims of the project are:

(1) to determine the most important phenotypic characteristics of particular autochthonous breeds of domestic animals that are bred in Serbia and Croatia (Tsigai sheep, some types of Pramenka sheep, Busa or Podolski cattle breed); (2) to determine and analyze breeding and zoo technical conditions on farms where local breeds have been bred; (3) to suggest potential development trends for improvement of autochthonous breeds. The study carried out within this project will be used a basis for further definition of breeding programs for small populations of autochthonous breeds or sorts of domestic animals. However, for the purpose of correct determination of breeding programs for preservation and sustainable exploitation of animal genetic resources, it is necessary to continue with the researches. If the populations of particular breeds or sorts of domestic animals were studied as a whole not only in Croatia and Serbia, but also in the whole region, it would be possible to determine whether there is genetic diversity primarily on the molecular level. Such results can be very important if considering the possibility to use reproductive cattle not only within national borders, but also in a wider geographical area.

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Programme type: National (bilateral)
PROJECT OBJECTIVE:

In the last decade genotype of fattening pigs has been totally changed. Existing pure breeds had been substituted with numerous hybrids with unstable production and increased sensitiveness. Antibiotics and synthetic growth promoters are being abandoned from use and some are even forbidden by the law. So to improve production many growth promoters, as well as feed additives are being used, and new products are introduced by the day. Regarding the ewer grooving production and need to be economic, research on immunomodulators action in production properties and feed quality has two major aspects: 1. How to produce enduring hybrids and feed them adequately to gain good production results. 2. And at the same time how to provide antibiotics free and good quality meat for consumers.

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For the purpose of immunomodulatory effect, influence of organic selenium and clinoptilolit as a feed additive will be researched. Production (weight gain, feed conversion, consummation) and carcass properties (ultrasonic fat measuring, longissimus dorsi muscle cross section measurement, carcass weight, randman, meat pH, color and water retention capability) as well as thyroid gland hormones, cortisol, insulin, glucagon, acid-base blood balance and biochemical parameters (glucose, urea, creatinine, proteins, globulins) will be measured.

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Programme type: National (bilateral)
ALTERNATIVE ORGANIC NUTRIENTS FOR CROP AND SOIL IMPROVEMENTS

PROJECT OBJECTIVE:

Bilateral project "The alternative crop nutrient sources for organic crop production and soil properties improvement" is based on national projects "Cover crop in organic agriculture" (Faculty of Agriculture Osijek) and "The possible use of wood ash in agri- and horticulture" (University of Debrecen). In both projects there is awareness of strong importance of the organic crop production in modern food production, environment protection and food security, and both projects are dealing with specific attempts of improvement of organic crop production, either through the cover crops such as the source of nutrients for organic crop production through the use of legumes and their mixture with other available crops ("Green Manure"; Nitrogen and Carbon sequestration), or through the utilization of the by-products of burning organic materials (forestry industry – wood ash, bio-energy – straw ash, etc.). Bilateral project will give both sides opportunity to implement ideas and technologies to create new, synergistic approach toward the use of alternative sources of crop nutrients, and provide viable solutions for organic crop producers, who are legally not allowed to use mineral fertilizers as the source of the crop nutrients.

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Goals of the project:
> to raise awareness of both nations regarding organic crop production and alternative crop nutrients methods through the use of green manure, organic leftovers, composts, etc.
> to find out ways and methods of improving organic crop production in both countries through alternative organic crop
> to search for environmentally sound methods of crop production and environment protection by improving the soil chemical, physical and biological properties
> to improve collaboration between scientific communities in both countries
> to prepare further bi- and multi-lateral projects on given topics

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Project duration: 2009-2011
Programme type: bilateral project, Croatian-Hungarian intergovernmental S&T cooperation programme
HEAVY METALS FROM FARM TO FORK (PROTECTION OF FOOD CHAIN)

PROJECT OBJECTIVE:
The aims of this project are the impact of soil, liming and fertilization on crop yield and quality, and on transfer of heavy metals into the food chain. Research plan includes ongoing experiments with combination of liming, mineral and organic fertilization which have been conducted for 6 years on more sites. During experiments, the analyzed soil properties will be: acidity, organic matter, availability of P, K micronutrients (Fe, Mn, Zn, Cu, Ni, Mo) and harmful elements (Cd, Co, Cr, Pb, Hg). Including soil data and by analyzing plant material, measuring crop yield and agricultural production, the removal and transfer of the same elements will be determined. The analysis of wheat, maize, soybean, rapeseed and vegetables will be conducted, with regard to accumulation of micronutrients and harmful elements in grains and eatable parts. Additionally, the heavy metals content will be analyzed in a fresh and composted manures as important segment of heavy metals cycle. Important part of project is analyzing consumer preferences and knowledge regarding to heavy metals and food quality. The Hungarian partner has 2 ongoing field experiments with heavy metal contamination that have been set up in 1991 and 1995. These experiments investigate of 13 elements in soils and plants (Al, As, Cd, Cr, Cu, Ba, Hg, Mo, Ni, Pb, Se, Sr, Zn). The data and results of these experiments will be evaluated with the data of the Croatian experiments. The field crops experiments and following composts and vegetable experiments will be used for looking for the answers of the following questions:
- Which contamination concentration is sufficient to cause fitotoxicity, decrease of yield and yield quality?

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- Which are the maximum contamination loads of different soils and plants?
- What are the transfer coefficient values of the contaminants between the elements of the food chain?
- Built in the results of the soil, plant and animal toxicology tests into the system of soil quality standards.

Objectives of the project are: conducting mutual different crops and vegetable field experiments, and assessing their data. All the experiments will be conducted towards new information about heavy metals from farm to fork, i.e. from soil and fertilizer by plants to agricultural products. Results of these experiments will be used by the national recommendation systems, farmers as well as by the environmental and food quality authorities. The expected results would be useful for the scientific support of food safety and soil quality standards.

In the course of the cooperation the young researchers would be able to learn the recent research and laboratory methods (ICP and CHNS/O Analyzer) that require more visits. Gained data will be published both in popular technical and scientific forums, experiences will be built in the education and research.

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Programme type: National (bilateral)
IMPROVEMENT OF PLANT PRODUCTION, SOIL FERTILITY AND ENVIRONMENT PROTECTION BY LEGUMES INCLUSION IN CROP ROTATION

PROJECT OBJECTIVE:

The objective of this bilateral project is to investigate the usage of legume crops in crop rotations, whose use in plant production gets more and more importance, especially in light of the growing prices of nitrogen fertilizers, which are often unreasonably used in the environment, which can significantly impair not only the natural and human eco-systems, but directly human's health. Also, both institutions have long experience in the research of plant production, which includes legumes, and are recognized as such not only by the scientific community, but also of business entities, both large, and small but no less important, family farms. The transfer of knowledge is especially important, because farmers on family-owned farms in both countries are still (unfortunately) without adequate knowledge of agricultural production. Main goals of this project are to:

- Improve agricultural production based on research of legumes in crop rotations;
- Identify various aspects of improvement of the fertility of different soil types by legumes;
- Explore ways of improving the efficiency of symbiotic nitrogen fixing bacteria;
- Determine the actual situation in terms of nitrogen, phosphorus, potassium, the reaction solution pH of soil and soil type;
- Explore the possible increase in nitrogen content, easily available phosphorus and potassium;
- Determine the impact of legumes inoculation on the total yield;
- Explore the content of total carbohydrates in legumes' tissue and content of plant pigments-chlorophyll and carotenoids- in legumes;
- Explore the content of vitamin C in legumes' tissue;
- Comparison of studied parameters between inoculated crops and control;
- Make recommendations for proper introduction and regular use of legumes in crop rotations; and for inoculation;
- Stress the importance of preserving the environment by using legumes in crop rotation;
- Explore the consequences of the use of legumes to environmental conservation, especially in the nitrogen-cycling;
- Develop cooperation between the two institutions for future bi- and multi-lateral projects on given topics.

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Project duration: 2009-2011
Programme type: National (bilateral)
SUSTAINABILITY OF SUMMER SECOND CROPS FOR BIO-ENERGY NEEDS

PROJECT OBJECTIVE:

Summer second crops, sown after the winter crops, have been traditionally used for food production, fodder (production of grain, green forage, hay and silage), green manure (sideration) and bee pastures, and recently for the production of bio-mass for energy, either as an energy source in the thermal power plant, where the crop bio-mass is used as a fuel for the energy, or as a mass of bio-gas, where the bio-gases are obtained by fermentation of the crop bio-mass, where in both cases waste can be used as organic fertilizer. That leads toward greater employment opportunities of local farmers, greater revenue per hectare, and greater sustainability through the diversification of production and the target market (usually food, but also new energy market!!!). Furthermore, the soil is better protected and conserved after the harvest, during the fallow period (reduced insulation, loss of water and organic matter in soil, etc.) and the competition for land resources between the crop production for food and energy is avoided or mitigated. Also, the use of such energy sources helps reduce the impact of fossil fuels on global warming.

Maize, as a major agricultural crops in both countries, Croatia and Serbia, is one of the potentially most interesting crops for this purpose, and certain awareness of the benefits of the maize for a bio-energy is already existing, what would this bilateral project used as a basis for further joint work. Besides maize, the research will include other potentially interesting crops, which, sown after-harvest, can provide raw materials for bio-energy plants outside the vegetation period of maize, and thus contribute to the sustainability of these facilities.

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Goals of the project:
> the exchange of ideas and information among institutions reporting a bilateral project, and improve good neighbourly cross-border cooperation
> expand joint cooperation through networking and the creation of teams
> finding sustainable ways of growing and marketing of summer second crops as a renewable source for the production of bio-energy, with emphasis on maize, which would lead to more stable and higher production, especially for family-owned farms
> promotion of sustainable agricultural production and environmental protection of soil, water and air, through the professional organization of round tables, workshops and on-field lectures ("Field Day") for farmers in both countries
> knowledge insemination through the lectures for students and professional organizations (Agronomy Society, Soil Science Society, etc.
> preparing for future joint projects, both bilateral, and multilateral, such as the EU FP7 projects, with emphasis on the cooperation of countries of the Pannonian region and beyond: Austria, Bosnia and Herzegovina, Bulgaria, Greece, Croatia, Hungary, Macedonia, Romania, Serbia, ...
> predicting potential problems and solutions for summer second crops for bio-energy in terms of global warming

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Sunflower is one of the arable crops in Croatia, used for production of edible oil, as well as valuable component of animal feed. The most important problem in sunflower production are diseases. Principal sunflower disease agents in Croatia are fungi, such as *Alternaria helianthi* (Hansf.) Tubaci and Nishihara, *Bortytis cinerea* Pers. Fr., *Phoma macdonaldi* Boerema, *Phomopsis helianthi* Munt.-Cvet et al, *Sclerotinia sclerotiorum* (Lib.) de Bary and *Septoria helianthi* Ell et Kell. Fungal diseases can reduce yield from 10-20% up to 50% or more. Losses due to diseases differ with cultivar, soil and climatic conditions and applied control measures. The objective of this study is to estimate susceptibility of sunflower cultivars to main diseases in climatic conditions of Osijek Baranja county. The experiment has been conducted in 2009 and 2010 growing season in Eastern Croatia (locality Čepin) with two variants of fungicide treatment. Susceptibility of sunflower hybrids has been evaluated twice: at the flowering stage R5.5 – R6 and at maturity R8 (stages according to Schneiter and Miller, 1981).

The first assessment has been done mainly to detect downy mildew (*Plasmopara halstedii*) and Sclerotinia wilt (*S. sclerotiorum*) and the second for Sclerotinia wilt and stem canker (*P. helianthi*). Disease index has been calculated out of collected data (Mc Kinney, 1923). After harvest, for each hybrid and variant 100 sunflower seeds have been examined to determine presence of saprophytes and parasites. Use of resistant hybrids is environmentally the most beneficial methods of diseases control and have not impact on the environment.

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**Programme type:** Professional research
EXPLOITING BY-PRODUCT OF LIVESTOCK PRODUCTION AND SLAUGHTERHOUSE WASTE FOR ENERGY PRODUCTION

PROJECT OBJECTIVE:

Croatia as a candidate for member of the EU must adapt the guidelines in the use of renewable energy sources for future investors and the current agricultural producers protect the environment from harmful emissions into the air, soil and water in accordance with the IPPC Directive 96/61 and nitric Directive 91/676. and commitments to increase production and use of renewable energy sources (Agenda 2000). and to encourage the application of new technologies, research and development of the demonstration plant. Agriculture now receives the most importance, because in addition to food manufacturers is becoming strategically important product and that is energy.

Provided research goal is to determine the possibility of using biogas manure from several farms in the Osijek-Baranja county. In addition to manure to produce biogas to examine the possibility of using slaughterhouse waste categories II and blood. The aim of the research is to determine the amount of available biomass, slaughterhouse waste II category, the amount of blood that can be collected from slaughterhouses, waste oil and waste grease from waste water filters from the Osijek-Baranja county.

On the basis of the information collected to set up anaerobic fermentation with a number of different experimental groups (a mixture of different substrates) and determine the amount of biogas produced, the composition and calorie value of the gas. Based on the results it is possible to calculate the amount of produced electricity and heat.

Produced electricity sold to the distributor and the thermal energy produced would be used to heat the buildings of the general social importance such as schools, kindergartens and medical institutions. Project but has economic significance for environmental mission to reduce harmful greenhouse gas emissions and reduce water pollution. After fermentation got to be good quality compost.

In addition to the above is a significant social impact because it would allow employment of a number of people and get more exercise joint family households (investors).

Research should be conducted in the Laboratory for renewable energy at the Faculty of Agriculture in Osijek.

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Programme type: Professional research
CAUSES AND DAMAGE OF LIME INDUCED CHLOROSIS IN VINEYARDS IN EASTERN PART OF THE OSIJEK-BARANYA COUNTY

PROJECT OBJECTIVE:

Chlorosis is light reversible leaves coloring which usually occurs as a symptom of the lack of specific elements, but also can be the result of root damage, pest attacks, viral diseases, etc. The lack of an element in a plant is commensurate with its availability in the soil and the length of the vegetation in which it plant can adopt. Therefore, plants suffer in the event of a lack of an element when its accessibility (and / or quantity of nutrients adopted) is less than the amount that is necessary for plant metabolic processes at a certain stage of growth and development. Deficiency can result from low amounts of nutrients in the soil, poor mobility or poor solubility forms of biogenic elements. On the alkaline soil, what are predominantly in the eastern part of Osijek-Baranya County, with a high content of carbonate, a frequent occurrence of chlorosis in crops and permanent plantations, mostly due to lack of iron and zinc. High content of carbonate directly and indirectly, except on the availability of iron and zinc, affects the accessibility of nitrogen, phosphorus, magnesium, potassium, manganese and copper.

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Iron is an essential element for the synthesis of chlorophyll and lime induced chlorosis on calcareous soils of our County is a large and poorly investigated problem in plant production, and with permanent crops, especially vineyards, resulting in reduced yields and quality of grapes and finally slower quality wines. Problem of lime induced chlorosis in alkaline soils, in Osijek-Baranya County, usually on chernozem, can be reduced by using iron-sulphate and Fe-chelate and foliar or directly in the soil and knowing the causes can be a preventive effect and significantly reduce or even to avoid damage. The aim of this project are:

1) determine the spatial and temporal occurrence and intensity of chlorosis (visually and chlorophyll meter) in Baranya and Erdut vineyard region,
2) create a model supported by computer program for predicting the occurrence and prevention of lime induced chlorosis in Baranya and Erdut vineyard region,
create thematic maps in GIS in the vineyards studied with geostatistical estimate the expected loss from the appearance of lime induced chlorosis.

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Programme type: Professional research
Cattle breeding development and milk production are complex, because there are request for big investments, solutions for agriculture field and also implementation of efficient technology and management production planning on family farms.

Mid 2008. Osijek-Baranja county has become the leading county in the Republic of Croatia for milk delivery with annual production of 14 million liters. Framework needs for Republic of Croatia for milk are about one billion liters, because of that, aim of this project is helping manufactures with scientific and professional contribution. This contribution would help manufactures further increase production and achieve goals define by the administrative department of agriculture and economy of Osijek-Baranja county. (About 200 million liters per year.)

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In the present circumstances agrarian productions can only be competitive if the family farms direct oneself on the agrarian-livestock production.

In this case the manufactures will not be so dependent on the field-crop prices, there are can used those field-crops for feeding their livestock.

Effective utilization of cattle genetic potential, field-crop seeding plan, proper tillage, fertilization and protection of cultures from pests and weeds will help manufactures to further increase milk production per cow and the planning of seeding field-crop that one necessary in the feeding of cattle.

In this research will include all relevant professional factors related to agricultural production in the county 8 The county department of agriculture, farmers associations, Center for the improvement of livestock in Osijek, HZPSS, HPA etc.)

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SOIL ANALYSIS AS BASIS OF FERTILIZATION AND INCREASING OF PRODUCTION PRODUCTIVITY

PROJECT OBJECTIVE:

Soil analysis is the basis for good fertilizer management that maintains the productivity of soil and improves the quality of crops. It promotes more efficient fertilizer use at a lower cost, and prevents environmental pollution from excess fertilizer. Soil analysis is intended, not just to improve crop performance, but also to improve long-term soil productivity. Soil productivity, which is a function of many factors, such as parent material, soil physical and chemical properties, is more stable than land productivity. The aim of this project is to increase productivity in the primary agricultural production on the scientific basis of family farms. Soil samples will be collected from eastern part of Croatia from soil depth of 30 cm and analyzed in order to collect all relevant soil data. Some dates will be collected by help of poll: size and cadastral plot reference, planning of the crop, the first crop and its yield, preceding organic fertilization, plugging in of harvest residua and other soil data, like soil conditioning, slope, agri-technics, texture class, biogene soil properties.

Chemical analyses will be performed by standard methods (pH electrometrically, hydrolitic acidity was determined by titration of Na-acetate, humus spectrometrically by bichromate method, phosphorus and potassium by AL-method and carbonates volumetrically). All the data will be recorded in an input relative basis and by the ALRxp expert computer programme the fertilization needs established with a proposal of measures to optimize technologically and economically the growing of crops as planned, for soil repair and recommendations for removal of limiting factors.

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Input and output data after computer processing are kept within the ALRxp programme automatically in output relational basis of the dbf format being suitable for the GIS system. Linking soil data like climate and agrotechnic with needs of the crop is very complex problem that this project tries to solve. A good evaluation of soil productivity can assist farmers to apply more rational agricultural practice to achieve higher crop yields.

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Programme type: Professional research
SEISMIC DESIGN OF FRAME STRUCTURES WITH INFILL PANELS

PROJECT OBJECTIVE:

Earthquakes occur regularly in the European-Mediterranean area, and are frequently destructive. Performance – based earthquake engineering aims improving the seismic – risk decision – making process through assessment and design methods such that a building attains specific level of performance under given specified earthquake demand. The term "infilled frame" designates a composite structure formed by one or more infill panels surrounded by a frame and refers to the situation in which the frame is built first and then infilled with masonry panels. Confined masonry usually describes the case in which the reinforced concrete frame is cast after the construction of masonry panel. Masonry infills are typically built with hollow bricks, although hollow concrete blocks are not uncommon. They significantly alter the building seismic response, and their effect should be duly accounted for in the design. However, related code provisions hardly include any detailed guidance as to how this should be done. Given the rather detailed provisions included for bare frames and other common R/C structural systems, and the advanced analytical tools currently available to designers, the paucity of code provisions for infilled frames should be primarily attributed to the incomplete understanding of their role, as well as to the numerous uncertainties involved in modeling the effect of infills. Experiences during the past earthquakes have demonstrated the beneficial effects as well as the ill-effects of the presence of infill masonry walls. The design codes have, however, been mainly focusing on the malefic effects. The objectives of the proposed project are to evaluate the effect of applying the full set of EC8 provisions to a multi-storey R/C frame with different arrangements of masonry infill walls, and to propose possible refinements to the design procedure, including explicit consideration of the infill with appropriate stiffness values. It appears that the only feasible way to account for the negative effects of irregularly arranged infill walls, but also for the positive effects of the infill which act effectively as a ‘first line of defense’ in the structure, is to directly include the infill walls in the analytical model used for design. The methodology will be useful for the structural evaluation of the existing buildings.

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Programme type: National
MECHANICAL STABILITY AND FUNCTIONALITY OF MUNICIPAL SOLID WASTE LANDFILL

PROJECT OBJECTIVE:

Basic and Key knowledge Mechanical stability of the landfill and efficiency of its barriers are the two critical elements. Determination of the friction between adjacent materials in big shear apparatus has some technical shortcomings influencing result. No general agreement exists in terms of use of peak, residual or deformation dependent shear strength value. 2D and 3D stability analyses are suggested. Earthquake effect should be considered. Isolation of waste depends on barriers and they are critical in terms of stability. Recently other materials than clay and geosynthetics are in use (asphalt, glass, improved soil, capillary barriers). Their use is strongly dependent on local conditions. Goals - determine significance of the test type, shear strength parameters, 2D and 3D analyses on static and dynamic stability - improve big direct shear test apparatus for testing of friction - apply probabilistic approach in stability evaluation and risk assessment - analyze use of existing materials and technologies for barriers - develop technical, technological and economical criteria for use of different barriers in regard to local conditions.

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Expected results - systematic analysis of existing knowledge and practice - improvement of the existing big direct shear test - development of probabilistic approach to the stability problem and risk assessment - directives for choosing barrier type in regard to local conditions - one doctor thesis and four articles, at least Check of results - experimental - numerical simulations - back analyses of the existing objects and their measurements - comparison with other research results - Importance of research - improvement of the test procedures and apparatus - probabilistic approach in stability and risk assessment - evaluation of possible solutions and technologies in regard to local conditions - proper choice of materials and technologies - improvement of knowledge and practice.

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Programme type: National
SEISMIC VULNERABILITY
POTENTIAL OF URBAN AREA

PROJECT OBJECTIVE:

Real, existing structures consist of different structural concepts, height and plain dispositions, with characteristic dynamic predispositions. Load capacity, ductility and stiffness, together with mass and damping represent the basic parameters of a structure that define its behavior during strong earthquakes. In order to gain an insight into the level of physical deterioration (degradation) of a structure and perform analyses of the damage level before and after an earthquake, seismic risk analyses of large urban regions, provided by applying available theoretical methods of damage analysis, should be fast and simple. As such the following has been done: the first step has been successfully completed with the scientific project “Seismic damage spectrum functions”. This project was based upon the determination of seismic damage functions of SDOF models on previously classified structures using a large number of earthquakes of different intensities as input load. What needs to be done is to define the dynamic and post-elastic properties of structures based on only a few basic parameters. It is necessary to perform the classification of structures and determine the relationship between their parameters, which can be obtained relatively quickly on the field, and dynamic and post-elastic properties of the structures that are necessary to carry out seismic risk analyses. Research contents five (5) phases: Analysis of the effect of structural seismic response parameters on damage level based upon earthquake load; Structure classification as function of structure type, height, plan disposition, structure material and condition and damping; Neural Network Implementation (the solution of the relationship (dependence) between “input” and “output” variables is to be determined); Valorization; The computer program would be developed which would aid in the quick analysis of potential damage level of large urban areas. The results obtained would set the guidelines for the protection of new buildings in the Republic of Croatia and would enable a relatively simple analysis of seismic risk potential of existing buildings in urban areas so as to prepare and organize the protection of people and resources after a catastrophic earthquake.

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Programme type: National
EVALUATION OF THE CORRELATION BETWEEN INVESTMENT PROJECTS AND THE ENVIRONMENT

PROJECT OBJECTIVE:

Every intervention in the space, necessarily influences the environment in which it is realized. Croatia has therefore, through the Environmental Protection Act (OG 82/94 and 128/99) and through the Book of Regulations about the Assessment of the Impact on the Environment (OG 59/00 and 136/04), prescribed the investors’ obligation to prove that the planned project will have no harmful influence on the environment. The Act also prescribes the duty to make a cost-benefit analysis, and the Book of Regulations prescribes the contents of such analysis. The Book of Rules, however, does not prescribe any methodology of the cost-benefit analysis. Such an approach is not acceptable, since the identification and valuation of all factors should be a basis for acceptance of the project regarding its impact on the environment. The purpose of the proposed research project is to improve the environmental protection, allowing at the same time sustainable development, through valorization of the correlation between investment projects and the environment, and consequently, enhancement of the related Croatian legislative. The research will have five phases: In the first phase, a certain number of realized investment projects will be selected, as a representative sample on which the application of the analysis of costs and benefits for the environment will be investigated, in terms of methodology, source and quality of the input data, as well as of the volume and time horizon of the analysis. In the second phase the legal framework and the regulations in the Republic of Croatia, regulating environmental protection and the evaluation of the relation between the investment projects and the environment will be analyzed. In the third phase of the project, methodology of performing the analysis of costs and benefits of the impact of the project on the environment will be developed. Special attention will be paid to the method of determining parameters such as the lifespan of the project, selection of the methods for calculation of the measurable and immeasurable values and the application of the analysis of sensitivity. In the fourth phase the methodology of the cost-benefit analysis of the influence of the project on the environment will be applied on waste management projects. In the fifth phase, the work results from the previous four phases will be analyzed and valorized, and adequate conclusions will be made.

FACULTY OF CIVIL ENGINEERING

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Programme type: National
FINANCING OF LOCAL AND REGIONAL SELF-GOVERNMENT

PROJECT OBJECTIVE:

The main goal of the project is to explore and identify new sources of financing for units of local and regional self-government, i.e. reconstruction of the existing and shared sources of revenues. Due to chronic lack of revenues in the budget, it is very difficult for units of local and regional self-government in general, and especially for those in areas of special state concern, to make capital investments in their area, because the financial value of some capital investment usually exceeds by several times their annual budget. Problems arise already with activities aimed at improvement of social and economic activities, like those related to municipal infrastructure, social activities at the institutional level, welfare, activities related to housing and municipal activities and public services, environmental management, protection of environment, etc. For this reason it is necessary to find new sources of financing in the area of non-fiscal financing instruments like issuance of municipal bonds and project financing. Project financing means joint partnership between public sector and private sector interested in investments. This creates conditions for joint investments through the most frequently used form of project realization, according to the BOT model (build-operate-transfer), where private investors build infrastructural facilities, run a commercial operation for a certain period, after which they turn those facilities over to the unit of local self-government at a symbolic price. Development of underdeveloped areas of Croatia can be stimulated through this and other models of financing for units of local and regional self-government.

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According to its territorial organization, Croatia has 550 units of local and regional self-government, and these include 124 towns and 426 municipalities located in 21 counties. Some of the towns and municipalities suffered damage during the war and they are now part of areas of special state concern, so these areas could be known under a common name - underdeveloped areas. The general problem related to the existence and functioning of units of local and regional self-government is primarily their financing. Croatia applies a mixed system of the vertical financial equalization, according to recommendations of the Charter of the Council of Europe. This system is characterized by fiscal sovereignty exclusively within the competence of the central authority, and by the right of units of local and regional self-government to obtain partial financing from allocation of state-shared revenue and partial financing from their own revenues. Financing of areas of special state concern is a special problem, because fiscal capacity of these areas, due to a range of relevant factors, is insufficient for their normal functioning. For this reason certain towns and municipalities lag behind in their economic development, therefore new, more efficient models for financing these areas must be found.

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Project duration: 2007-2010
Programme type: National
DEVELOPING
A SLAVONIA-BARANYA
TOURISM CLUSTER

PROJECT OBJECTIVE:

Based on available resources tourism is a potential and strategically important line of development for Slavonia and Baranya, that is, for all five counties located in these regions, especially in light of the expected construction of major European traffic routes through this area. Clusters are one of the models of economic development available to a region, as well as to a national economy as a whole. They represent spatially concentrated and interrelated economic and other interested operators engaged in complementary production activities and providing complementary products as the output values of these activities. The physical boundaries of clusters, however, are based on objective economic principles, rather than on legal and political, or voluntary principles. Clusters are, in fact, a union of cooperation and competition, in which competition dispels any fears of monopolisation and cartelisation. Hence, the objective of this project for developing and creating a Slavonia-Baranya tourism cluster represents a proactive approach to the issue of integrating the economic resources of these regions to generate the supply of quality tourism products, build the destination’s identity, and create a distinctive tourist brand. The project’s objective is to identify and, ultimately, generate a Slavonia-Baranya tourism cluster to unite all spatially concentrated and interrelated operators, small and large alike, from craftsmen to SMEs, whose products participate in creating tourism products. Special attention will be focused on food manufactures.

The project’s hypothesis states that the existing and utilised tourist resources of the Slavonia-Baranya region, together with its potential and hitherto untapped resources, can achieve full efficiency through the linking of all operators – economic and non-economic – of tourism product supply, into clusters as a modern model of economic development.

The project should lead to the operationalisation of the Slavonia-Baranya tourism cluster in which IT-reinforced interactive relationships among cluster members will help to create a powerful information networked structure capable of justifying its existence by accomplishing the general and specific business objectives of cluster members, and especially by building their (joint) competitive advantages.

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RETAIL TRADE IN THE VALUE CHAIN OF FOOD PRODUCTS

PROJECT OBJECTIVE:

The purpose of the proposed research is the application of the research results in the development strategy of business subjects in the Republic of Croatia that are dealing in the distributive trade, as well as in the development of other participants in the value chains (therefore including the manufacturers of food products). As the main strategic decisions, one can take those relating to the selection of adequate new models of shop formats, and, in that connection, of new models of cooperation between the retailers and other participants in the value chain. Equally, the purpose of the proposed research is the use of its results in defining the measures of the economic policy by the state, with respect to numerous infrastructural and other problems that must be solved parallel with the development of distribution (logistical and traffic problems, problems of regional planning, contemporary problems in the development of towns, problems of preservation of environment, of sustainable development, etc.). The aims of the research relate to the contribution in achieving a higher level of efficiency in food distribution trade in the Republic of Croatia, based on the use of modern management conceptions. These conceptions refer not only to a more successful business operations of individual business subjects in the sector of distributive food trade, but they also extend to other participants in the distribution channels (or more widely: marketing channels), i.e. in value chains.

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The issue in question here is, therefore, the trade subject as the carrier of the supply chain management, or efficient consumer response, which can be achieved through cooperation of all participants in the value chain. In that way, it would be possible to set up as a special goal a faster development of successful trading companies and their co-operative creations, and thereby also the initiation and new development of production companies in the field of foodstuffs, resulting in an improvement of Croatian foreign-trade balance in this sector. Research results would offer business entities in the field of distributive trade with food modern solutions for their development strategies. Also, the research results could help the carriers of the economic policy in the choice of measures and means of economic policy that would encourage the development of the necessary efficient rational formats of retail and wholesale operating units, business subjects and co-operative forms, for example for particular forms of ownership, for particular areas, etc.

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Project duration: 2008-2011
Programme type: National
MEASUREMENT INSTRUMENTS: CREATION AND ADJUSTMENT FOR ENTREPRENEURIAL USAGE

PROJECT OBJECTIVE:

The starting presumption in registering the Project was that having or applying good and reliable measurement instruments in different socio-economics environments result in different grading (both good and reliable). In other words, with the aim of using recent methodological procedures from the area of measurements (in this case, the phenomena of entrepreneurial economy), it is necessary to build reliable and adequate measurement instruments or to adapt the existing ones recommended theoretically. Project results should offer a base of measurement instruments that would be both tested and adjusted for a specific environment of the entrepreneurial economy of the Republic of Croatia. The project should result in constructing and testing of the measurement instruments in the area of entrepreneurial activities, first of all in the Republic of Croatia, and in a comparative analysis of identical measurement instruments applied and evaluated (tested) in related research abroad. The project is suggested primarily for ensuring adequate measurement instruments for a specific economic (but also demographic and social) environment in which Croatian entrepreneurs are developed. The adaptation of measurement instruments would ensure not only a correct indicator application, but also their development according to the project’s results.

Adjusting measurement instruments to specific entrepreneurial activities would ensure a basis for deterministic decision making for entrepreneurs. The base of created or adapted measurement instrument is aimed for publishing and thus made available for entrepreneurs, scientists who are interested and study entrepreneurial phenomena.

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The project research would be directed to adapting the Eurobarometer and related measurement instruments, but also creation of measurement instruments for relatively new areas of entrepreneurial initiatives, like e.g. cultural industry or a permanent evaluation of integration processes in all segments of entrepreneurial activities (measuring attitudes toward ethnocentrism according to CETscale, EU adapted Eurobarometer instruments, adjustment of the entrepreneurial activities according to EU demands, regional limits/assumptions for realization of entrepreneurial activities).

The research results are also assigned to the Ministry of Science, Education and Sports which financially supports the project with the aim of determinating measurable elements of entrepreneurial strategy.

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Programme type: National
DEVELOPMENT OF MEASUREMENT INSTRUMENTS IN SUPPORT OF AN EXAMINATION OF FIRMS’ MARKETING PROCESSES AND THEIR SUSTAINABLE COMPETITIVE ADVANTAGES

PROJECT OBJECTIVE:

Understanding phenomena which can be encountered in business decision-making processes, as well as understanding the behavior of B2B and final consumers (along with its determinants which guarantee efficient marketing management), are two factors which form the basis for identification of sustainable competitive advantages in international trade. These are of special importance for corporate strategy formation of Slovenian and Croatian companies. Both countries are facing challenges of achieving sustainable competitive growth, while facing the problems typical for small economies and attempting to fully integrate themselves in the European economic zone at the same time.

The purpose of the research project is to develop and test (in the framework of a comprehensive empirical study of companies and consumers in Slovenia and Croatia) selected measurement instruments which will be the tools of systematic case study-based analysis of transferability and applicability of the existing theoretical customer behaviour models. Theoretical framework for these endeavours will be given by theory of competitive advantages, theory of social identity, as well as theories and models of B2B and final customers' behaviour.

Methodological emphasis will be given development of measurement instruments to measure (1) perceived quality of products and services; (2) customer satisfaction (both of B2B and final customers); (3) customer loyalty (both of B2B and final customers; (4) the relationships among perceived quality, customer satisfaction and customer loyalty on one, and financial effects of these relationships on the other hand.

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From the viewpoint of contents the focus will be on studying the marketing orientation of Slovenian and Croatian companies. We believe that the marketing orientation, which places the consumer into the heart of every business (corporate) strategy (Fornell, Anderson, 1994; Oliver, 1997; Giese, Cote, 2000; Zeithaml, 2000), still hasn't become a predominant characteristic of Slovenian and Croatian companies, which is why they mostly form short-term strategies to achieve competitive advantages, and neglect formation of the long-term ones (Prašnikar et al., 2006).

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Programme type: National
FROM ENTREPRENEURIAL POTENTIAL TO ENTREPRENEURIAL BEHAVIOR

PROJECT OBJECTIVE:

Entrepreneurial potential is a set of skills, knowledge and cognitive models, which is developed through education. European Union has identified entrepreneurial skills as fundamental skills and necessary personal competence of every employee. Contemporary entrepreneurial education must supply individuals, teams and organizations with generic, flexible knowledge and cognitive models necessary for lifelong learning, project/contract/portfolio or self-employment.

Objective of this project is evaluation of the influence of education on personal entrepreneurial capacity of the individual, capacity of the system (at enterprise level, but also at education sector level), and the capacity for opportunity recognition. Through networking and interacting of the entrepreneurial capacity and entrepreneurial opportunities, entrepreneurial behaviour is created. Entrepreneurial behaviour plays an important role in shaping personal, economic and social development.

Expected results of this project are:

- Conceptualization and refinement of entrepreneurial behavior through entrepreneurial education (opportunity recognition; motivation for entrepreneurship, essential knowledge and skills).
- Mapping trends and state of development of entrepreneurial education, and identifying specific needs of entrepreneurial education programs.
- Developing and designing role models for entrepreneurship educational programs, and innovative methods of teaching entrepreneurship.

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- Dissemination of findings and promotion of instruments that strengthen the transformation of entrepreneurial behaviour (through interdisciplinary round tables, by organizing workshops, and by initiating student networking, counselling and career management services).

Project will refine understanding the complex relations of entrepreneurial education programs and entrepreneurial behaviour, and enable recommendations and redesign activities for entrepreneurial education. Higher quality of entrepreneurial education is important for individual competitiveness in the dynamic labor market, as well as for organizational competitiveness. At the enterprise level, entrepreneurial education increases flexibility and ability to adapt to changing conditions in the business environment. Targeted interventions in entrepreneurial education can increase capacities for coping with the challenges of unemployment, competitiveness, and restructuring of the national economy.

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Programme type: National
SINERGY OF HUMAN, PHYSICAL AND FINANCIAL CAPITAL FOR THE AUTOPOIETIC DEVELOPMENT

PROJECT OBJECTIVE:

The research we have been working on for over 30 years is focused on the importance of human capital, which has received much attention recently (knowledge-based Croatia), at least at the formal level. In practice, however, motivation, knowledge and team work are at a very low level. Working with students we have been monitoring their motivation for years, and trying to understand the variables of their dedication, hard work and success in exams. The conclusions we reached are a „alive metaphor“, or better the MODEL of all the weaknesses of our whole CULTURE of living, and indicate without a doubt that in an average Croatian student and worker, extrinsic motivation dominates over the intrinsic motivation. Our young people are far away from the fifth need according to Maslow, i.e. self-actualization (for example, students show greatest motivation in exams, while their interest in learning and further development decreases sharply after receiving an exam grade).

Similar situation is observable with the people coming into power after elections (from the state to local level), but also in the Church, science, economy or the media. Briefly, IT IS IMPERATIVE TO INCREASE THE MOTIVATION OF PEOPLE, and this is the first phase in the realization of this project. We have good theories (A. Maslow, R. Plutchik etc), we have developed the technology of motivation raising, which we need to verify on testing grounds of Osijek-Baranja County and the whole region (about 900,000 inhabitants). The next step is INCREASING THE KNOWLEDGE in every respect, especially in psychology, technology, economics and law, but also providing faster and higher quality learning for everybody who wants it, with minimum costs, and almost online. This has been extensively elaborated in the book by senior researcher METHODOLOGY OF SOCIAL SCIENCES (MDZ), Faculty of Law - Osijek, 2005, 2nd edition, and on the PORTAL http://gau.psp.efos.hr/, which includes dozens of digital books from those areas, hundreds of articles and thousands of links to domestic and foreign portals.

Although only a tentative version, this web page is an example how everybody who wants to learn is given the opportunity to study, in one place over the Internet, relevant domestic and foreign scientific and professional literature, sorted by authors and disciplines, which can significantly decrease the time devoted to studying and increase its quality. The idea of this project is to use government support to prepare multidisciplinary digital knowledge databases which would allow our students to acquire knowledge without losing time in searching for material by means of Internet browsers.

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Programme type: National
POST-TRANSITION IDENTITY OF RURAL AREA OF SLAVONIA AND BARANYA

PROJECT OBJECTIVE:

Slavonia and Baranya constitute a region where until recently rurality was a key feature of its identity. Rural areas used to be characterized by population vitality, numerousness and populousness of villages, agriculture as the dominant occupation, as well as the traditional relationship of respect towards the nature and religion. Such rural identity was disrupted by the industrialization and modernization of former Yugoslavia. The whole rural landscape was transformed into a hybrid of suburban and quasi-industrial areas. The new rural identity was shaped as a political project of an atheized and industrialized society.

The second new identity of the region was shaped in the period of transition of the Croatian society. There are several contributing factors: 1) consequences of the war (displaced and expelled inhabitants, looted property, mine-littered fields), 2) insufficient efforts of political authorities to revitalize the rural Eastern Croatia (failure to activate economic resources, poor infrastructure), 3) effects of the global environment (farmers' fears with regard to European and world integrations).

Research goals and hypothesis:
The main goal of the project is to investigate whether a new, post-transition identity of rural area of Slavonia and Baranya is emerging, and how far is this new identity a revitalization of rural values, or alternatively their market transformation.

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Starting hypothesis of the project:
Post-transition identity of rural area of Slavonia and Baranya has lost the basic features of traditionally conceived rurality as a consequence of marketisation and commercialization of rural life and also as a result of the key activity of countryside, i.e. agriculture, losing its economic and social function.

Expected results:
The work on the project should provide new insights into the region's identity and its post-transition reality which is getting increasingly further away from the attribute rural.

Checking the results:
Starting from the theoretical and empirical insights of rural sociology, followed by the new empirical research within this project in Slavonia and Baranya, we expect to gain new insights that should provide the answers to the above questions. They would also be the verification of the basic hypothesis.

Relevance of the proposed research:
The research is exceptionally important as a contribution to the study of the new identity of Croatian society. As it proposes to investigate the identity of Slavonia and Baranya rural area in a post-transition context of global integration processes, it is expected to provide new insights that could define this region through new features of identity, confirming the new notion of rurality.

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Programme type: National
REGIONAL UNIVERSITY

PROJECT OBJECTIVE:

Universities play a very important role in regional development (Garlick 1988) as they contribute to regional economies and regional development. They are frequently major employers and buyers of services. This direct connection is extensively presented in a well documented study (House of Representatives, 200, p- 275). Universities take care of the cultural, sports and physical infrastructure in a region. They provide leadership in a community. In regional development, universities work together with state and local authorities, as well as with local industry. The University in Osijek is a major factor in the development of eastern Croatia. It creates and transfers knowledge that is important for economic and social welfare at regional, national, but also at the global level.

Universities should be founded on well organized research capacities and research-based teaching. Goals and hypotheses: The principal goal of the transition of Croatian universities is to be transformed into integrated, competent, research-oriented and efficient universities, striving for institution and programme accreditation and quality enhancement. Quality assurance is one of the fundamental principles of the Bologna process. It is therefore essential for Europe to have a coherent policy based on the tenets that institutional autonomy creates and requires accountability, and that universities are the nodes of accountability in the process of developing an internal culture of quality. The expected results refer to consistent.

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Implementation of the Bologna process and university drives actions for regional development. The project should demonstrate how universities (and similar institutions of higher education) can play an important role in local and regional economy. Verification of results: The project will naturally be under the scrutiny of the university itself, its constituents, as well as other social factors in the region. Through publication of papers, presentations at symposiums and conferences etc. the project will be subjected to public review and assessment. A more explicit verification will be the issue of achieving the above explicit goals and expected results. The significance of the proposed research is in line with the Bologna declaration which emphasizes that knowledge-based Europe is recognized as an irreplaceable factor of social and human development. This increases the role and responsibilities of universities.

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Project duration: 2007-2010
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ENHANCING REGIONAL COMPETITIVENESS TO FACILITATE ECONOMIC PROSPERITY

PROJECT OBJECTIVE:

The main focus of this project concerns the question of how to foster sustainable economic growth and to ensure prosperity for all of the country's areas. Competitiveness is critical for achieving economic growth and prosperity. National competitiveness is founded on the regional and micro competitiveness. Regional (local) competitiveness assumes the identification of the growth potentials and constraints of certain areas, as well as strengthening its unique combination of resources. Entrepreneurship and partnership are the driving forces that enable the transformation of regional resources into national competitiveness, economic growth and prosperity. Within the framework of the project, the following issues are under consideration:

• what is the relation between regional imbalance, competitiveness, economic growth and prosperity and which ways of fostering sustainable regional economic growth are beneficial;
• what is the role of education and science, entrepreneurship, clusters and foreign direct investment in the process of building regional competitiveness;
• how to develop such partnership relations between universities, the private sector and development-oriented economic institutions, that could promote prosperity; how to enhance responsibility of all the stakeholders in development processes.

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The project is founded on the following assumptions:

• first, authorities are responsible for shaping such a business environment that will facilitate the development of all of its areas;
• second, sustainable growth and prosperity should be built through partnership relations;
• third, economic prosperity depends on the development of innovative, creative and responsible entrepreneurial mode of behaviour not only of entrepreneurs, but also of development-oriented economic institutions.

The main purpose of this project is to contribute theoretically to our understanding of economic growth and prosperity, regional (local) competitiveness as well as to contribute pragmatically to economic prosperity of Eastern Croatia. Pragmatic contributions are derived from the empirical analysis of region's performance, attitudes and opinions of its citizens, as well as from forecasts of its future economic trajectories. They will be the basis for policy recommendations aiming to improve competitiveness, multiply development possibilities and to strengthen entrepreneurial development capacity of regions, counties and local communities in general.

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Project duration: 2007-2012
Programme type: National
KNOWLEDGE MANAGEMENT IN THE FUNCTION OF ECONOMIC DEVELOPMENT OF EASTERN CROATIA

PROJECT OBJECTIVE:

Exponential and continued growth of overall human knowledge offers new possibilities for its creative application and continuously generates new needs. The process of EU accession has accelerated the changes in economic development of the Republic of Croatia. The Bologna process marks the start of harmonization in the area of science and education. The aim of the research is to formulate a subsystem of control model for education process. The model should allow a dynamic and transparent monitoring of the Bologna process application, harmonization with EU countries, and be a constituent part of the economic development strategy in Eastern Slavonia, Croatia and other areas which naturally gravitate to this region.

By means of intelligent methods of knowledge management aided by information and communication technology the University strives for excellence, and seeks advantages in relation to competition, to redefine the labor market. Our hypothesis is that the subsystem of control model for education process, on the basis of experience in change management (G.M. Caupin), will be able to determine the key issues: recognizing the aims which justify the change, common perception of the stated aims, understanding the modifications and creative application of the new environment which has appeared as a result of implementing and accepting the changes.

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The expected results of the research are in the function of economic development of the Republic of Croatia. A growing demand for sophisticated services in education and science has recognized the University as a polycentric nexus of the expected changes.

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Project duration: 2007-2010
Programme type: National
PROJECT OBJECTIVE:

Main goal of the project is to investigate the possibility of including the bank system into the financing of polycentric development. It is a fact that the bank system has been an unavoidable factor in the financing of local communities, but there are assumptions that it is possible to more significantly include this system into the financing of new models of financing. The role of the bank system in the financing of local communities today is characterized by the following: banks are in the function of financing the local communities but their business policy has been based on an undifferentiated approach in which all local communities have been treated in the same way; the bank system is a pure agent between those who provide the means and those who use them; nonexistence of local banks and of specialized development banks that could adequately evaluate some of the local (regional) specific qualities which are mostly the result of the given natural conditions; low level of involvement of banks in the issuing of municipal securities, low level of engagement of the existing banks in the segment of externals (auxiliary bank activities) in connection with the local community, nonparticipation of the local population in the financial system through nonprofit savings institutions (mutual funds).

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The existing approaches cannot offer solutions for a rapid reduction of differences in the level of development of particular local communities and therefore the project needs to offer new models that will guarantee and fully recognize particular local peculiarities.

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Project duration: 2007-2010
Programme type: National
AGRICULTURAL KNOWLEDGE INTEGRATION AND NEW KNOWLEDGE CREATION

PROJECT OBJECTIVE:

Agriculture is a complex economic activity as well as a complex scientific field and there are numerous potential users coming from agricultural sector who seek synergistic information about different aspects of the phenomenon, combined of different kinds of data originated from diverse resources. Due to the absence or unacceptance of standards for methodology, content or metadata, even with respectable information content, current information resources are becoming a barrier to the needed interoperability of data from different resources and their broader usage.

Internet in agriculture, like in all human fields of practice, enabled an increased production of information. It is evident all around the world as well as in Croatian information production concerning the agricultural sector. Information resources are numerous and they vary from simple web sites with more or fewer links to other resources, with a few downloadable documents, through complex web portals intended for narrower fields of interest but with deeper thematic contents (Povrce.com), with different amounts of services (tisup.hr, which serves for supply and demand of agricultural products, HZPSS portal of CROATIAN AGRICULTURAL EXTENSION INSTITUTE (CAEI) which contains numerous information about agricultural terms and activities and broader scope of services. Many web sites have links or access to different databases (scientific papers, books, events, taxonomies, geographic and meterological information etc).

On the other side, semantic web technology, based on well defined standards about metadata, enables interoperability among different information resources and integration of information and knowledge, thus representing the platform for complex searching of information resources and knowledge organization systems. Semantic web technology and widely accepted initiative and standards (W3C initiative and standards, Dublin Core Metadata Initiative, FAO's Agricultural Information Management Standards) about different domain concept representation, with ontologies based on different controlled vocabularies, (thesaurus, taxonomies) and metadata sets, providing creation of specific application profiles.

Using these achievements as well as the basics principles of semantic web, information resources availability in Croatian and other languages, the necessity to integrate them in other to achieve a higher quality knowledge, the purpose and the aims of this project are determined as to:
- investigate the extent of using available digital information resources among the target group,
- develop higher quality searching and dissemination system of agricultural information
- develop intelligent tutorial system in agriculture
- develop intelligent system for crop selection in particular land plot
- develop mobile network service for target group who require information relevant in agriculture.

FACULTY OF ECONOMICS

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Project duration: 3 years
Programme scheme: National
SCIENCE PARK CONCEPTUAL PLAN IN MARIBOR AND OSIJEK

PROJECT OBJECTIVE:

Project entitled Science Park Conceptual Plan in Maribor and Osijek has a goal to improve innovation activity and accelerate growth of existing technology- and service-based companies, increase the scope of cooperation between companies and universities, and improve interregional cooperation through establishment of joint R&D units between companies and universities in the cross-border area, and for those purposes develop a comprehensive conceptual plan and joint strategy for establishing science park in Maribor and Osijek.

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Tasks performed within the project are:

- Development of comprehensive science park business plan at locations Maribor and Osijek, including the justification study, specification of services that are relevant in both environments, and evaluation of companies that are essential for establishment of joint R&D units;
- Preparation of complete concept architectural outline scheme of the science park at locations Maribor and Osijek, including environmental influence analysis, conceptual spatial plan, survey and architectural computer model.
- Identification of six to eight key areas for establishment of joint R&D units, definition of strategy for achieving critical mass of companies and cross-border networking, detailed specification of one joint R&D unit in the field of ICT, including the identification of key cross-border partners, and creation of the program of R&D activities.
- Creation of joint strategy for establishing of Science Park in Maribor and Osijek.

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Project duration: 2007-2008
Programme type: INTERREG III/A
INTERNATIONAL CENTRE FOR ENTREPRENEURIAL STUDIES

PROJECT OBJECTIVE:

The ICES project – International Centre for Entrepreneurial Studies – is aimed to provide new capacity of higher education institutions to react to the needs of the economic development, with new knowledge and skills offered through the creation of the doctoral program in entrepreneurship and innovation; developing a virtual learning platform for entrepreneurial studies, and interdisciplinary and outreaching model of entrepreneurship education (entrepreneurship across campus) at the J.J. Strossmayer University of Osijek.

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The wider objective of the project is to develop an international center of excellence for learning and teaching entrepreneurship in Croatia in order to lever a process of changes, through developing the entrepreneurial capacity of academic experts. The project International Centre for Entrepreneurial Studies (ICES) will contribute substantially toward this wider objective with three specific project objectives:

- To create a modular Ph.D. program in Entrepreneurship and Innovation aiming to build a critical mass of intellectual capacity (academic base) for entrepreneurship education;
- To develop a virtual learning platform based on new innovative methods and tools to be used by all higher education consortium members to deliver effective entrepreneurial programs of all kind;
- To create the interdisciplinary and outreaching model of university entrepreneurship education (entrepreneurship across campus) that strongly contributes to the commercialization of the university intellectual property and to the development of the overall entrepreneurial culture of the university and business community.

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Project duration: 2007-2009
Programme type: Tempus (CD)
APPRAISING THE GROWTH POTENTIAL OF SMEs

PROJECT OBJECTIVE:

Businesses achieving rapid growth represent only a small fraction of all new firms, and besides not all of them aim to achieve it. Yet, this small fraction is responsible for a disproportionate share of the creation of new employment. As early as from the 1980ies, a consensus has emerged that SMEs are important constituents of economic systems that contribute to their dynamism in recognizing opportunities and ability to create wealth and prosperity. This consensus has strengthened over time due to growing stock of empirical evidence underlining the important role of small and growing businesses, particularly in job creation. However, as business practice confirmed, high-growth entrepreneurial activity is not a linear result of a singular factor, but very complex and knowledge demanding process. All stakeholders (entrepreneurs, bankers, venture capitalist, governments, educators…) should learn about interactions between key factors laying in the foundations of high-growth processes of SMEs to be able to develop appropriate policies, instruments and measures to increase a share of high-growing SMEs in the economy.

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The purpose of this research is to develop knowledge about the factors and policies that influence enterprise growth, in order to create presumptions for strengthening the participation of SMEs with high growth potential in Croatia's economy. This research purpose will be accomplished through following objectives: 1st objective: identify and describe successful practice for stimulation of fast growing enterprises, applied in selected GEM countries and develop frameworks for understanding the anatomy of these processes; 2nd objective: test the applicability of conceptual frameworks for assessment of enterprise capacity for rapid growth applied in conditions of stable economies, using data on Croatian enterprises that operate in highly intensive transitional conditions; 3rd objective: based on data on enterprises in Croatia, create conceptual framework for assessment of capacities for rapid growth and test it on data from different industries, for the purpose of determining growth mechanisms, barriers and key resources; 4th objective: develop an instrument for monitoring the dynamics of enterprise growth within the national economy; 5th objective: establish a catalogue of policies and instruments within GEM countries focused on stimulating fast growing enterprises; 6th objective: develop recommendations for the increase of motivation for rapid growth of enterprises in Croatia.

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Project duration: 2007-2012
Programme type: National
COMPARATIVE DEVELOPMENT OF AGRITOURISM IN ISTRIA AND OSIJEK-BARANJA COUNTY

PROJECT OBJECTIVE:

Tourism as an economic activity was already in the early nineties recognized and proclaimed to be one of the corner stones of economic growth and development in Croatia. The economic results and performance of Croatian tourism in the past few years confirms and justifies such a designation. However, the fact is that tourism potentials in Croatia are far from being fully exploited yet. The results of TOMAS research in Croatia (2002) show that over 90% of foreign tourists identify our country as a "sun&sea" destination. On the other hand, trend in the tourism demand market clearly indicate the growing need and interest for tourism product differentiation. Tourists are increasingly looking for original, authentic (or ethnic) products, unusual destinations, and unique experience. This is something that mass tourism cannot offer. Development of agro tourism in Croatia could be the right answer to these demand trends. It could successfully eliminate some of the major problems in the existing Croatian tourism product offer which is mainly limited by the "sun&sea" image: high seasonality, relatively small value added, competitiveness and profitability of the industry within the region. Agro tourism is not limited by the season, could be more competitive, attract both existing and alternative tourist segments, increase the value added. At the same time, a number of additional positive effects could be foreseen: additional incentives for farmers and farm development, rural development in general as well as development of a number of supplementary business activities (food production, environment protection, traditional crafts and authentic products (as souvenirs) production, development of hospitality, cultural, sports' and other activities). Istria county has already made a significant step forward in agro tourism development which has contributed to the regional development. It can teach a lot other regions in Croatia, but at the same time, it can still do more to promote and develop its unique agro tourism product. Therefore the major purpose of this research is to contribute to the creation of two regional unique agro tourism brands: in Istria and Slavonia and Baranja by using existing theoretical and practical experiences and by creating own model for the product and brand development.

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Project duration: 2007-2009
Programme type: National
ORIENTING NATURE AND SOCIETY TEACHING TOWARDS PUPILS’ LEVELS OF ACHIEVEMENT

PROJECT OBJECTIVE:

According to the results of previously conducted research the knowledge of young school-age children is to a greater extent formal, rather than applied. The project Orienting nature and society teaching towards pupils' levels of achievement will introduce vertical and horizontal correlation in teaching nature and society and it will direct those contents to different levels of the pupils' achievements to enable a quality effect on pupils' competencies. It is especially useful to combine teaching nature and society with subjects such as nature, biology, geography and history which are parts of that subject in elementary school. The goals of the project besides quality education and achieving permanent knowledge, are developing pupils' abilities to actively use the gained knowledge as a basis for further studying and education, as well as lifelong learning. Another goal is to advance methodological theory and teaching practice by combining experiences with the understandings gained through research and project teaching along with the correlation and integration of the contents of nature and society and other subjects. Inside the science subject group we will show and combine cyclic expansion of knowledge, abilities and skills horizontally and vertically. The research will be directed not only towards the enhancement of knowledge, skills and abilities, but simultaneously towards acquiring values, attitudes and habits with the aim to create active members of society.

We will define the pupils' levels of achievement in nature and science teaching and we will suggest criteria for their evaluation. Different sources of knowledge, methods and working forms play a significant part in achieving these aims. We assume that it is possible to achieve a better application of the pupils' knowledge and abilities in interpreting everyday life by choosing contemporary methods and working forms and by educating teachers to apply those accordingly, as well as through a meaningful correlation of nature and society and by defining pupils' levels of achievement. We will apply descriptive and causal methods, including procedures such as observation, documenting, initial and final questioning by means of objective type questions, interviewing and administering questionnaires. The causal method will be used to monitor changes that are due to the introduction of new methodical procedures. The results achieved will be examined through standardized pedagogical procedures. New schemes on gaining functional knowledge will enrich teaching thus relieving pupils. Teachers who, during their studies, did not manage to fully acquire certain knowledge and skills required to solve tasks in modern teaching, will get additional education and hence be able to raise their teaching quality.

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Project duration: 2008 – 2011
Programme type: National
DEVELOPMENT OF CREATIVITY IN LIFE LONG TEACHER EDUCATION

PROJECT OBJECTIVE:

A phenomenon of human creativity still is not enough investigated from pedagogical point of view. It especially relates to teacher creativity and its influence to student creativity. The goal of our research is investigation conditions which support or hamper teacher creativity either in process of pre-service and in-service education. Educational process designed for future teachers has particularly delicate task because it needs to support their own creativity and in same time to be exemplar of didactical possibilities in supporting of student creativity. A phenomenon of human creativity still is not enough investigated from pedagogical point of view. It especially relates to teacher creativity and its influence to student creativity. The goal of our research is investigation conditions which support or hamper teacher creativity either in process of pre-service and in-service education. Educational process designed for future teachers has particularly delicate task because it needs to support their own creativity and in same time to be exemplar of didactical possibilities in supporting of student creativity. Therefore important task of this project will be orientated to investigation of possible didactical solutions in process of teacher pre-service education. In-service teacher education can be a factor of hamper teacher creativity as well as a factor of its supporting. This project will be orientated to the important aspect of teacher professionalism. Project will investigate different possibilities of teacher permanent education with special stress on their initiatives, self-organizing, cooperative relationships, development of self-esteem and professional competences. We will investigate social and emotional climate which supports or disturb their creativity. We will investigate theoretical foundations of human creativity, define application to teacher creativity, investigate characteristics of instruments for measuring creativity, produce new instruments and develop methods and procedures for supporting teacher creativity. The results of project will be applied in teaching practice at teacher faculties and in in-service teacher education organized through learning communities. One part of teacher cooperation will be applied through web based learning system. On theoretical level project will make new progress in understanding human creativity and its role in modern teacher profession like in modern didactical forming teaching process.

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Project duration: 2008 - 2011
Programme type: National
EDUCATION OF MATHEMATICALLY INCLINED PUPILS

PROJECT OBJECTIVE:

The main focus of the project Education of mathematically inclined pupils will be to discover new ways of encouraging and supporting interest in mathematics in as many pupils as possible, regardless of their future professional orientation. Additionally, students of university Teacher Studies will be included in the project as well, and the results will be systematically presented to teachers in the same profession. In this way we would contribute directly to quality improvement in teaching mathematics. Mathematics classes need to be a fruitful soil for future scientists in the field of mathematics and beyond, even more so because in Croatia, and Slavonia in particular, for a number of years an insufficient number of students has opted for natural and technical science studies, especially mathematics. Moreover, the number of professionals in this field of study is insufficient as well. By encouraging pupils with special interest in mathematics we intend to contribute to changes in present situation.

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We first introduced some changes in the course methodology of teaching mathematics. As the regular teaching program does not provide pupils with enough opportunities to practice their talent in mathematics, it seemed necessary to create additional motivation and competence development opportunities during extracurricular activities, which also enables us to monitor the development of competencies of teacher trainees involved in such activities. The next step was to start the Little School of Mathematics for pupils in fourth grades of primary schools who showed a special interest in mathematics. During the third stage we examined and compared the existing theoretical foundations and dilemmas presented by authors from different branches of science (mathematics, psychology, pedagogy, information science), who discussed the issue of identifying mathematically gifted pupils. In late 2008, with the help from school psychologists and ICT experts who specialize in intelligent systems, we conducted a research of 247 fourth graders from primary schools in Osijek. Using results of this and earlier research, we created an expert system called MatDar for identifying mathematically gifted pupils.

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Project duration: 2008-2011
Programme type: National
THE NEED OF THE PUPILS' NEW POSITION IN AND OUT OF THE TEACHING PROCESS

PROJECT OBJECTIVE:

The project aims at investigating the position of pupils in contemporary schools in Croatia and to suggest the possible changes thought the application of the modern teaching strategies. More precisely, its purpose is to alter the asymmetrical teaching communication into symmetrical by training teachers to use different teaching strategies. In order to do that, it is necessary to examine whether the usage of the contemporary teaching strategies influences: pupils' activity level, pupils' position and role, pupils' initiative, intensity of teaching communication, pupils’ attitudes towards the observed teaching process.

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It is important to improve the teaching process so that it would become interesting to students. In that way they would enjoy learning and would not avoid it. Through contemporary teaching methods it is possible to change pupils' attitudes toward school and make them more active participants of the teaching process.

In addition, questionnaires will be distributed in order to measure pupils' attitudes toward school. For comparison, teaching will also be examined in those schools that were not involved in Croatian National Educational Standard in 2005.

The main goal of the project is to stress the importance of the positive attitude of pupils towards teaching and extra-curricular activities, which is the result of changes in teaching, especially the pupils' position in it.

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Project duration: 3 years
Program type: National
CROATIAN LANGUAGE AS A COMPONENT OF NATIONAL IDENTITY IN BILINGUAL COMMUNITIES

PROJECT OBJECTIVE:

Croatian language is an important component of national identity, especially in bilingual minority communities. Croatian language is one of the two languages of bilingual minority communities on both sides of Croatian-Hungarian border area. The need to foster the links in the times of intensive European associations is related to the factual geographical closeness as well as cultural, educational and research ties between the countries. Croatian language as a small-scale language has to preserve its role as a continuous conveyor or national cultural values and as a component of national identity. As a result, certain questions are raised that this project aims to answer: about the status and role of Croatian language in educational minority institutions, about the written communicative competence in Croatian language of pupils in minority schools, about the errors in written work of bilingual children, about the Hungarian language interference in written works in Croatian.

The primary objective of the project is to determine the current status of Croatian language in bilingual minority groups in Hungary and Croatia and to produce guidelines for further nourishment and survival of a small-scale language at borderlines - in bilingual communities - for national identity protection. Separate aims are as follows:

- to analyse textbooks and other relevant literature for Croatian language learning and teaching to describe methods of teaching and learner-centred tasks
- to describe linguistic and stylistic errors of bilingual pupils so as to assess their written competence in Croatian language
- to describe and compare errors resulting from the interference of the two languages
- to identify and guide functionally other learning stimuli and different forms of preservation of Croatian language outside the minority education system - scientific, educational, cultural institutions and media
- for the nourishment and preservation of Croatian language as national

Detection and description of language errors will point at the language competence of bilingual children, thus determining the status of Croatian language in minority communities. The results of the comparison of language competence in bilingual communities will serve the purpose of updating Croatian language syllabus, for textbook writing and for application of appropriate methods of teaching and learning. Description and analysis of various forms of publications will point at the appropriateness of methods used so far. The results of the project will serve as guidelines for the creation of language policy in minority communities.

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Project duration: 2007-2010
Programme type: National
DISTRIBUTED COMPUTER CONTROL IN TRANSPORT AND INDUSTRIAL PLANTS

PROJECT OBJECTIVE:

The goal of this research is in the field of distributed computer systems for control in transport and industrial plants to provide our own contribution to fault detection and fault tolerance, testing and validation, real-time operation, scheduling of tasks, estimation, modeling and simulation, characterized by nonlinearity and coupling of dynamic quantities and/or timing discrete and stochastic events, and create development, design and construction of advanced control systems that will control complex systems in a reliable, safe, timely and efficient way. The project results can be applied in, e.g. various branches of industry, transport, power engineering, to mention a few. The proposed research is oriented to developing and establishing distributed real-time computer systems for complex systems control. In order to support validity of methodological research and encourage as direct application of the developed advanced methods and tools as possible, extensive experimental research is planned to be conducted both by laboratory equipment and real control systems in transport means and industrial plants.

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Rolling stock, trams and diesel-electric trains are complex plants that must operate properly and reliably and be comfortable. These demands may be satisfied by a decentralized and distributed control system with particular vehicle subsystems. Exploitation testing of a distributed rolling stock control system will be carried out in cooperation with its manufacturer. Production lines in industrial plants also require control system reliability and fault-tolerance. Moreover, converters might include intelligent sensors as estimators of difficult-to-measure process variables. Therefore, application is targeted to ceramic tile industry, manufacturing of equipment for production and control of the ceramic tile quality, sugar production and sugar-beet noodle processing, sensor manufacturing, etc. Application is planned for domestic (Croatian) industry, but due to rather attractive results, it may also be of interest to foreign industry. By applying control in the process of manufacturing ceramic tiles, by improving the process quality and sugar-beat noodles processing, it is possible to considerably save energy and reduce environmental pollution, which might be interesting from both the economic and the ecological point of view.

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Project duration: 2007-2011
Programme type: National
ADAPTIVE VIDEO TRANSMISSION OVER WIRELESS NETWORKS IN HETEROGENEOUS ENVIRONMENT

PROJECT OBJECTIVE:
A new generation of mobile networks, as well as new IP-based wireless networks with increased bandwidth, enables implementation of different video based services. A radio channel for such type of networks is characterized by hard transmission conditions in terms of attenuation, shadowing, multipath fading and multi-user interferences which results in time- and location-varying channel conditions. Enhancement of video signal quality in such networks can be achieved by appropriate selection of error-resilient modes and parameters at the encoder and the decoder, as well as in the transmission system. Furthermore, integration of different categories of networks as well as heterogeneity of users requires implementation of scalable video coding with a different level of error protection. Goals of research are as follows:

- Global optimization of video quality through joint source-channel coding, adaptive selection of error resilience parameters, as well as adaptive selection of modulation parameters according to importance of the data and channel state information.

Development of an adaptive technique for dynamical modification of the constellation size and level allocation of sub-channels in orthogonal frequency division multiplexing (OFDM).

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Rate-distortion and power-distortion optimization for video transmission over wireless code-division multiple-access (CDMA) systems. Analysis of multicarrier – CDMA utilization for reliable video transmission.

- Analysis and implementation of the adaptive antenna arrays and conformal antenna for multipath diversity and interference suppression.
- Development of a scalable video coder for error-resilient transmission with unequal error protection for layered coding of video.

The optimization procedure for parameter selection for the given user will be developed according to link capacity, transmission channel condition and available processing power in different transmission scenarios. This procedure will provide an optimized solution for video transmission over wireless networks and enable an improvement of quality of services.

This research leads to reliable video transmission over non-dedicated networks like the Internet that enables a low cost video link for different applications. Along with the wireless interface, this will provide important services such as telemedicine, distance learning and video surveillance to widespread categories of users in both urban and rural areas.

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Project duration: 2007-2010
Programme type: National
PROJECT OBJECTIVE:

A broad application and very high availability for broadband Internet access becomes a base for new services development, primarily e-commerce, e-business (business to business - B2B, business to consumer – B2C, consumer to consumer – C2C), Life Long Learning (e-learning), broadband e-government (government to consumer – G2C), and a personal huge data exchange between the users (peer to peer – P2P). Since the availability of broadband access in highly urban and suburban area will very soon be sufficient (technologically and economically, there remain an open question of broadband Internet access in rural area, i.e. the areas with undeveloped information and communication infrastructure and the areas with rare population.

The problem of broadband Internet access in rural areas is very complex one and to find out an efficient solution it is necessary to include interdisciplinary researches and many different aspects. First, it is necessary to research a categorization of the rural areas by different criteria: primary business, population density, geographic characteristics of the area and available information and communication infrastructure (study case: Republic of Croatia).

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For the respective category is required to research and ascertain a sociological surrounding and to define the potential services requiring broadband access. On the basis of the defined services it is necessary to state the minimal service quality requirements for all service categories.

On the basis of complex analyzes it will be proposed a technical and technological solutions of broadband Internet access for the different categories of rural areas. For every proposed solution it will be required to perform an economical analyze of prospective installation of new systems and market perspectives. By this step, it will be necessary to take into account a development importance of the rural areas for the total development, strategic food production, production of bio fuels etc. and also to mediate an active role of the state in promotion of rural area development. A very important result of the project will be a vision of “digital farm” and “digital village”, as base for successful development of rural areas.

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Funding scheme: Ministry of Science, Education and Sports
Project duration: 2007-
Programme type: National
ADVANCED INDOOR WIRELESS ACCESS SYSTEMS AND THEIR ENVIRONMENTAL INTERACTION

PROJECT OBJECTIVE:
Advanced architectures of indoor (in house) wireless access systems are researched. Environmental impact to the physical (PHY) layer technologies with spectral density improvement: Orthogonal Frequency Division Multiplexing (OFDM), Ultra Wideband (UWB) modulation and Space-Time processing, is estimated. OFDM signaling scheme is studied as a way for the improvement of robustness against multipath propagation, intersymbol interference (ISI) and narrowband interference, efficient use of the available radio frequency spectrum, and possibility for deploying the single frequency networks. Investigation of urban environment robust Coded OFDM (COFDM) technology, which is candidate for terrestrial digital broadcasting (DAB and DVB-T), wireless LANs, and radio broadcasting in AM-frequency bands under 30 MHz (DRM – Digital Radio Mondiale), is carried out. Ultra wideband and low power spectral density signaling scheme is generated by baseband ultra short duration mono-pulses. Enormous bandwidth of UWB modulation is modulated by extremely high data rates using the baseband signaling methods (PAM, BPSK, PPM).

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The STP technology with multiple-input-multiple-output (MIMO) antenna structures, which simultaneously exploits spatial and temporal diversity using antennas and error-control codes, is considered as capacity enhancement and range extension solution in cellular and ad hoc network architectures. Achievement of higher date rates and lower power spectral densities by combination of different PHY layer technologies: multi-carrier CDMA (OFDM and single-carrier Direct Sequence (DS) spread spectrum), or UWB baseband PHY layer with multi-user CDMA, is discussed. Some of these technologies ask new spectrum allocation, and other may exploit already congested spectrum through the promise of greater capacity. The suitability of heterodyne and homodyne direct to baseband conversion radio receivers in software reconfigurable radio receiver (Soft-radio) applications is evaluated. The key features of soft-radio: layered radio receiver architecture, fast extern A/D conversion, flexible input RF section, effective procedure of data management (DSP), are estimated in the light of the advances in RF microelectronic technology. Methodology of analysis and development of the key radio frequency CMOS sub-circuits is adopted.

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Project duration: 5 years
Programme type: National
ON-LINE MONITORING,
TESTING AND DIAGNOSING
TRANSFORMERS

PROJECT OBJECTIVE:

On-line monitoring is automated continuous supervision of key quantities for transformer operation. Such a system directs attention to instantaneous and potential problems. In the case of fast developing problems one should react immediately, and from an advanced monitoring system one expects recommendations for action on the basis of expert knowledge implemented in the system. If potential problems are relatively slow evolving, testing will give more comprehensive and more accurate data about transformer condition. On the basis of available data diagnostics interprets the cause and gives necessary counter-measures. Decisions made by monitoring system, tests, and diagnostics, should be based on complete measurement results. Although at on-line monitoring the emphasis is on changes of measured quantities, the measurement uncertainty is fundamental for correct decision making. On-line monitoring systems are relatively new ones which are added to transformers besides the existing ones for control and protection. In its final form, the on-line monitoring system will integrate all the systems that exist simultaneously into one complete system for on-line monitoring, on-line diagnostics, control, and protection.

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Such a system will make possible: early detection of incipient faults and prevention or reduction of failures (safety of personnel and environment), increase of availability, optimization of transformer management (controlled overloading, assessment of remaining life, life extension), and analysis of fault causes. Through surveys of literature on on-line monitoring, testing and diagnostics, through development of new methods of measurement and improvement of the existing ones, development of sensors and transducers, development of methods for estimation of measurement uncertainty, improvements of the existing and creation of new criterions for on-line monitoring and diagnostics, integration of diverse systems, development of mathematical and physical models, building on-line monitoring systems with expert knowledge basis and decision methods based on complete measurement results and artificial intelligence, we intend to realize significant improvements in transformer management, transformer reliability, safety and protection of personnel and environment from ecological accidents. Achievements will be tested by simulation of processes and conditions of transformers in operation, and testing on transformer on site.

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Programme type: National
PROJECT OBJECTIVE:

Processes and automata with self recovery are investigated. The basis idea is derived from imitating self recovery of the seed grain material. Artificial automata are designed that mimic holographic effects that are achieved by coherent stimulation of grain material. Self recoverable automaton is designed in two steps, first as automaton that distinguishes ambient information content, automatic actions and superimposed mechanisms of self-preservation and next as transposing of automata states into respective holograms.

Thus a phenomenological imitation of holographic structure with finiteness of its state numbers of such ambient adaptive automata is achieved. Artificial holographic system is based on 1D and 2D equivalent graphs of their system states. A HOLA system is designed as based on associative data processing of holographic data of the phenomenologically structured automaton. The importance of research is based on direct benefit of producers and processors of seed grain and silos materials, for producers of robots and manipulators with human adaptable interface and for producers of equipment in manufacturing processes, security, building and automobile industry.

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Project duration: 2007-
Programme type: National
SCHEDULING IN AUTONOMIC DISTRIBUTED COMPUTER SYSTEMS

PROJECT OBJECTIVE:

Resource management leading to autonomy is an important hypothesis for establishing a distributed computer system in demanding applications. That environment of dedicated and non-dedicated computers is extremely heterogeneous and time varying. Resource management corresponds to mapping which consists of matching jobs to computers and scheduling tasks on the matched computer. From the point of view of combinatorial optimization, both cases deal with scheduling. Heterogeneity and dynamics significantly increase scheduling complexity. On the other hand, environment heterogeneity prefers execution of tasks of various demands. In these circumstances achieving an autonomic distributed system requires careful environment description, timing order of mapping and special scheduling algorithms. With respect to the above hypotheses, the main goals of the project are to: - analyze a classical scheduling theory and adjust it to demands for autonomy of distributed systems, - establish prerequisites of successful scheduling, such as multilayered and multiparameter environment descriptions, taking into consideration its dynamics and representing it accurately enough, - establish mapping which comprises monitoring of environment, determination of machines candidates for mapping, matching and scheduling, - analyze the existing and offer our own scheduling procedures based on the expected execution time and load balancing, - develop an autonomy mechanism based on long-term and short-term performance prediction, - realize the above mentioned software solutions and test them in the testing and the real environment in accordance with project goals and application. Expected results i.e. methodology, analyses, algorithms and software solutions should enable effective and flexible resource management. It should be autonomic, i.e. renewable, extensible, and operating with increased reliability. Research results will be checked by complexity analysis and simulation upon completion of every individual phase of the project. After completing parts of the software solution, checking will be done on the testing and the real distributed environment in application. Pervasiveness and ubiquity of distributed computer systems, such as a computational grid, requires resource management which enables autonomy and flexibility to applications. Such distributed systems will be interesting both to research institutions and industry and economy.

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Project duration: 2007-
Programme type: National
ELECTRICITY MARKET SIMULATIONS AND ANALYSIS CURRICULA FOR ENGINEERING EDUCATION (EMSA)

PROJECT OBJECTIVE:

EMSA project is synthesized with the aim to improve educational level of the higher education curricula in the field of Electricity Market Simulation and Analysis at the Faculty of Electrical Engineering (ETFOS). The specific objective of the EMSA project is to develop the teaching content of the new, already adopted at the ETFOS master studies in electrical engineering, with the duration of 2 years, devoted to the electricity market simulation programs. The second project objective is, the ETFOS to develop and conduct life-long learning courses, flexible to adapt to new technologies, trends and industry needs for power engineers professionals. Following such objective, the EMSA project will create and implement the Electricity Market Simulation Analysis (EMSA) at the J. J. University of Osijek, specifically ETFOS, providing courses on computational modeling, simulation and state-of-the-art methodologies in domain of numerical simulations of electricity market in deregulated power systems, supported by Internet based technology. The EMSAs will be incorporated into several courses and fields of studies within the framework of the master studies at the ETFOS, promoting best practice and multidisciplinary engineering.

The EMSA Project tackles the challenge of education in electrical engineering in the following ways:

I. Development of the teaching content of the curricula for power (electrical) engineering at postgraduate levels.

The courses will include theoretical background of the fundamental laws of power system control, electricity market in economic and engineering means. Since electric power system has its own electrical laws (Kirchoff's) and also is exposed to economical laws, which may be contradictory. Reliability and security of power system is the crucial question and task of all subjects in the electricity market which is deregulated in EU countries and is on that way to be in Croatia. Costs of power system operation, local marginal prices and reliability aspects are very important and need to be understood and well presented to students.

During the Project realization the following compulsory and elective modules will be developed

- Power System Analysis;
- Power System Economics;
- Electricity Market

These modules will be targeted to master degree students as compulsory and elective courses, but EMSA could be later modified to widen its spectrum to the LLL courses and courses and HEP ETS (HEP - Educational and Training Center designed for EE professionals).

Coordination and cooperation with SIEMENS company a leader in the field of electricity market development and research.

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Project duration: 2006-2010
Programme type: EUREKA-ITEA
ESNA - EUROPEAN SENSOR NETWORK ARCHITECTURE

PROJECT OBJECTIVE:

The ESNA (European sensor network architecture) project aims to provide the necessary support for effective development of wireless sensor network applications: a standard architecture, technology and application-development guidelines, and proof-of-concept implementations.

The objective of ESNA is to contribute to establishing wireless sensor networks as a technology discipline serving business needs. There are three main goals:

1. Explore and model detailed application requirements that will drive technology development,
2. Explore and further develop technologies for WSN applications,
3. Explore methodology and business aspects of WSN.

The main technological result will be open sensor network system architecture with support for several off-the-shelf sensor network nodes, including applications, software development kits and middleware services, based on documented interoperability specifications.

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The methodology results will be guidelines for sensor network application development – including guidelines for dimensioning of networks, and type of nodes to use for different application domains, as well for requirements analysis and design at a systems level. ESNA will produce these results by iterating co-ordinated work on a generic architecture and its development platform, and on specific WSN applications that evaluate the underlying platform and guidelines.

ETF and HEP will use WSN for SF6 leakage detection shall measure SF6 gas pressure and temperature. As WSN is scalable communication platform, the same infrastructure could be used for monitoring additional circuit breaker parameters: vibration, mechanical forces.

Except for monitoring additional circuit breaker parameters, WSN could be used for monitoring parameters of other primary equipment: transformer surface temperature, transformer vibration, mechanical forces on bus bars and bushes.

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Project duration: 2005-2009
Programme type: EU EUREKA-ITEA
COLLABORATIVE INTERNATIONALISATION OF SOFTWARE ENGINEERING IN CROATIA

PROJECT OBJECTIVE:

The main project objectives are: continuous quality assurance and improvement of the bachelor, master and doctoral studies in the field of software engineering on Croatian universities based on collaborative and permanent curriculum development, teaching staff and student (bachelor, master, doctoral) exchange, development of new and improvement of existing teaching content and materials (books, manuals, e-learning). Permanent quality improvement of professional education offer (life-long-learning) on Croatian universities with the respect to the job market demands and European standards, based on definition and development of key competences and adequate qualification structure in the field of software engineering in Croatia. Partners on project are: University Paderborn, Mälardalen University, University of Zagreb, University of Split, HIT, HrOpen, BEST, Ericsson Nikola Tesla d.d., Končar Elektroindustrija d.d, Siemens d.d., Ring datacom d.o.o. i E-Hrvatska. One of actions on project was opening of Competence Center for Software Engineering; Software quality, Reliability and Diagnosis on July 2, 2009 at the Faculty of Electrical Engineering in Osijek.

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Competence centers are established with the intention to be a primary channel for the development of economic associations or clusters of small and medium-sized enterprises in selected strategic areas of national development. These centers cover their research, development, production, investment, marketing, public relations, etc. In regional development, they are used as catalysts for cooperation between domestic and foreign participants. Competence centers define recognizable regional profile and identity through cooperation and joint activities with partners in the environment.

Starting from theoretical knowledge and analysis of regional endogenous influence of Slavonia and Baranja province, imposes the need of joint discussions, through direct dialogue between all actors of regional development, the possibilities of establishing and verifying Competence Center for Software Engineering; Software Quality, Reliability and Diagnosis in Osijek, as a competence center for the development of logistics and information technology in the wider region.

Given the geographical position this center could become a "crystallization point" for regional development and would have the following goals.
EMSA - ELECTRICITY MARKET SIMULATION AND ANALYSIS CURRICULA FOR ENGINEERING EDUCATION

PROJECT OBJECTIVE:

EMSA project is synthesized with the aim to improve educational level of the higher education curricula in the field of Electricity Market Simulation and Analysis at the Faculty of Electrical Engineering (ETFOS). The specific objective of the EMSA project is to develop the teaching content of the new, already adopted at the ETFOS master studies in electrical engineering, with the duration of 2 years, devoted to the electricity market simulation programs. The second project objective is, the ETFOS to develop and conduct life-long learning courses, flexible to adapt to new technologies, trends and industry needs for power engineers professionals.

Following such objective, the EMSA project will create and implement the Electricity Market Simulation Analysis (EMSA) at the J. J. University of Osijek, specifically ETFOS, providing courses on computational modeling, simulation and state-of-the-art methodologies in domain of numerical simulations of electricity market in deregulated power systems, supported by Internet based technology. The EMSAs will be incorporated into several courses and fields of studies within the framework of the master studies at the ETFOS, promoting best practice and multidisciplinary engineering.

The EMSA Project tackles the challenge of education in electrical engineering in the following ways:

1. Development of the teaching content of the curricula for power (electrical) engineering at postgraduate levels.

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The courses will include theoretical background of the fundamental laws of power system control, electricity market in economic and engineering means. Since electric power system has its own electrical laws (Kirchoff's) and also is exposed to economical laws, which may be contradictory. Reliability and security of power system is the crucial question and task of all subjects in the electricity market which is deregulated in EU countries and is on that way to be in Croatia. Costs of power system operation, local marginal prices and reliability aspects are very important and need to be understood and well presented to students. During the Project realization the following compulsory and elective modules will be developed

The modules: Power System Analysis; Power System Economics; Electricity Market - will be targeted to master degree students as compulsory and elective courses, but EMSA could be later modified to wider its spectrum to the LLL courses and courses and HEP ETS (HEP - Educational and Training Center designed for EE professionals. Coordination and cooperation with SIEMENS company a leader in the field of power engineering is also planned since their experts are well recognized in EU in the field of electricity market development and research.

II. According to the needs of the electricity market, the EMSA partners proposed the several topics to be included in the 3 Lifelong learning course dedicated to the electrical engineering professionals performed by the different partners.

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Project duration: 2007-2009
Programme type: Tempus
IMPROVEMENT OF FOOD SAFETY IN PRODUCTION AND PROCESSING OF CEREALS

PROJECT OBJECTIVE:

The purpose of the proposed project is to improve safety of domestic cereal-based products for human and animal consumption. Implementation of HACCP System in processing and production of cereals and cereal-based products is also one of the objectives. Croatia as candidate country has obligation to bring into force EU regulations and laws concerning HACCP. A few special goals are implicated: The determination of F. graminearum and F. culmorum distribution on cereals in a region of intensive agricultural production, as well as their ability to produce DON and ZEA; The identification of genotype varieties that exhibit resistance to Fusarium contamination; The establishment of tolerance contamination levels for Fusarium species in cereals with respect to maximum permissible concentrations of DON and ZEA in the final products;

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The determination of the most efficient methods to suppress or eliminate molds growth during biotechnological processes of malting and ensilage, using biological and chemical antifungal substances intended for food and feed conservation.

APPLICATION OF RESEARCH:

The results will provide new knowledge that can be used to develop highly resistant genotypes of cereals and to improve efficiency of agricultural protection methods in cereals production. Furthermore, it can be used as a basis for implementation of HACCP System in the production and processing of cereals. The development of highly resistant varieties leads to reduction in the usage of phytopharmaceuticals and makes cereal production in Croatia ecologically more acceptable.

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Project duration: 2006-2011
Programme type: National
DEGRADATION OF GROUNDWATER HUMIC ACIDS BY ADVANCED OXIDATION PROCESSES

PROJECT OBJECTIVE:

Assurance of health drinking water is one of the main priorities of nowadays and it becomes even harder every day. Harmful residues of industry and agriculture eliminated to the environment contribute to the water pollution and some contaminants are the result of interactions between hydrological cycle and the biosphere and geosphere. Natural water throughout the world contains natural organic matter (NOM) but the concentration varies greatly between locations. NOM is a complex mixture of organic materials where humic acids are the predominant compounds. NOM change aesthetic characteristics of water like taste, odor and color and its harmful effects are most intensively expressed during water chlorination process when harmful disinfection by-products appear. The goal of this research project is to determine the possibility of application of advanced oxidation processes (AOPs) for the degradation and removal of humic acids, and generally NOM, from water. AOPs are based on the formation of hydroxyl radicals that are powerful oxidant which reacts rapidly with most organic compounds.

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Hydrogen peroxide based AOPs will be performed in this research: Fenton process (Fe²⁺/H₂O₂), Fenton-like process (Fe/H₂O₂), Photo-Fenton process (UV/Fe²⁺/H₂O₂) and Photo-oxidation with hydrogen peroxide (UV/H₂O₂). Experiments will be performed in model solutions with standard humic acids and with the real NOM rich groundwater samples. High degradation and removal efficiency of humic acids from water are expected. Degradation efficiency as well as structural changes of humic material will be monitored through determination of total mineralization and through UV-VIS and fluorescence spectroscopy. After optimization of each applied AOP, the most efficient AOPs for the treatment of groundwater humic acids will be selected. Since the problem of humic acids in the groundwater could not be completely solved by using conventional water treatment, there is an option to use the results of this Project in order to solve this problem.

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Project duration: 1998-2010
Programme type: National
NUTRITION AND LIFESTYLE IN HEALTH PROTECTION

PROJECT OBJECTIVE:

World Health Organisation (WHO) reports purport the fact that nutrition is an external factor which can help in health saving and promotion. Croatia has stood out that all necessary media should be used in the function of nutrition improvement and inhibition of negative West trends in fast and energy overloaded foods consumption. Yet, this battle is not so simple as it can be seen from many documents on the national levels (Croatian agriculture at the crossroad, Ministry of Agriculture, Forestry and Water Management, Zagreb, 1997; Croatian Food and Nutrition Policy, Ministry of Health and Social Welfare, Croatian National Institute of Public Health: Zagreb, 1999 and Strategy of Development of the Republic of Croatian for the 21 century,

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Nutrition, Bureau for the Strategy of development of the Republic of Croatia, 2001). On the other hand, if we give up on this endavour, battle against problems rising from an unbalanced nutrition, like sustained increment of chronic noncommunicable diseases, will be lost, and expenses for healing problems resulting from the unbalanced diet will grow. The aim of this project is to give scientific approach insight and possibilities of solving this problematic situation through dietetic assessment of nutrition and lifestyle. During the project, it is planed to enfold population groups like babies, students and working people.

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Project duration: 2007-
Programme type: National
PROJECT OBJECTIVES:

To establish learning partnerships (HELP) in South Eastern Europe between higher education and enterprises at the local level to:

Identify and prioritize the main learning and training needs to promote local enterprise development.
Evaluate the existing learning and training opportunities at the local level and the ways these could be improved within HELP in terms of the access, structure and content of learning and training programmes.

Share experience of local HELP at the regional level and explore existing models of partnership for knowledge exchange between education and enterprise.

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To increase the availability of relevant information at the regional level on the nature and extend of skill shortages affecting economic development.

Prepare certified learning and training programmes within HELP tailored to local enterprise development needs and priorities.

Pilot, monitor and evaluate the learning and training programmes, especially the potential for sustainability based on private provision.

Disseminate results widely, particularly at the regional policy-making levels to support economic transition within South Eastern Europe.

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Program type: Tempus
STUDIES ON THE ISOLATION AND IDENTIFICATION OF LACTIC ACID BACTERIA FROM NATURAL FERMENTED YAK AND GOAT MILK AND THEIR PROBIOTIC EFFECTS

PROJECT OBJECTIVE:

Bifidobacteria are often described as “probiotic” as they have beneficial effect on health of the host. Diet, antibiotic therapy, stress and other factors may disrupt delicate balance of gastrointestinal microflora. Consumption of fermented milk product containing bifidobacteria helps to restore this balance in favor of beneficial micro-organisms. In this project different types of Chinese and Croatian milk (cow’s, goat’s, sheep’s and jak’s milk) will be fermented by bifidobacteria and other lactic acid bacteria. During fermentation, specific parameters will be investigated: changes of pH value, lactic and other acids content as well as changes of probiotic cells concentrations. One of the most important parameter – changes of cell numbers during storage to ensure the therapeutic minimum will be also analyzed. One of possible way to ensure enough cell numbers of these sensitive bacteria is fortification of different milk types with prebiotics – non digestible natural or modified oligosaccharides. These prebiotics, even if not entirely fermented during bifidobacterial milk fermentation, can serve as growth promoters of naturally present bifidobacteria in human colon. Chinese prebiotics like konjac will be analyzed as growth promoters during fermentation as well as during storage of fermented product.

Since lactic acid bacteria act antagonistically to important human pathogens like Escherichia coli, Salmonella enteritidis, Enterococcus faecalis and Listeria monocytogenes, inhibitory effect of fermented different milk types with addition of selected prebiotics during phases of fermentation and storage of fermented milk will be also examined. Sensorycal analysis will also be performed in order to determine product with best organoleptic properties for consumers. Obtained data will be used to improve present production of fermented milk as well as to develop new probiotic formulations with more pronounced probiotic effect.

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Project duration: 2009-2011
Programme type: National (bilateral)
HEAT TRANSFER AND THERMAL PROPERTIES OF FOOD DURING PROCESSING

PROJECT OBJECTIVE:

Technological procedures and processes in food production are consisted of whole series of mainly thermal processes. Amount of transferred heat during processing is connected with mechanisms of heat transfer and thermal properties of food. Information on the thermal properties of food is very important for design of process equipment, conducting, modeling, optimization and simulation of processes. Besides thermal properties of food, the physical properties and transfer of mass are also important. Literature data about mechanisms of heat transfer and thermal properties of food during processing are indicators for further investigation. Because of unsuitable standard methods for determination of food thermal properties, already existing methods are modified in that purpose, in accordance with food nature, changes during processing and temperature range. The thermal properties can be calculated. Because they are function of chemical composition of food, the equations for calculations are based on that composition. The equations include thermal properties of every constituent of food as a function of temperature: proteins, fat, carbohydrates, ash and water. Aims of this project are: development and validation of methods and apparatus for determination of thermal properties of different type of dough and porridge food based on fruits and vegetables; finding dependence of thermal properties of food composition in temperature range from 50 to 200°C and describing heat and mass transfer phenomena. For complete understanding of these processes, some other parameters which define processes of frying, baking, sterilization and pasteurization will be determined, in the purpose of prediction, conduction and optimization heat and mass transfer. Expected results of investigation will benefit to better understanding of the above-mentioned processes, applying the results in equipment design and as a base for energy optimizing and modeling of processes.

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They will also serve in validation of used method and apparatus and as a base for modeling the equation for prediction of food thermal properties. Results will be verified using standard methods and procedures on the same materials and under the same conditions. Because the food industry is a big consumer of energy, it is very important to know the thermal properties and mechanisms of heat transfer as well as the possibilities for rationalization of energy consumption which contribute to the environment preservation.

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Project duration: 2007-2010
Programme type: National
MODELLING AND SIMULATION OF DRYING AND EXTRACTION PROCESSES IN FOOD PROCESSING

PROJECT OBJECTIVE:

In the cases when there is no theoretical model for some unit operation/processes the modern food process engineering demand inventing continuous quantitative mathematical model. For drying and extraction as unit operations, semi-empirical and empirical model exist only for the particularly cases, which limited their usability. Therefore it will be test the applicability of these models for describing processes of drying and solid-liquid extraction in the food production or the new - more acceptable semi-empirical or empirical models will be formulate. For that purpose, experimentally in laboratory scale, it will be establish the dependence of some model variable on related process parameters in way that will be used for models testing and simulation of drying and solid-liquid extraction in food production. During that, the mathematical tools specifically numerically mathematric such as regression method, interpolation and similar will be use. Drying experiments will conduct in convection, infrared, vacuum and fluid-bed dryers and influence of process parameters (temperature, humidity and velocity of drying air, moisture content and size of sample) on drying kinetics will be determined. Solid-liquid extraction experiment will be carry out on universal extraction system with observing the influence of process parameters (temperature and extraction time, type and concentration of solvent, solid-liquid ratio, characteristic and preparing of sample material) on yield, attain and kinetics of extraction. Quality of drying processes will be assessing by determining of some nutrition content in sample material before and after drying, by sensory analysis as well as by examination of rehydration ability. Success of extraction will be evaluating by qualitative and quantitative analysis of extracts obtained from raw and dried materials.

Spectrophotometric and HPLC techniques will be use for achieving of above mentioned analysis. It expecting a production of quality food products by drying and extraction and developing a good mathematical models, which be applied as base for optimisation and leading of food production processes in semi-industrial and industrial scale. In this way, will be improved energetic and economic efficiency of food production and quality of food products, too.

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Project duration: 2007-2010
Programme type: National
DEVELOPMENT OF INTEGRATED DRYING METHODS AND PROCESSES OF BIOLOGICAL MATERIALS

PROJECT OBJECTIVE:

Dehydration is a complex physical process consisted of mass and heat transfer in multiphase system. In most cases the plant tissue (biological material) is treated using different methods prior to dehydration process, in order to decrease changes in the material during pre-treatment, dehydration, and storage period. Different biological materials exhibit specific behaviour during the dehydration process, so it is of great importance to optimise process parameters to keep the nutritive and sensory properties of dehydrated products. This is especially important for the Slavonia & Baranja region, as the production of fruits and vegetables has remarkably increased recently. Taking this into account, the development of integrated dehydration processes of fruits (apple, apricots, pears and plums) and vegetables (carrot, parsley, celery and cayenne) will be evaluated on the of basis kinetic parameters as well as on the parameters which contribute to the protection of nutritive and sensory properties. The dehydration kinetics of samples will be determined by continued recording of mass changes, temperature profile of material and drying media and moisture profile (using computer process control).

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To accelerate the dehydration kinetics, eliminate the enzymatic browning activity as well as non enzymatic changes during the dehydration process, different physical and chemical procedures of samples pre-treatment will be performed (hot water and steam blanching, freezing, solution treatment: sodium bisulphite, ascorbic acid, calcium chloride, 4-hexyresorcyln, starch) and depending on method used related technical solutions will be proposed. To evaluate the impact of each method and process parameters on the properties of dried materials, standard analytical methods will be used: thermo-gravimetric, dehydration, colorimetric, volumetric and high-pressure liquid chromatography - HPLC. Furthermore, the research will investigate the influence of different dehydration and pre-treatment methods on the antioxidative properties of the examined biological materials. Energy analyses and development of more efficient heating system through the energy conservation will be performed and the overall heat integrated model will be designed. Mathematical model of process will be derived using great number of measurements. The overall results of the research will serve as a basis to make proprietary computer simulation.

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Programme type: National
FUNCTIONAL PROPERTIES OF DIFFERENT TYPES OF MILK AND WHEY FERMENTED WITH PROBIOTICS

PROJECT OBJECTIVE:

Proposed research is based on the results of some studies, which confirm functional value of milk fermented with probiotics, as well as on the results of studies in which nutritional and therapeutic value of goat milk are accentuated. Whey has high biological and nutritional quality. In general, whey is a byproduct in dairy industry. Tasteful and dietetic fermented dairy products could be produced by the fermentation of whey by the use of probiotics. Results of some studies show high antimicrobial potential of honey, but there is no clear scientific evidence about the prebiotic properties of honey. The basic aim of this research is to preserve functional and sensory properties of cow, goat and soy milk fermented with chosen probiotic strain during the storage period. Furthermore, parameters of fermentation of goat and soy milk with selected probiotic strains have to be examined and optimized. The aim is to produce fermented products of goat and soy milk with high sensory and functional quality. Lactobacilli (L. acidophilus, L. casei, L. plantarum) and bifidobacteria (B. longum, B. bifidum Bb-3 i B. lactis) will be used for the fermentation of milk and whey. As a prebiotic substance, honey could improve the growth characteristics of slow fermented probiotic strains in cow, goat and soy milk. Moreover, purpose of honey addition into milk before the fermentation is to enhance antimicrobial potential of fermented milk (or whey) against psychrofilic bacteria Yersinia enterocolitica and Listeria monocytogenes.

Two types of acacia honey, taken from two different zones in Croatia, will be used: Bilogorian and Slavonian. The aim is to determine the optimal content of honey addition, regarding to sensory and functional properties of final product. Two original in vitro methods will be used to determine the inhibition of Y. enterocolitica and L. monocytogenes by the samples of fermented milk. In all prepared samples during the 30 days of storage at temperature 4 – 8 °C will be determined: number of probiotic cells, titration acidity, pH value, as well as the content of some functional and antibacterial substances (short (SCFA) and middle (MCFA) chain fatty acids, lactic acid, acetic acid). An important goal of proposed research is to determine the parameters of whey fermentation with chosen probiotic strains. Composition and antimicrobial potential against psychrofilic bacteria between cold (microfiltered) and thermal sterilized whey will be compared.

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Project duration: 3 years
Programme type: National
NONDESTRUCTIVE METHODS IN FOOD PRODUCTION AND STORAGE PROCESSES

PROJECT OBJECTIVE:

The aims in this research are development and application of cheap, nondestructive methods of analysis based on analysis of electromagnetic waves. For start, research will be conducted in area of visible and hearing part of spectra. Response frequency spectra will be determined by applying of fast Fourier transformations on acoustic signal in time domain and by digital analysis of sample image in different time intervals and technological phases of process.

Biological diversity of raw materials in food industry demands constant supervision of process impact on product properties. Elimination of degradative changes in production and storage can be possible by analyzing one sample from the start to the end of process. That is the reason for developing and adaptation of nondestructive methods of analysis. On that way, on-line analysis in real process and immediate acquisition of data about texture and other changes of food material properties becomes possible.

Physical, chemical and biochemical changes occur in production and storage processes and cause changes on nutritive values and organoleptic properties.

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Furthermore this cause changes of electromagnetic waves absorption and reflection. Based on approximately 30,000 analysis done in previous researches can be said that optimization in production process and storage with preserving of essential compounds and organoleptic properties of food materials can be done by targeting techniques and methods.

In previous research as samples were used following materials: apples, pears, rye and other types of bread, cookies, egg mixtures, biscuits, hard and semihard cheese, meat products and chemical emulsions.

In this work, digital cameras and computer software for image analysis and acoustic impulse response, colorimeter, penetrometer and frequency analyzers will be used.

Final results achieved in this research will be used for scientific paper publishing, improvement of food technology processes and also as examples for presenting in higher education in area of process modelling, optimization and automatization. In the aim of spreading knowledge about application of electromagnetic waves in food engineering the existing web site will be enriched with new examples.

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Project duration: 2007-2010
Programme type: National
SYNERGISTIC MIXTURES IN ANTIFUNGAL AND ANTIMYCOOTOXIGENIC FOOD PROTECTION

PROJECT OBJECTIVE:

Present project formulates and investigates efficacy of mixtures with synergistic antifungal and antimycootoxigenic action (medium chain fatty acids and their glycerides, essential oil components and fractions, flavonoids, synthetic and natural phenolic antioxidants). Many of these compounds share common mechanisms and sites of action in the fungal cell, including changes to the cell membrane or oxidative stress. Another objective is to investigate activity of certain enzymes, important for cell growth in unfavorable environments, in correlation to mycotoxin levels and applied treatments. This is an attempt to elucidate the role of chosen enzymes in mycotoxin metabolism. Additional objective is to evaluate possibility of modulation of browning reactions with abovementioned compounds toward greater microbial and mycotoxigenic resistance of plant material.

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Optimal combination of antifungal compounds is expected to have an effect greater than the sum of the effects of individual compounds, as already noted in a number of natural mixtures (e.g. essential oils). Application of these mixtures in food systems would result in significant suppression or arrest of mould growth and synthesis of mycotoxins. Research results would lead to development of more efficient food preservation methods. Principles of antifungal synergism, subject to minor modifications, are also applicable for antibacterial food preservation. Knowledge of relationship between glutathione-S-transferase, other enzymes and mycotoxin levels, would enable better understanding of the fungal cell, and more efficient food protection. Modulation of browning reactions could result in new minimally processed and other products. Functional properties of many of the synergistic components would also result in safer and healthier foods.

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Project duration: 2007-2012
Programme type: National
IMPROVEMENT OF QUALITY, SHELF LIFE AND FUNCTIONALITY OF WHEAT-BASED PRODUCTS

PROJECT OBJECTIVE:

The increasing global market demands for improvement of quality, shelf life and functionality of wheat-based products setting the need for comprehensive approach in solving this challenge to food industry and scientific community. Staling of bakery products and related losses in bakery industry, use of additives or modifications of production processes for retardation of staling, sourdough usage, use of frozen semi-processed products and quality of end-use bakery products represent some of the tasks which need to be resolved. Therefore, researches on this project will be conducted on wheat seeds as the main raw-material, as well as on bakery products. Enzyme potential and composition of the tested wheat which influences technological quality and functionality of finished products will be investigated in relation to chemical and biochemical changes during storage of wheat grains. Application of additives and sourdough fermentation, as well as optimization of technological parameters for production of bakery products will be used for improvement of bakery product quality, aroma, taste and shelf life.

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Quality of frozen and non-frozen breads prepared by chemical and biological acidification will be investigated. Approved methods for analyzing staling kinetics of bakery products will be applied and new analytical methods will be tested and developed. Resistant-starch properties during processing will be investigated and novel formulation applied for development of different functional foodstuffs. Technological operations and processes for utilization of unused bakery products in the reproduction of bakery products will be developed. That could lead to reduction of losses in bakery production. Since wheat-based products are greatly represented in human diet, development of the novel technologies and investigation of nutrient influence on quality, shelf life and functional properties of wheat-based foodstuffs are of great importance for economic development.

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Project duration: 2007-2011
Programme type: National
IMPROVING ACADEMIA – INDUSTRY LINKS IN FOOD SAFETY AND QUALITY

PROJECT OBJECTIVE:

This project anticipates

• To develop Academia - Industry interfaces to enhance the relation between the parts, and promote the transfer of knowledge in areas of food safety and food quality;
• To develop and implement training courses to promote life long learning for formation of Skills and knowledge in the area of food safety and quality;

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• To develop methodology of knowledge transfer between academia and industry in the area of food safety and quality;
• The establish centers of knowledge resources in the area of food safety and quality, including legislation.

The project is leaded by Prof. Javier Arántegui, University of Lleida (Spain), with the participation of consortium members from Greece, Austria, Bulgaria, Portugal, UK, Macedonia, Croatia and Serbia.

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Project duration: 2010-2013
Programme type: Tempus
DEVELOPMENT OF NEW MODIFIED STARCHES AND THEIR APPLICATION IN FOOD INDUSTRY

PROJECT OBJECTIVE:

Starch is important food additive that is used in order to achieve and enhance certain properties of food products. Usage of native starches is limited due to retrogradation and instability in acid conditions, which result in syneresis and unstable texture, gelatinization difficulties, viscosity changes, low stability at high temperatures etc. To improve functional properties of starch, different modification techniques are used. By application of different chemical, physical and enzyme procedures, or their combinations, it is possible to produce modified starches, with properties different than those of native starches. Specific category of starches are resistant starches (RS), which are nowadays intensively researched, due to their impact on human health and properties of products and starch-based edible films. The aim of this project is to prepare new modified starches by application and combination of chemical, physical and enzyme procedures and to define their usage in food industry. Native starches of corn (normal and waxy), wheat, potato and tapioca will be used as research materials. Cross-linking, esterification, oxidation, controlled degradation and combination of these methods will be used as modification techniques.

One area of project researches will focus on resistant starches determination in plant materials, methods of their preparation and application, and the other will be preparation of edible films and coatings based on starch with adjunct antioxidants and antimicrobial agents. Starch modifications will alter viscosity, gelatinization temperature, improve stability, result in specific functional properties, freeze-thaw stability, stability at low pH, stability during food processing (high pressure, heat treatment, extrusion etc.) etc. Characterization of modified starches will include gelatinisation and retrogradation parameters, viscosity, gel firmness, swelling power, solubility, syneresis, stability, aroma retention, film firmness, digestibility and analysis of properties of products with addition of starch. Modified starches will be used in creating food products (confectionery, milk-, meat-, fruit-, vegetable-based products, snacks, frozen food) in order to improve their quality and stability.

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Programme type: National
DEVELOPMENT OF PROCESSES FOR HIGH QUALITY FOOD PRODUCTS

PROJECT OBJECTIVE:

Because of partial restrictions in the use of sulphites as an inhibitors of enzymatic browning in raw fruits and vegetables, a number of sulphite substitutes have been introduced in the food industry (ascorbic and erythorbic acids or their sodium salts in combination with citric acid and other additives). In order to develop effective browning inhibitor formulations and processing conditions for fresh-cut fruits and vegetables in this project, as a part of investigation will be to find an effective browning inhibitor formulation or some new and GRAS (Generally Recognized As Safe) browning inhibitor. In the same time these formulations should not support human pathogen microorganisms survival. For that reason a new synergistic mixtures (fatty acids and their glycerides, fractions of essential oils, antioxidatants) will be applied too, in real systems (fresh fruits and vegetables).

The prolongation of shelf life beyond of that of traditionally preserved food products (such as pasteurised) will be one of the objective of this project. The high pressure processing (HPP) will be applied on some fruit and vegetable products in order to inactivate present microorganisms, and enzyme activity without the use of chemical preservatives, and in the same time to retain food quality (colour, aroma, physical properties) and nutritive value equal to or better than pasteurized.

In the same time it will be pay a certain attention to find out whether high pressure injures or permanently inactivate microbe cells. That is the basic question, which need an answer to achieve a food safety.

Researchers on this project will try to develop food products with some improved sensory (aroma, flavour), rheological (viscosity, consistency), thermophysical (temperature and heat of freezing) and physical properties with an addition of different hydrocolloids, starches, starch modifications, or resistant starches from different raw materials.

In all cases a very important attention will be given to processing parameters, preservation and packaging methods.

The raw material that is going to be used for this research, mostly fruits and vegetables will be analysed on specific compounds such as phenolic compounds, pigments, aroma compounds and others, depend on preserving process. Since anthocyanins and other flavonoids have an array of health-promoting benefits, their antioxidative activity in fruits and vegetables will be investigated by most recent techniques.

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Project duration: 2007-2011
Programme type: National
FRUIT AND VEGETABLE JUICES FERMENTED WITH BIFIDOBACTERIA: FERMENTATION KINETICS, COMPOSITION AND ANTAGONISTIC ACTION AGAINST SELECTED INTESTINAL AND UROGENITAL PATHOGENS

PROJECT OBJECTIVE:

Fermented juices of fruits and vegetables have been recognized as an alternative kind of functional food. In comparison with fermented dairy beverages, considerably higher content of vitamins, minerals and antioxidants has been emphasized as an advantage of fermented fruits and vegetables juices. Hypothesis is that high content of some organic acids in fermented fruits and vegetable juices could influence on their inhibitory potential against many harmful microorganisms. The aim of this research is to determine the antagonistic influence of some fruit and vegetable juices fermented by bifidobacteria against selected intestinal and urogenital pathogens (Escherichia coli, Listeria monocytogenes, Yersinia enterocolitica, Staphylococcus aureus…). Some original in vitro analysis will be used. Pathogen inhibition will be assessed through to the biochemical processes during juice fermentation. The biochemical parameters of fermentation processes will be analysed as followed: 1. Influence of fermentation phase; 2. Influence of production and content of antibacterial agents during fermentation (organic acids, hydrogen peroxide); 3. Influence of pH value; 4. Antibiotic-pathogen-probiotic interaction. The antibiotic sensitivity tests will be used to compare the inhibition zones of fermented juice with standard antibiotic inhibition zones. There is no clear scientific evidence about antagonistic potential of fermented fruits and vegetables juices on the growth of intestinal and urinary pathogens. One part of proposed investigation is to compare inhibition and bactericidal effect of fermented juices on pathogens with these of dairy beverages.

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Project duration: 1 year
Programme type: National (bilateral)
THEORY AND PRACTICE OF INSTITUTIONAL APPROACH TO REGIONAL DEVELOPMENT

PROJECT OBJECTIVE:

The regional development has become one of the most challenging issues in the era of globalization, which shifts increasingly greater responsibility for economic growth and development from the nation-state to the region. Thus far, the regional development was studied in enencirle of the neo-classical theory of growth, but recently there is a growing interest for the institutional economy and endogenous theory of growth which the successfulness of one region’s economic performance assesses based on mobilizing endogenous potential of the particular region which stem from the economic, political and social particularities of that region. Numerous scientific and empirical studies have examined the impacts of institutions and their effect on the differences among different countries’ growth rates. Recent literature marks increasing number of authors who examine various institutions necessary for the efficient implementation for regional development policies. Taking into consideration the theoretical assessments on the region as an important source of competitive advantages in the global economy as well as empirical studies on the successes of highly dynamic regional economies and industrial districts, the goal of this project is to identify, develop and strengthen the institutions able to successfully channel regional developing policies and involve them into the context of managing regional development at national level. The particular attention will be devoted to analyzing conditions and perspectives of institutional dynamics in East Croatia and defining which one would be the most suitable for further development, considering region’s technological, institutional, economic and cultural specifics.

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The project will contribute to the academic building of knowledge in the area of new institutional economy and its application in the economics of regional development. Results of the theoretical and empirical research will be of use to academics and other scholars interested in regional development form the institutional point of view, while the representatives of the local and regional government can use the results of the research as guidelines to reform and innovate institutions necessary to effectively manage local and regional development continuously challenged by the more globalized economy, the changing terms of social welfare, the revolutionary developments in information and technology and the need for sustainable development.

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Project duration: 4 years
Programme type: National
MINORITY RIGHTS PROTECTION IN INTERNATIONAL LAW AND NATIONAL LEGISLATION

PROJECT OBJECTIVE:

Minority rights are one of the most interesting, but also most controversial issues of the contemporary International Law and it is of great legal and political significance for the Republic of Croatia. Recognition of human rights, with minority rights having the key position, shows to what extent a state is a democratic and modern member of the international community. Through systematic analyses over a five-year period of time, project researchers would examine all constitutions in the world and national legislation of all European states in terms of minority rights protection. The research is based on all relevant international legal standards, institutes, guidelines and norms. Particular attention will be paid to the activities of universal and regional international organizations, e.g. the United Nations, Council of Europe, the Organization for Security and Cooperation in Europe and the European Union.

The project “Minority Rights Protection in International Law and National Legislation” will, through a systematic approach, also analyze protection and promotion of minority rights in the Republic of Croatia, which have officially been recognized as priority areas of general protection of human rights in the National Programme of the Croatian Government for a period 2005-2008. Knowledge and information obtained from working on this project would, among other things, facilitate foundation of an Institute for minority rights research at the Faculty of Law in Osijek, which would be the first of a kind in the Republic of Croatia.

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The goal of this project is, among others, to educate its researchers to give members of national minorities piece of useful information and provide expert analyses for students, experts in different fields and others interested in minority rights and freedoms. Finally, working on this project would enable publishing two planned scientific monographs on protection of minority rights. In the Republic of Croatia there is no comprehensive scientific-research work on this topic, let alone a comparative and multidisciplinary approach to this problem which is going to be a part of this project. The first monograph would include International Law standards and a systematic review of constitutional provisions of every state in the world with a special reference to national legislation of all European states concerning minority rights protection. The second monograph would focus on protection of minority rights in the Republic of Croatia.

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Project duration: 5 years
Programme type: National
PROJECT OBJECTIVE:

Service, as an activity or use which one party can offer to another is usually intangible, does not result in proprietorship of anything and does not have to be connected to a certain physical product. Basic characteristics of services, expressed through immaterial, non-divisibility, inconsistency of quality, inability to store and transience, result in numerous problems in the process of service quality management. The purpose of the research through service quality management is to contribute to the development of local and regional government. The development of public management contributes to the understanding of altered role of the state in transitional conditions whereas the management of human resources is being recognized as the key factor of the public management. In order to know which competencies of a man as the new "ruler" of information age one needs to develop, a man should be viewed simultaneously as a service provider and a service user. The goal of the project is to obtain the model which will credibly measure the service quality as a dominant “product” of the information age.

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The project will embrace services that satisfy human needs, ranging from the basic human needs (health) to the developmental needs (education). The research starts in the field of health which is related to the basic human need, the service quality is in the best interest of every individual and there is possibility of fast feedback on the satisfaction with service quality. One of the proposed research goals is to develop a methodology of monitoring and following the successfulness of the Bologna process at all levels of education, from vocational and undergraduate to specialist and doctoral studies. By detecting the biggest gaps between expected and received educational service it is possible to qualitative intervene in programs and/or executive plans. Research results could have important contribution to the development of the University and the Faculty of Law under which the project has been applied.

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Project duration: 2007-2012
Programme type: National
THE INFLUENCE OF SURFACE TREATMENT PROCESSES ON THE FATIGUE BEHAVIOR UNDER MULTIAXIAL LOADINGS

PROJECT OBJECTIVE:

The objective of the present project is to investigate the influence of two different mechanical surface treatment processes (deep rolling, surface peening) on the fatigue behavior. The focus will be put on multiaxial load conditions. To this purpose, fatigue tests will be performed on unnotched and notched specimens with a testing diameter of 6 mm under combined rotating bending/torsional loading. The residual depth profiles will be characterized for both surface treatment processes over the complete lifecycle in order to determine cyclic softening or hardening effects in the material as well as residual stress rearrangements and relaxation. The investigations will be performed on the quenched and tempered steel 42CrMo4. The results will be used to develop a surface layer model for implementation in a finite element lifetime post-processing tool based on the local stress concept.

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Simultaneously, finite element calculations of the individual surface treatment processes will be performed in order to develop material models accounting for the previously mentioned stress rearrangement and relaxation effects. The residual stress state obtained from simulation will be used in order to develop simplified residual stress characteristics for implementation into the surface layer model. Third points of concern are surface flaws from manufacturing and thermal surface treatments (quenching cracks etc.). The compressive residual stresses induced by mechanical surface treatments such as peening reduce the mode I crack tip loading, thereby preventing fatigue crack growth and allowing safe operation of slightly flawed components, which is of enormous economic importance for manufacturers. For an assessment of the fatigue resistance of flawed components with residual stresses, methods from fracture mechanics will be used.

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Project duration: 2008-2009  
Program type: National (bilateral)
NEW APPROACH TO DESIGN OF WELDED COMPONENTS BASED ON BENEFITS OF PRESENT HETEROGENEITY IN THE WELD JOINT

PROJECT OBJECTIVE:

Welded components are an unavoidable part of any pipeline, pressure vessel, power plant, refinery or bridge, so integrity assessment of such structures, where cracks may appear during production or exploitation presents imperative today. It is well known that welded joint is a critical part of any welded component with respect to defects, geometry, misalignments and mechanical anisotropy. The safe use of welded structures depends not only on fracture toughness of the joint but also on capacity of material to yield and harden in the vicinity of a flaw. There are many methods and procedures, which assess the significance of crack-like defects in welded joints with present mechanical and geometrical mismatch, mainly involved in the recently developed SINTAP (Structural Integrity Assessment Procedure) procedure for European industry. With this procedures instantaneous failure, i.e. end-of-life conditions can be assessed in terms of crack size, applied force or applied strain. In recent years a lot of experimental and numerical studies were devoted to effects of materials dissimilarity in the weld joint, especially in USA. These studies shown that welding by consumable with different yield strength related to the base metal could be useful in some practical situations. The aim of this project will be to analyze all parameters influencing the fracture behavior of the welded component with present materials heterogeneity in the weld joint. It will be investigated all advantages and disadvantages of such approach, performing the welded configurations with different geometries and strength mismatch factors $M$ (ratio of yield strengths between weld metal and base metal). The most influencing geometrical factors are weld joint shape (I-, V-, X- or K-grooves), width of the welded joint in root $2H$, thickness $B$, crack length ratio $\xi=a/W$, slenderness of the weld $\psi=(W-a)/H$, crack location within the weld (centre or heat affected zone) and type of loading (tension, bending).

The influence of the material and geometrical parameters on the fracture behavior will be investigated experimentally and numerically. Final result of this investigation should be a new concept how to design welded joints with intentionally present materials heterogeneity in them. This solution should increase the fracture resistance of welded components during life-time of exploitation.

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Project duration: 2005-2007  
Program type: National (bilateral)
Advanced Cutting Techniques for Environmentally Friendly Manufacturing

PROJECT OBJECTIVE:

Recent achievements in sensor technologies (multi-sensor systems, micro sensors), in signal and data processing methods and related hardware and software (e.g. new mathematical transformation functions, new powerful digital signal processors), modeling of the physical world and physical processes are a valuable technical basis for new approaches and objective in cutting process improvement. New and enhanced cutting process development, such as dry cutting and high speed machining, are just requiring for verification purposes this highly sophisticated process monitoring solutions. High speed cutting involves complex interaction (geometrical, thermal and chemical) on tool edge /work piece contact zone which lead to empiricism extremely difficult for adequate description and understanding by mean of shear flow (local shear stresses and strain range). This project utilizes some experimental results that stand on the way for approximate expression development. Therefore proposed project has few objectives:

1. to determine influence of geometrical errors of the work piece on the process dynamics and dynamic parameters of high speed cutting process,

2. to verify damping parameters which are mostly influencing deformation process of the chips, and machine tool components,

3. to perform test aimed on determination of procedures for cutting tool load capacity and machine tool stiffness improvement,

4. to compare MQL ecological benefits with bulk tool wearing influence on cutting process,

5. to model cutting process of work piece by finite element method getting an insight into stresses and strain field in shearing zone.

Investigation and modeling of cutting process is the main task of the project. Within project proposal two approaches were performed: experiments and numerical analysis. Due to complexity and interdisciplinary of cutting process (mechanics, dynamics, thermodynamics), each project partner will be focused on some specific tests.

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Project duration: 2007-2009
Programme type: National (bilateral)
INTEGRITY ASSESSMENT
AND ENERGY EFFICIENCY OF
STRUCTURES IN SERVICE

PROJECT OBJECTIVE:

The project has a twofold purpose: on the one hand, it will join the existing competencies, equipment and knowledge of both teams in the field of construction integrity, on the other hand it will put the emphasis on research into evaluation of construction energy efficiency with the help of modern equipment. The first project year will be devoted to numerical analysis and measurement of thermomechanical stresses on an energy component (for example steam boiler or parts of a nuclear or thermal power plants). The aim is to determine nonstationary temperature distribution and to simulate the thermomechanical shock, where it may occur. Such a model could be implemented in the procedure for assessing the integrity of components and critical assessment of possible errors in the component. Softwares for finite element method will be used for numerical analysis, while the ARAMIS system for noncontact three-dimensional analysis of deformations would be used for measurement of deformations on specific thermoenergetic component.

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In the second project year the focus will be put on use of thermography in the construction analysis. Routine measurement of the energy efficiency of buildings will be a basis for experience gain, which will be necessary for application of the latest infrared cameras (which can measure temperature with very fine gradations of 0.02 K) in completion of more complex tasks, such as stress definition on thermal power plant outer wall (for example boiler incinerator). In doing so, the assumption is that a plant is vibrating with a minimum frequency of 10 Hz, and that there is a stress difference of at least 10 MPa. Frequency-amplitude characteristics of energy component vibration will be measured by vibscanner. Distribution of thermomechanical stresses on boiler wall, obtained through thermal imaging cameras equipped with appropriate software, will be used for control of combustion process in operation, and for validation of complex numerical models.

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Project duration: 2010-2011
Program type: National (bilateral)
PROJECT OBJECTIVE:

The proposed Network aims to intensify contacts between the participating institutes by exchanging undergraduate and doctoral students and teachers. IntACA network offers possibility to intensify contacts between the CEEPUS Partner countries. Thus proposed network is a great opportunity to create competitive educational and research area of Central and East Europe institutions. This helps to strengthen the ties between universities (faculties), not only for possible further education options but also for a transfer of knowledge between theory and practice. The main goal of the network is to improve both educational and research cooperation between partner institutions with the aim of joining use of laboratory equipment of partner institutions (learning special techniques which are not available at the home institutions) and to improve the quality of lectures by means of intensive cooperation on development of joint courses and course materials. High significance will be given to educational and professional (scientific) value. The main scientific objective of proposed network is to give students a survey about the importance, the role, the possibilities and the limits of Intelligent Enterprise (IE). In addition to these, there are also some important topics in production management and overall connection between engineering and economical factors.

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The main goal is to prepare students to conduct theoretical and applied research in advanced manufacturing and to encourage inter-disciplinary studies. This approach is covering technical, educational, economical, human, environmental and social aspects. The network is focused on the research topics of Intelligent Enterprise and Production Management, covered by corresponding institutions:

- University of Novi Sad, Serbia
- University of Applied Sciences Vienna, Austria
- Graz University of Technology, Austria
- University of Zenica, Bosnia and Herzegovina
- J. J. Strossmayer University of Osijek, Croatia
- Budapest University of Technology and Economics, Hungary
- University St.Cyril and Methodius – Skopje, Macedonia
- Krakow University of Technology, Poland
- University of Kragujevac, Serbia
- University of Maribor, Slovenia and
- Technical University in Košice, Slovak Republic.

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Project duration: 2009-2011
Program type: CEEPUS II
IMPLEMENTATION AND UTILIZATION OF E-LEARNING SYSTEMS IN STUDY AREA OF PRODUCTION ENGINEERING IN CENTRAL EUROPEAN REGION

PROJECT OBJECTIVE:

The main objective for all participated partners in the proposed projects is implementation and utilization of e-learning systems in study area of production engineering in Central European Region. The main objective is in concordance with the e-learning initiative of the European Commission.

Connected with this objective is possible to identify other objectives as: information and communication technologies (ICT), promoting digital literacy as e-books, e-papers, e-courses, etc., teaching process must be based on e-presentations (slide-shows), development of virtual laboratories especially in case of equipments with large dimensions, development of simulations to improve the functions parameters, using the virtual tests for find the possible errors in design, using the simulations for improve the maintenance and reliability of machines and equipments. Implementation of virtual laboratories specific for each University and realization of virtual laboratory network between Universities, implementation of modern communications technologies, especially for the case of lifelong learning, between the students and teaching staff of universities.

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Mobility of students and teachers enable to realize the education in higher level. It is possible trough e-learning system to implement and develop a way to have permanent access to resources of partners with benefits for all participants. Therefore the basic aim of the proposed project is increasing of education level, increase flexibility of students in Central European region and to give the possibility to the students to have access to other Universities in Central European region in area of production engineering. The other very important aim is develop existing Joint programs for master and PhD study program and to realize new Joint programs for master and PhD study program, awarding multiple degree and support for finishing of PhD thesis. Network partners are:
- North University of Baia Mare, Romania
- University of Applied Sciences, Graz, Austria
- J. J. Strossmayer University of Osijek, Croatia
- College of Nyíregyháza, Hungary
- Szent István University, Gödöllő, Hungary
- University St. Cyril and Methodius – Skopje, Macedonia
- Koszalin University of Technology, Poland
- Rzeszów University of Technology, Poland
- Poznan University of Technology, Poland
- Politehnica University of Bucharest, Romania
- Transilvania University of Brasov, Romania
- University of Novi Sad, Serbia
- Polytechnical Engineering College, Subotica, Serbia
- University of Maribor, Slovenia
- University of Žilina, Slovak Republic
- Technical University in Košice, Slovak Republic
- Slovak University of Technology in Bratislava, Slovak Republic

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Project duration: 2009-2011
Program type: CEEPUS II
UNCONVENTIONAL AND HYBRID UNCONVENTIONAL PROCESSES AND PRODUCTION TECHNOLOGIES

PROJECT OBJECTIVE:

Unconventional machining and surface processes are specialized operations used by industrial companies worldwide. They are particularly applicable for the shaping and finishing of materials that are difficult to tackle by conventional methods of machining and are often regarded as complementary technologies to existing practices. In the USA, electrochemical machining is particularly useful for major aerospace companies such as Pratt and Whitney and GE Company. They rely on American Manufacturers for the necessary equipment. In international industries, major Japanese companies have secured commercial leadership in electrochemical (ECM) and electro-discharge machining (EDM), particularly concerning the production of micro-parts, in which the use of wire machining is also prominent. In the USA, the Ingersoll Rand Company manufactures water jet-cutting equipment. Ultrasonic machining equipment is made both in Japan and USA, as well as in Europe. In these non-European countries the environmental problems resulting from the use of unconventional machining are recognized but have not been adequately addressed.

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Main objectives are:
- To establish a network between universities (cooperating Departments and Institutions as well as people) with similar study program in the field of Unconventional Processes and Production Technologies and to associate the effort in developing joint research projects for international grants in the near future;
- To promote the regional cooperation in education and accelerate information transfer in the field of common interest;
- To enlarge the possibility for utilization of unique laboratory equipment and devices in the participating universities for research work, mainly for young teachers working on their dissertations and for PhD students as well as for students working on their master thesis;
- To investigate on environmental protection in unconventional production technologies with a special emphasis on the development of constructional solutions aiming to decrease their harmful influence;
- To prepare highly-skilled engineers that will contribute to acquisition of commercial leadership of the European companies in the non-conventional technologies.

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Project duration: 2009 – 2010
Programme type: CEEPUS
INCREASE OF THE EFFICIENCY OF CASTING PROCEDURES - CROATIAN PERSPECTIVES

PROJECT OBJECTIVE:

If Croatian foundries intend to become important producers of castings for western and oversea industrially developed countries, it is necessary to solve a great number of organizational and technological problems. The most important problem is how to achieve casting quality. Primarily, owing to insufficiently educated personnel and to historically caused difficulties, the level of Croatian foundries is not satisfactorily high in the sense of organization and scientific professional knowledge enabling quick entry in western integrating processes. Therefore, it is indispensable to increase efficiency and to improve castings quality. In near future (up to 5 years) it would be possible to ensure more significant participation of Croatian foundries on western markets. To achieve that goal they have to be informed about global trends and to have high professional knowledge on the respective casting. That is why; they need exceptional engagement of their own scientific and professional potential. Croatian foundry experts are aware of the mentioned circumstances. Considering the fact of the need of foundries integration into western trends, it is necessary to achieve higher scientific level of personnel in foundries taking into account the existing knowledge and new scientific information achieved by this project. By research it will be proven the importance of introducing contemporary methods of deciding in single phases of the technological process in industrial castings production based on scientific knowledge, as opposed to frequently empirical or intuitive access in our country. Purpose and goals of proposed investigation project are to put forward production companies in mechanical and electromechanical field, especially in casting technologies, and to introduce contemporary informational, mathematical and statistical methods into production.

Hence, there is a need to detect influential parameters in order to increase the efficiency and castings quality and then to apply scientific approach instead of empirical approach which is frequently use in our country. In that way, the conditions for the increase of efficiency and castings quality would be realized in addition to high quality reliability, according to requests of global market. The goal is also elaboration of informational and other accessories in order to bring forward the production, especially to link castings construction with production technology by means of informational tools forming a functional complex. In that way development of professional and scientific personnel will be stimulated in order to involve the experts into production activities.

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Project duration: 2007-
Programme type: National
CAD/CAM METHOD OF MODERN TOOL CONSTRUCTION FOR HIGH STRENGTH STEEL PLATES IN 4D

PROJECT OBJECTIVE:

CAD/CAM method progress as base for future CIM-concept has assigned great attention in bending industry. Goals are:
1. computer aid for part shape obtained by bending and deep drawing
2. computer aid for bending and deep drawing tools production
3. computer aid at measurement parts obtained by bending and deep drawing
4. computer aid for intermediate shape bending (bending in more grades) and deep drawing

Construction process, work setup and production would be given on selected specified example, where presented process would be identical or similar and it would be used for other geometry. Results, i.e. up specified development project, would be used at production of different plate parts. Basically, it would be aided part for work piece production with different tables and norms. It’s important that every drive has tables just for yourself and don’t give access of any information someone else.

CAD/CAM method of a modern tool construction at bending and deep drawing HS steels with ultimate strength of 1000 MPa, would in progress in following stages:

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1. construction of part geometry
2. initial shape
3. classification bending and deep drawing stages according to operations
4. mechanical springback
5. calculation of required information for applied machine (force, motion)
6. CNC program production which would be relied to CAD model and technology for production on metal cutting machines
7. CNC tool production would be controlled on CNC measurement device

Process and tool development would be parallel analyzed by theoretical and experimental view. In first case it would be used simulation process based on FEM, expert systems and computational model for achieving optimal tool.

Concept with name 4D process would be used. Analyze of production concept would be connected directly with simulation and plate behaviour in cold state would be presented during forming process. Time, as fourth dimension, plays your role here (4D process). On that way it can be seen the hole process. It would be visible on monitor, step by step, what’s going on and would give correspondingly calculation.

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Programme type: National
RESEARCH OF THE IC ENGINE COMBUSTION CONTROL AND MANAGEMENT

PROJECT OBJECTIVE:

Goals & Hypothesis
By controlling the IC engine combustion process it is also possible to manage the process and insure optimal parameters during the conversion of heat energy into mechanical work inside of the engine.
The goal is to achieve optimal engine performance for all working conditions, throttle settings and rpm (over the whole engine working field). Such a performance would insure minimal fuel consumption, i.e. maximal engine economy and the engine would operate within ecologically acceptable boundaries.

Expected results:
1. Mastering the parameter values of a controlled and managed combustion process, specific work within the engine and optimized engine performance for all working conditions, throttle settings and rpm within ecologically acceptable boundaries (lowest exhaust gas emission).
2. Development and application of sensors and software for the IC engines.
3. Ability to manufacture new high-value products and develop new entrepreneurship.
4. Decreasing IC engine fuel consumption, i.e. increasing engine economy.
5. Contribution to ecology and environment preservation.

Methods of verifying the results:
1. Theoretical - establishing a combustion process model.
2. Experimental - conducting measurements on IC engines within laboratory conditions.

Research importance:
1. Scientific - mastering the parameter values of a controlled and managed combustion process, specific work within the engine and optimized engine performance for all working conditions, throttle settings and rpm within ecologically acceptable boundaries (lowest exhaust gas emission).
2. Applicable - development and application of sensors and software for the IC engines (eg. ship engines), decreasing IC engine fuel consumption, manufacturing new high-value products, increasing profit, environment preservation, developing new entrepreneurship and establishing new work places.

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Project duration: 2007-
Programme type: National
PROJECT OBJECTIVE:

Applying production systems, it is necessary to differentiate two systems. One is solving the development and design of products, and the other is solving the production of products. The acceleration of activities in the production system is the most important connection in today's economy, as on national so on corporate level. If in the production achieved the acceleration of particular operations, then must accelerate the system of development and design. This system must to satisfy the high-grade development of all product elements beside the requirement of total time reduction. This means that is one of conditions for the high-grade development and parallel processing of particular elements, including the systems of simultaneous engineering just in the area of development systems. The aims of project are the research of all properties of product design for the Global Product Realization by Rapid Production (RP) and their interaction. The product design can adapt to the rapid manufacturing, processing or assembly by optimizing of design properties. This is the hypothesis of this project. For that purpose, we will analyze the conceptual design and design in detail for production, checking: the ratio between the design and production, structure of design, form of components design, selection of materials and semi-finished materials, usage of standard and completed components, documentation and PDM system which will enable the software processing. All these must be appropriate. The expected results are the defining of directives for development of product design made from classical materials and contemporary polymeric materials, and their characteristics in respect to requirements of RP. We expect also the systematization of solutions for the several groups of problems with the direct influence on the rationalization of RP procedure. The results will be checking up by subjective, objective and combined methods, in other words by applicable examples in the technique and medicines. The obtained directives will applied on the analysis and evaluation of design properties of real products in respect to requirements of RP. The importance of suggested research is possibility to create the database, which is indispensable for the optimal development of product as well as for the suitable PDM system in the process of production. It is also helps the approaching and competitiveness of Croatian products development to the EU and worldwide trend.

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ANALYSIS AND FRACTURE ASSESSMENT OF STRUCTURES OF ANISOTROPIC MATERIALS

PROJECT OBJECTIVE:

Intentions to build most of acquired knowledge about growing mechanisms and propagation of failure in structures as one unique procedure on the level of European industry resulted in adoption of so-called SINTAP procedure (Structural Integrity Assessment Procedure). This procedure is the base and frame for integrity assessment of any construction. Of course, it is difficult to encompass all influences which can appear during operation simultaneously (e.g. aggressive media, high temperature, creep, fatigue due to cyclic loading, materials heterogeneity in the joint etc.). In such a manner anisotropy of mechanical properties can crucially affects an unstable fracture and it is not included in the procedure for estimation of structural fracture behaviour. Continuum mechanics equations, which are valid for homogeneous and isotropic materials have to be significantly modified in order to involve the effects of materials anisotropy. All present heterogeneity should be modeled with corresponding constitutive relations.

Special attention will be given to fracture behaviour analysis of composite materials with the delaminating crack located between two anisotropic plies. Thus, advantages and disadvantages of individual fracture criterion, which are based on the mixed mode stress intensity factor and strain energy release rate will be considered. Algorithms for calculation of these parameters will be implemented as routines into software package for finite element analysis – ABAQUS. Numerical results will be fundamental in creation of limit load solutions compendium for the structures made of heterogeneous and anisotropic materials. Performed experimental testing should confirm the validity of assumptions used by finite element analysis. Proposed investigations are important, because this compendium can be used to increase the safety of structures in exploitation, by estimation of the structure lifecycle. Gathered knowledge about mathematical modeling of composition function where heterogeneous materials are involved, is planned to be applied in biomedicine.

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INFLUENCE OF DUPLEX PROCESS ON STEEL STRUCTURE AND SURFACE ENGINEERING

PROJECT OBJECTIVE:

Structural changes in alloys induce changes of specific volume of the newly built grid. In steels the most intensive grid volume changes occur at phase transformation level, i.e. it is necessary that the tempered product changes its volume in relation to still unheated part of the product, especially in thermodiffusion heat treatment. Thermo diffusion creates in surface layers of steels or castings thin surface layer of carbides B, V, Ti, N or Nb, which generate very hard and stable connections. This surface with very hard carbide layers have great resistance to tribological wear, which in the end prolongs the life time of products and tools.

MECHANICAL ENGINEERING FACULTY

This project has envisaged the following research: - The influence of thermo diffusion process on product components, design and tool volume changes; - Establishment of phase transformation (A1 and A3) and martensite transformable size changes (temperature Ms); One of the research goals is establishment of temperature height Ms in steels with increased hardness values treated with thermo diffusion process (continuation of many year research on thermodiffusion process in steels); extremely hard duplex layers on steel surface layers, such as: FeB, VC, VB, VN, TiC, TiN, CrN, VN, BN and others. The influence of duplex process on tribological properties (adhesion, abrasion, erosion, tribocorrosion) of construction steels with increased hardness values.

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ADVANCED TECHNOLOGIES OF DIRECT MANUFACTURING OF POLYMERIC PRODUCTS

PROJECT OBJECTIVE:

Lead time to launch the product on market is the key success factor of any product. Therefore, one of the most important goals of contemporary production is to shorten the time from arise the idea of the product up to its final realization, i.e. to increase production efficiency. One of the possible answers to such demands leads to accepting and systematic development of Rapid Manufacturing (RM) technologies inside of the Rapid Product Development (RPD) concept. Rapid production can be achieved by adopting of Rapid Prototyping (RP), Rapid Tooling (RT) and other advanced manufacturing technologies (e.g. high-speed machining), and by their systematic development and adjusting to special demands arising from specific production and application. These technologies make the manufacturing of complex products possible, directly from the computer data in very short time. Project applicant has been involved in systematic investigations in the field of polymeric product development almost over past two decades. In this effort they keep up on development of production of plastic and rubber (polymeric) products from the product idea to its final management as a waste and they take part in transfer of knowledge.

MECHANICAL ENGINEERING FACULTY

The main purpose of suggested project is to continue this permanent research work toward the investigation of advanced rapid production technologies. Presumption is that it is possible to adjust rapid manufacturing technologies to growing demands of contemporary production by optimization of their most important characteristics. So, the aims of the project are to investigate technological and economical characteristics of some of the most important contemporary techniques of rapid production and their applicability in the various fields of human activities, especially in technique and medicine. The research will be focus on study of two rapid prototyping techniques (3D printing–3DP and hybrid technology-OBJET), microinjection injection molding of compact and nanocomposite polymeric materials and high-speed machining of metals and polymeric materials, especially biocompatible ones. We will compare technological and economical characteristics of the chosen technologies researching materials, speed, cost, accuracy and easy of use. These characteristics are decisive in estimation of applicability of each technology inside the rapid production concept, especially in an estimation of their applicability for medical applications.

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ADVANCED JOINING TECHNOLOGY IN LIGHT MECHANICAL CONSTRUCTIONS

PROJECT OBJECTIVE:

The possibility of significant cost reduction in production, and also during exploitation of constructions and products can be achieved by manufacturing of light mechanical constructions. It is very important in production of constructions and products, to apply appropriate material joining technologies (with satisfactory quality and reliability, acceptable from costs, environmental protection and energy saving point of view). By application of modern joining technologies, it is possible to shorten significantly the duration of production process, with equal or even better quality and reliability of mechanical constructions and products. The reduction of construction or product weight leads to lesser consumption of materials and energy in production, and also to significant saving of energy in exploitation. It can be clearly noticed on movable and portable mechanical products (railway vehicles, civil construction machines, road vehicles, harbor cranes, pressure vessels …), and also during disposal and recycling of product at the end of its life cycle. The implementation of modern material joining technologies in production conditions of our environment is not on the satisfactory level.

MECHANICAL ENGINEERING FACULTY

Within this project, the investigations in laboratory, workshop and field conditions are predicted, during with, the economical and technological aspects of modern joining technologies would be investigated (modern welding and other joining processes of metals and polymer materials used in production of light construction, adhesive bonding, and joining of materials by cold forming technique). From the construction and products weight reduction point of view, today, in homeland production, the new types of high strength fine grained micro alloyed and low alloyed steels, aluminum, magnesium and titanium alloys are especially interesting. In our production environment the high strength steels are more and more used in design of different mechanical constructions and products (components of large harbor cranes, railway tanks, spherical tanks, components of railway and civil construction vehicles etc.). Aluminum alloys are also unavoidable in light construction manufacturing (construction of coatings during reconstruction and revitalization of transport cars for railways, construction of boats, tanks …). Special aspect of Project is using modern joining processes supported by automation and robots.

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ADVANCED CUTTING TECHNIQUES FOR ENVIRONMENTALLY FRIENDLY MANUFACTURING

PROJECT OBJECTIVE:

By determination of cutting technology, in market oriented metal manufacturing industry, technologists are daily facing with demands for reduction of internal superfluity and with necessity of implementation of advanced techniques. With application of advanced cutting techniques it is possible to achieve different forms of reduction in manufacturing process. However, unprepared and unconditional erection of technology level with new techniques can sometimes be faced with problems and with bad effects on human and environment. Therefore, it is proposed to perform analysis with objective and scientifically based methods and to perform comparison of traditional with advanced high speed dry cutting technology. Investigation proposed with this project includes economic, ecologic and technologic aspects of implementation of advanced cutting technology.

Selection of topic of investigation is based on cutting technology development which was in near past going in two directions: reduction of cutting time and keep the undesired consequences of manufacturing process on environment low. High speed cutting procedure integrated with minimum quantity lubrication system (MQL) – coolants are harmful for operator and for environment, offer technological solution which will provide reductions in manufacturing and allow decreasing of internal superfluity. It has to be noted that coolant related costs are in last 20 years increased 5 times and are several times higher than cutting tool costs.

Application of advanced cutting technology in manufacturing conditions within our environment is not on the satisfactory level. Reason for that situation lays in fact that there is no enough time and educated pupil in workshops which will be involved into challenge of development and implementation of advanced techniques aimed to technology level erection on present and on future products and material which are mostly representative for their own manufacturing.

From the time shortening point of view, high speed cutting in the best known and applicable technologic solution, and from the environmental impact point of view – dry cutting technology or MQL technology is the best and applicable choice. Special challenge of these technologies implementation are related with materials to be machined and its machinability in particular and especially by high strength steels, aluminum, titanium and manganese alloys.

MECHANICAL ENGINEERING FACULTY

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DEVELOPMENT OF ERP SYSTEM FOR DIGITAL FACTORY

PROJECT OBJECTIVE:

To develop ERP system for different types of production and to apply it in the Centre for development of products, technologies and logistics with the following laboratories: laboratory for product design - LARP; laboratory for new technologies - LANT; laboratory for new materials - LANM; laboratory for new informatics technologies - LAIT; laboratory for conventional technologies - LAKT; laboratory for intelligent production systems - LIPS; laboratory for new informatics technologies - LNIT and laboratory for production logistics - LOGP. Existing ERP systems are orientated to large production systems. Requirements of small and middle enterprises, especially of single production in a way of integration and data acquisition directly from production processes numerical controlled machines, robots and conventional machines are less researched and solved. According to possible perspectives of Croatian metal industry that has to be orientated according to single and small-scale production with large changes in assortment development of ERP system will have huge significance. Main project goals are: to develop or adapt ERP systems according to requirements of small and middle enterprises those have production resources of different level of automatisation (CNC machines, CIM system, hand work, conventional machines).

To research and develop equipment control systems (mentioned in program) and theirs integration with CA applications (CAD, CAM, CAPP, CAMI), high bay storages and Internet business in Digital factory, as well. Hypothesis is to develop own ERP system that has to be adapted according to requirements of small and middle enterprises that covers single and small scale production, according to demands of modern market and simultaneous applicability of high automated and conventional equipment. Expected results are: to develop management system for production and services of enterprises that have high automated and conventional equipment and integration of the following own developed models for planning, scheduling, launching and priority rule. Results verification will be done through the control of planned activities and completed models in laboratories of the Centre. Project results will manage development of management system for Digital factory that will be informatics supported. In the same time particular models (planning, scheduling, launching etc.) will be applicable for different types of production.

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Numerical Modelling of Convection-Diffusion Phase Change Problems

**Project Objective:**

Melting and freezing are phase change phenomena that have become an indispensable part of many technological processes like the manufacturing of metal alloys, continuous casting, welding. They are key mechanisms in refrigeration techniques. Nowadays these phenomena have received increasing attention due to possibility of their application in latent heat energy storage, specially for efficient solar energy storage. The processes of melting and solidification belong to the class of moving or free boundary problems. The essential and common feature of these problems is the existence of a time and space dependent phase boundary, whose position cannot be identified in advance, but has to be determine as an important constituent of the solution. The existence of the moving boundary introduces a non-linear character to this type of problems. Nowadays, these problems are usually solved by numerical techniques. Modelling of the transport phenomena occurring during solid/liquid phase change involves consideration of the fluid flow and heat and mass transfer processes.

**Mechanical Engineering Faculty**

Special attention should be given to the treatment of the latent heat evolution. The aim of this project is to develop an efficient numerical model for solid-liquid phase change in a binary fluid with influence of natural convection.

The proposed research will be continued on the research carried out in the previous research project “Methods of computational fluid mechanics” and in the doctoral thesis “Influence of natural convection in the phase change processes” in which the model of phase change in pure matter was developed. The purpose of the proposed research is to increase the level of the understanding of the phase change processes in binary mixtures with the possibility of their application in the real technical problem solving. It is expected that the obtained experience will create the conditions for researchers’ inclusion in similar European project and improvements of the computational fluid mechanics and thermodynamics courses for mechanical engineering students.

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**Project Duration:** 2007-

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INFLUENCE OF GENETIC AND ENVIRONMENTAL FACTORS ON CHILDHOOD ASTHMA

PROJECT OBJECTIVE:

Asthma and other atopic disorders arise through complex interactions between genetic and environmental factors that together direct development of the immune system to allergic phenotype. Genome screens in asthmatic subjects have identified linkage on many chromosomes but susceptibility genes have not been identified. Candidate genes possibly involved in the immunological pathways of asthma include genes for IL-4 receptor, IL-13, FeR1ß and glutathione S-transferase and gene clusters for several cytokine and cytokine receptor genes. Gene ADAM 33 seems to be associated with bronchial hyperresponsiveness, airway remodeling and disease progression. The so-called “hygiene hypothesis” assumes that exposure to endotoxin and other microbial products in early life protects from asthma, but in children with asthma (and in adults) endotoxin aggravates the disease. Endotoxin promotes cytokine secretion and inflammatory processes and thereby may direct maturation of immune system towards protective immunity or allergy. The effects take place through the CD14 receptor, the expression of which is genetically determined. Our study will include 400 children 6-18 years of age from Brodsko-Posavska County with allergic asthma and 400 children of corresponding age and sex without asthma. Standard ISSAC questionnaires will be completed (with parental assistance) by children from both groups. Blood samples will be collected from children in both groups for genetic and immunological tests. Leukocyte DNA will be extracted and used for PCR. Amplified products will be minisequenced and analysed with regard to "candidate" genes by means of microchip technology. Samples of dust will be collected from children's mattresses and analysed for the content of endotoxin and mite (D. pteronyssinus) allergen. The findings will be correlated to genetic predisposition and to the expression of asthmatic phenotype. Levels of IL4 and IFNgama will be determined in children having gene polymorphism for these cytokines. The results will be analysed by nonparametric and parametric statistical methods. Expected results are: identification of most common gene polymorphisms and/or of genes associated with asthmatic phenotype, and a correlation of gene expression with endotoxin and allergen levels in house environment. The findings might contribute to identification of children at risk of asthma and to its prevention.

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PHYSICO-CHEMICAL AND METABOLIC RISK FACTORS OF URINARY STONE FORMATION

PROJECT OBJECTIVE:

A Calcium oxalate (CaOx) and phosphate are the most representative inorganic components in a composition of renal calculi. Calculi formation can be caused by activity of different factors, but the main reasons are high urine saturation regarding calcium salt precipitation and defect of precipitation inhibitors in urinary system. Inhibitory characteristics of urine are in correlation with urinary chemical components, with concentration of organic macromolecules (proteins, glycosaminoglycans, lipids) and organic and inorganic ions (magnesium, citrate) in the first place. The role of glycosaminolycans (GAG) is controversial in appearance because of their inhibitory and promontory characteristics. The aim of this study is to establish the role of GAG in different stages of CaOx calculi formation in vitro and discrimination of urine in calculi formers and healthy persons, based on inhibitory capacity of urine. The first aim: To establish the influence of different GAG (heparan-sulfate, chondroitin-sulfate, hyaluronic acid) on CaOx crystallization and interaction between CaOx crystals and renal cells. The thesis: GAG promotes nucleation, inhibits growth of CaOx crystals and reduces damage of renal cells by CaOx crystals. Expected results: Intensity of inhibition and promotion of crystallization, in reference to cell damage are dependent on type and concentration of GAG. Methods: CaOx formation kinetics will be tested, in synthetic and real urines with a supplement of GAG in different concentrations. Number, size, composition and morphology of crystals, pH change and Ca and Ox ions concentration in solution will be followed kinetically. Damage of cell membranes will be established by kinetic measures of protein secretion, osteopontine and superoxide-dismutase expression and cell apoptosis. The second aim: Developing methods for detection of tendency to urolithiasis, based on determination of inhibitory urine capacity. The thesis: Inhibitory urine capacity is a parameter of discrimination in calculi formers and healthy person’s urine. Expected results: The most efficient method will be chosen for determining inhibitory capacity of urine. Methods: Inhibitory capacity of urine will be established by titration method based on complex binding of added calcium ions. Inhibitory capacity of urine will be determined with a deposition method based on deposited quantity of calcium salt in urine grafted with CaOx crystals. Metabolic parameters in urine will be correlated with inhibitory capacities. The method that shows more significant discrimination between inhibitory capacity of urine in calculi formers and healthy persons will be proposed to a diagnostic purposes.

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GENE POLYMORPHISM AND FUNCTION OF TRANSPLANTED KIDNEY

PROJECT OBJECTIVE:

According to the data published in European Guidelines for Kidney Transplantation there is a linear increment in the incidence of end stage renal disease (1). These patients are candidates for kidney transplantation. Therefore there is a growing need for a kidney transplant. Unfortunately, the availability of organs for transplantation and transplantation frequency do not accompany that need adequately. Each year around 3000 patients included in the waiting list for kidney transplant in USA die before being transplanted, while additional 100000 patients die before being enrolled to the list (2). According to the data of the Referral Centre for Transplantation of the Ministry of Health of the Republic of Croatia there has been total of 1000 kidney transplantations done in Croatia from 1985 to 2003 (University Centre Zagreb and University Centre Rijeka). Data for July 2004 report on 1000 patients on the waiting list for kidney transplant in Croatia, while the number of those dialysis treated is thrice as more. A third of the potential recipients wait for transplant more than 6 years. There was total of 113 kidneys transplanted in 2004 in Croatia (in Zagreb University Centre Zagreb and Clinical Hospital Merkur, and University Centre Rijeka) (3,4). Clinical outcome of organ transplantation depends in a great part on immune processes that are responsible for rejection or tolerance of the transplanted organ. As far as a better modality of renal replacement therapy is not created, achievement of tolerance to a transplant remains the basic aim of the treatment. After a year posttransplantation 85% of cadaveric kidney grafts are functional. Half-life of such transplant is 8 years. Main cause for chronic rejection is alloreactivity. Numerous studies indicate that genetic determination of allograft survival also includes molecules other than HLA system, which is the main interest of the proposed project.

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ROLE OF SMALL PROTECTIVE TFF PROTEINS IN HEALTH AND DISEASE

PROJECT OBJECTIVE:

The gastrointestinal (GI) epithelium, constantly exposed to various irritants, is a site of unique challenge in maintaining cell and tissue homeostasis. The epithelia synthesize products that tend to limit inflammation and to improve the integrity of the epithelial barrier. Small peptides with known as Trefoil Factor Family proteins (TFFs) allow the healthy gut to restrain inflammation. TFF’s mode of action is multifactorial and seems to be expanding from that of simple secretory proteins that interact with mucins, towards more complex proteins involved in various aspects of carcinogenesis (TFF1 acting as tumor suppressor) and inflammatory reactions. Recent data showing involvement of TFF2 & TFF3 in modulation of immune response opens the question of TFFs action in whole body, and not only in gastrointestinal tract. This project is focused on: A) investigating the role of TFF proteins in immune response; and B) the in vivo evaluation of new potential therapeutic agents (synthesized by projects WG1, WG2, WG3). We will monitor a difference in gene expression profiles (genes relevant to immune response) of inflamed GI tissue of wild type and TFF2 deficient (TFF2 knock out) mice due to provoked inflammation (cDNA Microarary and quantitative PCR, Western Blotting and immunohistochemistry). The function of a newly described TFF1&TFF2 interacting protein: TFIZ1, that is strongly down regulated in gastric tumors, will be investigated. We will monitor the regulation of TFIZ1 gene expression due to effects of various pro-inflammatory cytokines (Dual Luciferase Assay).

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The in vitro tools (expression plasmids and reporter gene plasmids) developed in course of investigation of TFF’s role will be used to assess binding specificity of newly developed small molecules synthesized in cooperating program projects (WG1, WG2, WG3). These novel small molecules will be designed in a way to improve their interacting specificity with DNA/RNA (WG1, WG2, WG3) or proteins (WG3: novel inhibitors of PNP:purine nucleoside phosphorylase). The in vivo effects of new designed potential therapeutic molecules (therapeutic effect proven in cell lines, WG4) will be tested on normal mice as well as on mouse tumor and inflammation models. The results of these investigations will: A) improve our understanding of immune response regulatory mechanisms and B) enhance the design of new molecules that could be tools for intervention in case of disease (anti tumor and anti-inflammatory effect).

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SEROTONIN RECEPTORS AND
CHANGES WITH
ANTIDEPRESSANTS IN RAT
MODEL OF DEPRESSION

PROJECT OBJECTIVE:

In this application we propose to investigate 5-HT synthesis, one the brain’s many neurotransmitters, in an animal model of depression. Neurotransmitters are small molecules used for communication between neurons. Depression is a common brain disorder. A well characterized animal model should help us advance our understanding of the underlying biology of depression. It will also help us in our research of the drug actions on the brain when used as treatment for this disorder. Many of these drugs have been used in the treatment of human depression. However, it has been found that the drugs can be very helpful at first, but fail to continue to work after a certain period of time. In the majority of situations, we still do not know the mechanisms of these drug actions.

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This prevents us from rationally explaining why they stop working. This lack of understanding also hinders the development of new generation medications. Because the etiology of the disorder in humans can be very diverse, a more uniformed animal model should be greatly helpful with this research.

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EFFECTS OF OXYGEN ON VASCULAR FUNCTION IN HEALTH AND DISEASE

PROJECT OBJECTIVE:

Adequate peripheral tissue perfusion primarily depends on ability of resistant blood vessels to increase or decrease diameter in response to various vasodilator and vasoconstrictor stimuli. Previous studies demonstrated that in diabetes mellitus there is an enhanced vasoconstriction and impaired vasodilation in response to different stimuli, which could be one of the risk factors for development of microangiopathy, impaired regulation of blood flow in peripheral tissues and development of tissue hypoxia and ischemia. Hyperbaric oxygen therapy (HBOT) is an adjuvant therapy for some ischemic conditions in diabetic patients, but controversial in therapy of cerebral ischemia. Although physiological mechanisms of HBOT are not fully understood, some studies showed that HBOT could alter expression various enzymes (such as COX-2 and eNOS) both in brain tissue and in endothelial cell culture thus possibly affecting vascular structure and function. The general purpose of this project is to evaluate the effects of HBOT on vascular reactivity and blood vessel structure in normal rats and in rats with streptozocin-diabetes mellitus. This project will test hypothesis that HBOT will affect normal and impaired vascular control mechanisms of cerebral resistant vessels in response to vasodilator and vasoconstrictor stimuli and will affect cerebral blood flow regulation via HBOT affecting enzymes in various pathways mediating vascular reactivity to vasodilator and vasoconstrictor stimuli. In contrast to HBOT, chronic intermittent hypoxia (CIH) will compromise CBF regulation due to effect of CIH to impair vascular responses to endothelium dependant stimuli. In the evaluation of the blood vessels function we will use in vitro videomicroscopy of isolated, perfused resistant vessels, aortic ring studies, in vivo laser Doppler flowmetry, biochemical measurement of vasoconstrictor and vasodilator mediators and determination of the protein expression (eNOS, COX-1,2, CYP450 omega-hydroxylase enzymes) by Western blot in rats after acute or chronic exposure to HBOT or CIH. Incidence of stroke, other cerebrovascular and cardiovascular diseases and peripheral tissue ischemia is higher in diabetic that in healthy population and could be a consequence of impaired function of microcirculation. Proposed research will allow for the first time to elucidate the mechanisms of HBOT effects that could slow down development of diabetic vascular dysfunction and ease the complications of DM.

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MODEL OF THE EARLY CANCER DIAGNOSIS INTEGRATED IN THE GENERAL MEDICINE PRACTICE

PROJECT OBJECTIVE:

In the County of Osijek and Baranja from 1990 to 2003 there was an increase in new cancer diagnoses cases from 1,134 to 1,415, which is an increase by 24.8%. In the said period the number of persons who died of the carcinoma of the prostate increased by 30%, the number of persons who died of the large intestine cancer increased by 62.3%, while the number of persons who died of the breast cancer decreased by 20.6% and the number of persons who died of the uterine neck cancer decreased by 69.2%. The Croatian Oncological Society has prepared a proposal of the national programme of preventive measures and early cancer diagnoses for the most frequent localizations of the carcinoma of breast, uterine neck, large intestine and prostate. This proposal was accepted by the Ministry of Health and Social Welfare of the Republic of Croatia. The proposed methods of an early cancer diagnosis for the aforementioned localizations are standard examinations of diagnostics and procedures of the Croatian Institute for Health Protection. The programme of early cancer diagnosis is not implemented systematically and comprehensively, in spite of existing legal premises. The family medicine teams could make, in a planned and systematical way, early cancer diagnoses, as they have enough knowledge and skills and cooperate well with the population in a direct practice as well. By an organized application of early cancer diagnosis measures concerning the most often localizations we could expect an increase in the number of diagnosed and cured patients, a significant increase in the survival exceeding 5 years and a long term decrease in the general and specific mortality.

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The research aim is to evaluate acceptability and applicability of an early diagnosis of the carcinoma of the breast, uterine neck, long intestine and prostate, based on the model of an active and systematic work of family doctors and in doing so taking the opinion of the population and standpoints of the physicians into consideration; to evaluate the necessary time and staff standards for the implementation in regular work; to establish the diagnostic validity of the methods, if implemented by the family medicine teams in their regular work; to evaluate the advantage in comparison with the price; to calculate the survival exceeding 5 years. The research sample will include from 10,000 to 15,000 risk probands that are entered in the list of insured persons of the Croatian Institute for Health Insurance.

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MECHANISM OF ANTIPSYCHOTICS-INDUCED METABOLIC SYNDROME

PROJECT OBJECTIVE:

The atypical antipsychotics have become widely used because of their lower rate of extrapyramidal adverse effects compared to older classes of medication. However, while some of the atypical drugs are better tolerated, they also increase the incidence of diabetes. It was found that patients treated with olanzapine and clozapine have 37% greater chance of developing diabetes over a five-year period. The mechanisms responsible for the elevated risk of diabetes associated with some antipsychotics are not fully understood. The mechanism could be associated to the defect in regulation of insulin, leptin and ghrelin secretion which may be also attributed to neuropeptide Y (NPY) family which has role in key brain area, the arcuate nucleus. Neuronal melanocortin receptors are also involved in this regulatory mechanism. We propose that atypical antipsychotics affect regulation of this neurosecretory response and thereby influence energy-balance. The aim of our project is to determine receptors and hormones which play pivotal role in antipsychotic induction of diabetes type II and metabolic syndrome. The correlation of aminergic as well as histaminic, muscarinic and cholinergic CNS receptor occupancy of atypical antipsychotics with secretion levels of NPY and insulin may give an answer to which of brain receptors are responsible for this disbalance and diabetes mellitus development. We plan to compare in vitro and in vivo effects of various antipsychotic drugs ranging from drugs that are potent inducers of metabolic syndrome and diabetes like olanzapine to novel drugs like aripiprazol or drug candidate BL1020 (Bioline RX) for which there are some indication that they will not trigger diabetes or elevate cholesterol. We will try to confirm these findings in the clinical studies that we plan to conduct.

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Better understanding of the underlying mechanisms will be useful in preventing development of diabetes in schizophrenic patients treated with antipsychotics. Furthermore, it would be advantageous to spread the use of antipsychotics, especially those associated with weight gain, in the treatment of anorexia nervosa. If we clarify mechanisms responsible for efficacy of antipsychotics in the treatment of anorexia nervosa, it will support their wider and safer use for the treatment of this disease and induce discovery and development of targeted drugs.

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Project duration: 2007-2010
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PROJECT OBJECTIVE:

Prostate cancer is by incidence second most common cancer in male population of Croatia, with incidence rising over past years. Since a population is getting older, this is expected. It is expected that prostate cancer, as disease of older population, will in near future become a lead cancer of male population. Despite its high incidence, mortality rates are relatively low, only 5.8% of all cancer deaths in male (Croatia 2003) were from prostate cancer. Most of these cases are disseminated disease at diagnosis or hormone refractory prostate cancer as unique entity, for which presently adequate treatment is lacking. Etiology factors of prostate cancer are rare and not adequately investigated. Previous inflammation, chronic prostatitis and family inheritance are so far only in scientific correlation with prostate cancer. Information that inflammation can be a factor in prostate cancer development has started investigation on inflammation regulation and prostate cancer. Cytokine and Toll-like receptors are involved in earliest immunological response. Polymorphisms in genes for cytokines and Toll-like receptors have been described and such polymorphism can alter person's immunological response. Some of these polymorphisms are so far correlated with prostate cancer. In our research we speculate that presence, of yet undetermined, polymorphism of cytokine or Toll-like receptors genes is promoting factor in prostate cancer development and progression. We will determine which polymorphisms and

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will construct a map of all included in our population of subjects. We will determine is such cytokine and Toll-like receptors genes polymorphism map a population dependable and can it be used in prognostic purposes. Such knowledge can be used in clinical practice where suppression or busting of some cytokines can be associated with better control of prostate cancer. Right now first experimental researches of such compounds that block a selected cytokine are in progress.

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MECHANISM OF BIOLOGICAL ACTION OF NOVEL SMALL MOLECULES TARGETING TUMOR CELLS

PROJECT OBJECTIVE:
Cancer is the second leading cause of death in the world, with increasing incidence in many countries. High prevalence, high death rate, and ineffective therapy have spurred the search for novel strategies in the treatment of cancer. This project is aimed at elucidation of mechanism of biological action of new small organic compounds, bisamidines, mono- and bis-intercalators with covalently attached molecular tools, and modified N-sulfonyl and sulfonamido pyrimidine and purine derivatives, and C-substituted 9-deazaguanine derivatives. These compounds are designed for strong and/or selective interactions with biogenic macromolecules (DNA, RNA and/or proteins) involved in tumor and inflammatory processes. In this project, we will study the effects of novel compounds on human tumor and normal cell lines by monitoring cells’ viability, biochemical and morphological changes in the treated cells by colorimetric assays (MTT test, neutral red test, lactate dehydrogenase test), incorporation of radioactive labeled substrates assays and flow cytometry methods. In this way we will gain data about activity and selectivity of new molecules. In addition, study of compounds’ mechanism of action should disclose their dominant targets and facilitate design of novel compounds done by Program collaborating groups. To identify the molecules controlling gene expression and regulate programmed cell death - apoptosis, provoked by testing compounds in the tumor cells, we will monitor expression profiles of relevant genes involved in: apoptosis, cell metabolisms and growth, cell cycle and signal transduction pathways by cDNA microarray and quantitative real time PCR methods. The parallel line of investigation will include study of inhibitory potential of modified guanine and 9-deazaguanine derivatives on purine nucleoside phosphorylase (PNP). PNP is crucial for the integrity of the immune system and its inhibitors could represent a novel class of agents, useful for treating various autoimmune diseases and T-cell leukemias. This project will provide invaluable information about structural and biological reactivity relations, and will contribute to the development of novel molecules that could affect the viability of human tumor cells. Therefore, research proposed in this project has high potential for discovery of novel strongly bioactive lead compounds pointing toward novel antitumor and anti-inflammatory pro-drugs and/or drugs.

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LIPID RAFTS AND GLYCOCONJUGATES IN DEVELOPMENT AND REGENERATION OF CNS

PROJECT OBJECTIVE:

Cholesterol and glycolipids are the main constituents of lipid domains in cellular membranes (lipid rafts) that are involved in the formation of membrane microenvironments that modulate signaling. A significant number of cellular interactions, especially in the early stages of brain development, proceed more or less normally despite changes in these domains. This was clearly demonstrated by animal models which lack complex gangliosides, but their brain development is normal. However, postnatally they develop epileptic seizures, hyperactivity and demyelination. If both simple and complex gangliosides are deficient, there is no normal brain development and extensive neuronal damage appears. The final stage of development is the fine adjustment and maintanance of cellular connections, what requires finely tuned and constant micro-environment. Disorders of these mechanisms can clinically appear as: demyelinating diseases (Guillain-Barré, multiple sclerosis) where glycosphingolipid antibodies appear in patient's sera, degenerative diseases (Alzheimer) where cholesterol homeostatis is disturbed, or epilepsy and mental retardation if there is a disruption of glycolipid metabolism. The best example for lipid domain disruption is axonal regeneration in adult CNS which is insufficient or non-existing in evolutionally higher organisms. The purpose of this project is to determine changes of lipid domains that influence signaling in axonal growth during brain development and compare them with changes during re-growth of axons after adult central nervous system lesion. Critical molecular interactions in axonal regeneration will be modulated by changing the constitution of lipid domains with agents that influence cholesterol and glycolipid metabolism. Cellular models of neurons and oligodendrocytes of amphibians, rats and mice

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with lack of complex ganglioside synthesis will be used in our study. Mechanisms of axonal regeneration will be modulated by agents acting on lipid domains and studied in transgenic YFP (yellow fluorescent protein) mice, mice with lack of complex ganglioside synthesis or cross-breeds of these two mice. We expect to discover signal mechanisms involved in regeneration and degeneration of axons that are influenced by changes in lipid domains. This study will advance the understanding of pathogenesis of degenerative brain diseases, autoimmune demyelination disorders and mechanism of axonal regeneration in adult organisms.

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PROJECT OBJECTIVE:

The quality of presented research results is a key assumption for accurate scientific conclusions. Lack of knowledge about research methods resulting in errors in data analysis and data handling seriously compromise the quality of results. Estimated prevalence of papers with unacceptable quality of statistics over the last 15 years is about 40% to 70%. In the absence of thorough, empirical research in the field, characteristics of questionable results are insufficiently known. The objective is to investigate prevalence and characteristics of the questionable results in published research. We aim to recognize the main characteristics of the questionable results and develop a checklist for evaluation of the quality of published results. We expect to quantify the proportion of papers with the questionable results and to determine the characteristics of questionable results in the amount sufficient for the construction of the checklist. We anticipate that using the checklist will have beneficial influence on the decrease of the questionable results prevalence. The prevalence of questionable results will be investigated on the sample of original research papers submitted to the Croatian Medical Journal. The main recognized characteristics of the questionable data will be included in the new statistical review form. Difference in prevalence and characteristics of the questionable results between samples of papers reviewed with the old and the new statistical review form will be used for the estimation of the usefulness of the new form. Relevance of the proposed research. Scientific confirmation of the prevalence of questionable results is important factor in forming an action frame for measures aimed at decrease of the prevalence of papers with questionable results.

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Knowledge about characteristics of the questionable results could enable targeted adjustment of the contents of research planning and scientific writing courses. Properly composed checklist could assist authors in improving the quality of result presentation, or be of use to anyone who uses published results in their work. Knowledge about main characteristics of the quality of the presented research results along with recognition algorithm could be utilized in forming control mechanism for responsible conduct of research evaluation and control.

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BIOMECHANICAL OPTIMALISATION - SOME ACTS IN ORTHOPEDICS

PROJECT OBJECTIVE:

Two basic methods are used in arthroscopic reconstruction of the anterior cruciate ligament: reconstruction with patellar ligament and reconstruction with tendons from semitendinosus or gracilis. In professional literature opinions on transplant firmness, postoperative knee pain, knee function and extensor and flexor muscles strength are divided. Considering the significance of the patellar ligament, changes in healing process, development of local «mechanical» inflammations and intra-ligament calcification are cited. The aim of this research is to determine difference in transplant firmness in adequate laboratory conditions on a mechanical model exposed to controlled and measurable stress-strains. The results will be presented numerically. Also, advantage of a particular method will be proved, as well as its influence on late postoperative course, muscle atrophy and rehabilitation. Orthopaedists, radiologists and surgeons as well as employees of Institute for Materials and Mechanical Engineering at Faculty of Electronic Engineering will participate in this research. Laboratory studies will be carried out on anatomical specimens obtained from Institute of Anatomy collection, Faculty of Medicine in Osijek. Reproducibility of both methods will be compared by employing elaborated morphometric methods to determine muscle volume by using MR and ultrasound and possibly also Cybex II device. Morphological changes in patellar ligament will be monitored in short-term and long-term period by standard ultrasound and color Doppler. Statistically, significantly greater firmness and resistance to extension is expected with patellar ligament, which would confirm the applicability of this method in top-quality athletes and in highly active people at the age between 20 and 40.

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POSTPROCESSING OF HIGH RESOLUTION LIVER IMAGE DATA IN DETECTION OF DIFFUSE LIVER DISEASES

PROJECT OBJECTIVE:

Biopsy of liver tissue is a way of diagnosing diffuse liver diseases. However, the small tissue sample cannot be representative for the condition of the organ as a whole, especially in the early phase of the disease. High resolution CT has not been used in diffuse liver disease diagnostics, due to long-lasting data acquisition and liver movability during respiration. However, development of exceptionally fast multi-slice CT devices enables their use in this field of research. At the same time, development of modern multi-frequent ultrasound probes improves the quality of liver imaging so that image texture in both cases described can yield relevant information of liver structure on submillimeter level. The aim of the research is to find out to what extent the data obtained by HR-CT as well as by ultrasound liver image distinguish normal from changed liver structure on submillimeter level. The first part of the research will include patients with suspected diffuse liver disease (non-acute forms of hepatitis B and C, alcoholic liver diseases, steatosis) and the control group. The control group will include patients referred to CT of the abdomen due to suspected disease of other organs who do not have signs of diffuse liver disease in their medical history as well as clinical signs of the disease. The raw data of a thin CT-slice from the middle part of the liver obtained by multi-slice CT scanner for both patients and the control group will be stored and used for later analysis of density distribution. The second part of the research will include only a group of patients. Liver biopsy results and biochemical parameters, ultrasound liver images taken at 3.5 and 5 MHz, Doppler measured flow in liver artery and portal vein and sequence of HR-CT liver images during bolus contrast opacification will be collected.

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All image data will be analysed by methods that could distinguish the control group from patients: statistical tests for independent samples, histogram analysis and image texture analysis (fractal dimension etc.). ROC curve will be used to assess obtained parameters that distinguish patients from a control group. This research investigates whether and to what extent the methods of liver parenchyma imaging can assess diffuse liver diseases activity in the large part of the liver through the multitude of data obtained by noninvasive methods. This can be of great significance in the diffuse liver disease detection and treatment evaluation.

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EFFECTS OF MAJOR ABDOMINAL SURGERY ON THE SMALL INTESTINE PERFUSION

PROJECT OBJECTIVE:

During conditions of reduced heart minute volume, the perfusion of vital organs is preserved on the account of visceral organs. Small intestine ischaemia may cause translocation of bacteria and increased endotoxin release into the portal circulation which leads to inflammation, activation of leucocytes, secretion of cytokins and circulatory changes in remote organs. Malignant tumors of digestive system require longlasting surgical procedures under general anesthesia that impair circulation in intestinal wall leading to hypoperfusion and even ischaemia. The proposed project is based on assumption that the intensity of changes induced by ischaemia is related to the duration of hypoperfusion. We hope that the research results will confirm the hypothesis that longlasting open abdominal surgeries cause hypoperfusion of mesenteric circulation with consequential alteration of the small intestine mucosal integrity.

In a two-year period the research will include at least 60 adult patients without portal hypertension planned for surgery under general anesthesia due to malignant tumors of oesophagus, stomach, colon, liver or pancreas. We will try to confirm the hypothesis that longlasting surgical procedures in the abdominal region cause hypoperfusion of mesenteric circulation with consequential changes of the small intestine mucous membrane integrity. It will be done by collecting the tissue metabolism data from the mesenteric vein during the course of longlasting anesthesia while two small intestine mucosa samples will be taken at the beginning and end of procedure for possible histological changes on intestinal villi and brush-like surface. Pathohistological test results will be assessed using histological criteria.

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In case that the research confirms the hypothesis that there are significant difference in hypoxic damage of intestinal mucous membrane in the course of longlasting abdominal surgeries, further research will be required to determine the changes that should be introduced in preoperative procedures for patients expected to undergo longlasting, especially abdominal surgery. Accurate identification of patients at higher risk as well as of measures to prevent mesenteric perfusion impairment and mucous membrane integrity in small intestine will be the aim of this research.

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FUNCTIONAL MODEL OF CIRCULATION: DESIGN BASED ON ARTERIAL ELASTICITY

PROJECT OBJECTIVE:
During systole the left ventricle uses part of energy to expel blood against peripheral resistance, while the significant amount of energy is stored by expansion of elastic wall in large arteries that act as small power pump during the diastole, which maintains the arterial pressure with gradual fall to the diastolic pressure level. Diastolic pressure value depends on circulatory system repletion, peripheral resistance and duration of the diastole. Diastolic pressure in the aorta and peripheral arteries is elastic energy remained from previous cardiac cycles. The hypothesis of this project is that elasticity of large arteries facilitates tide volume flow towards periphery so that it is feasible with lower pressures in the left ventricle, than it would be if there was only systolic pump. If the energy stored in the elastic wall is decreased by atherosclerosis or some other disease, there will be increased tide volume during systole, which requires higher systolic pressure and greater exertion in the left ventricle. Basic parameters to describe elastic qualities of blood vessels can be obtained by collecting, combining and analyzing physical data on pressure and blood flow. By data processing it will be attempted to find precise and at the same time the simplest possible model of circulatory system that will include description of elastic qualities and explanation of its significance to human body functioning as a replacement of presently prevailing Windkessel model. Physical and other data will be collected on condition and changes of condition in circulatory system of large number of healthy volunteers of different sex and age. Noninvasive methods will be applied: electrocardiogram to determine cardiac cycle phases, Doppler measurements of blood flow velocity and other parameters in regional arteries and veins, infrared measurement of the flow in peripheral capillaries.

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The data will be used to define mathematical models that will be tested by collecting data for patients with arterial hypertension, nicotinism or atherosclerosis. The model that proves to be valuable will then be applied on parameters obtained by coronarography. If the developed model could assess the condition of the elastic component in circulatory system and so offer means to monitor an individual's arterial system aging or disease development, it could have far-reaching consequences for understanding of these two processes which are the main cause of death in the western civilization.

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GENE POLYMORPHISMS OF DETOXIFICATION MOLECULES IN INFLAMMATORY BOWEL DISEASE

PROJECT OBJECTIVE:

The inflammatory bowel disease (IBD): Crohn’s disease (CD) and ulcerative colitis (UC) are chronic relapsing inflammatory bowel diseases of the gastrointestinal tract. The precise etiology of the disease is unknown but an interplay of environmental risk factors and immunologic changes will trigger onset of the disease in a genetically susceptible host. The research on genetic susceptibility of IBD has been tremendous and over 10 chromosomal regions have been identified by genome wide scanning. Further fine mapping as well as candidate-gene studies have already led to the identification of a number of susceptibility genes including CARD 15, DLG5, OCTN1 and 2, NOD 1, HLA and TLR 4. One of them is caspase activating recruitment domain 15/ nucleotide oligomerisation domain 2 gene (CARD 15/ NOD) located at 16q12. Although mutations in NOD2 are observed frequently in Caucasian patients with CD, but not with UC, they have rarely been found in Japanese CD patients, suggesting that NOD2 is not a major determinant for CD in Japanese. We will focus on MDRI and CYP3A4 genes, because they are expressed in the gastrointestinal tract and play a role in biochemical barriers against internal and external xenobiotics. The aim of this study is to investigate the frequency and distribution of CYP3A4 and MDRI genes in patients with ulcerative colitis and Crohn’s disease.

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Genetic and immunological data from human studies in combination with results from animal model system are the foundation of a hypothesis, which includes a role for microbial antigen exposure in the initiation, perpetuation and amplification of the disease. In ulcerative colitis it appears as though the T-cell response to the antigens is not T helper (th) 1 dominant as in the case of Crohn’s disease but rather is either Th2(interleukin (IL)-4, IL-13 or is mediated by specialized cells such as natural killer (NK) T cells (IL-13) The second part of this project is prospective study which would examine whether systemic (plasma) and local (mucosal) cytokine production is predictor of future relapse in patients with quiescent ulcerative colitis and Crohn’s disease. The impact of other clinical and laboratory parameters on relapse will also study.

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BONE TURNOVER FEATURES IN PATIENTS WITH UROLITHIASIS

PROJECT OBJECTIVE:

Several clinical and epidemiological studies revealed increased bone turnover and lower bone mass in patients with urolithiasis. Osteopontin (OPN) is a phosphorylated protein of wide tissue distribution that is found in association with organic matrix of kidney stones. It is a strong inhibitor of crystal formation and growth in vitro, but there is still debate regarding its effects upon crystal adhesion to tubular epithelial cells. Osteopontin also influences bone turnover, both by promoting differentiation of osteoclasts and by enhancing osteoclasts activity. Recent studies discovered important role of osteoprotegerin (OPG) and RANKL (receptor activator of NF-kappaB ligand) in bone turnover process, in addition to known effect of some cytokines (such as IL-1, IL-6, TNF-alpha) on bone resorption. Aims and hypothesis: We assume to find increased production of cytokines enhancing bone resorption and therefore lower bone mass in patients with idiopathic calcium urolithiasis. The objective of the proposed research is to assess changes of cytokines involved in bone turnover and increased bone resorption, as that might play role in bone loss in recurrent calcium stone formers. Expected results: Results of proposed investigation should reveal differences in bone turnover dynamics as well as diversity in cytokines and osteopontin levels in patients with urolithiasis compared to healthy controls.

Therefore, possible effect of increased level of cytokines and osteopontin on increased bone turnover in calcium stone formers should be determined, in addition to analysis of other risk factors such as dietary calcium restriction and hypercalciuria. Relevance of the proposed research: Explore the factors that could have influenced the changes in bone density in recurrent calcium stone formers. Testing the results: Bone mass of examinees will be determined by standard diagnostic procedures (densitometry), as well as biochemical markers of bone turnover. Relative correlation between cytokines levels and increased bone turnover will be determined by using biostatistic methods.

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FREQUENCY DOMAIN HEART RATE VARIABILITY IN AUTONOMIC DISBALANCE ASSESSMENT

PROJECT OBJECTIVE:

Heart rate variability is almost established procedure among physiological methods in assessment of sympatovagal balance in healthy subjects. However, the method looks for significant modifications when used in population with expression of disease. The most significant variable – low- to high-frequency ratio from spectral heart rate variability analysis – was confirmed as an example of disproportion of this method's value in healthy subjects and in patients. Our preliminary reports show that during different pathological processes in human organism autonomic modulating activity changes frequency level. This thesis will be studied by analysis of changes in cardiological and nephrological patients’ clinical and heart rate variability status. Changes in time and frequency components of heart rate variability will be studied in four groups of patients, who experience changes in heart rate variability during the natural course of their disease.

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The significance of time changes will be analysed using t-test for dependent samples, while the spectral analysis curves, that will describe different levels of autonomic disbalance, will be defined using a particular model. This research will contribute to clinical medicine by giving a clear and non-invasive definition of autonomic disbalance and enabling of quantification of its recovery during different treatment options.

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INDIVIDUAL VARIABILITY
RESPONSE TO
ANTIPLATELET THERAPY

PROJECT OBJECTIVE:

Antiplatelet therapy, tromboxane A2 and prostacycline inhibitors (aspirin), ADP blocators (thienopyridine) and glycoprotein IIb/IIIa inhibitors decrease frequency of cardiovascular complications in patients with acute coronary syndrome and after coronary stenting, however certain amount of that events continue to occur. On healthy volunteer samples and samples from patients with coronary disease antiplatelet effect of aspirin, clopidogrel and glycoprotein IIb/IIIa inhibitors was examined and occurrence of repetitive arterial thrombosis is determined as resistance to therapy. Key question that has not been revealed in previous investigations is whether laboratory determined resistance point to clinical resistance to that therapy. Basic hypothesis of this proposal is the existence of individual variability in response to antiplatelet therapy. We assume that different causes like biovariability, interactions between drugs, baseline functions of platelets before the initiation of treatment, genetic polymorphism, interactions with other blood cells and other factors may be potential mechanisms of that resistance. The primary goal of the research is to determine "resistance" apropos individual variability in response to antiplatelet therapy and to clarify the impact of that resistance to frequency of repetitive cardiovascular complications in persons undergoing percutaneous coronary intervention. We plan to determine the relation between individual variability in response to antiplatelet therapy and genetic factors and to analyze possible role of platelet markers in prediction of new cardiac incident. We also plan to determine the relation between resistance to antiplatelet therapy and other coronary risk factors, in the first line smoking and concomitant therapy. Following the inclusion all patients will be clinically examined and samples of blood will be taken for basic laboratory and biochemical measurements, aggregometry and genetic analyze on platelet proteins, following the admission of 300 mg of clopidogrel and 300 mg of aspirin. After that patients will undergo percutaneous coronary intervention with stent implantation. After the procedure they will continue to take 75 mg of clopidogrel and 100 mg of aspirin daily through 9 months. On the fifth day following the intervention samples of blood will be taken for aggregometry. Clinical examinations will take place 28 days, 3 months and 9 months after the procedure when the occurrence of new cardiovascular events will be noticed.

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BIOMECHANICS OF HARD TISSUES

PROJECT OBJECTIVE:

This project includes two models of biomechanical studies. The first one does the research of morphometric, structural and biomechanical features of the sternum. It will be conducted in cooperation with cardiac surgeons. Median sternotomy, the main surgical intervention in cardiac surgery, is potentially hazardous procedure because of the suture dehiscence risk following the sternotomy closure. In this project we will try to confirm the hypothesis that suture dehiscence does not depend only on surgical technique, but also on biomechanical features of the sternum bony tissue, which has been insufficiently explored. The first part of the research will include osteometric measurements, radiographic examination of structure and toughness for each segment of the sternum and creation of sternum mineral density map. The second part of the research will include laboratory tests of various suture types used to close median sternotomy. The tests will be carried out on sternum specimens using the specially designed device to measure dynamic strain on the model simulating respiration. The third part of the research will include clinical tests of certain suture types advantages. The obtained data on structural and biomechanical features of the sternum will be used to optimize median sternotomy closure. The second model does the research on morphometric, structural and biomechanical features of the hyoid bone in cooperation with forensic examiners. The hyoid bone ossification level may be used in forensic medicine to determine the age of the cadaver. The hyoid bone is often fractured when strangulation, hanging by the neck or similar trauma in the neck region occurs. Forensic medicine needs to determine the size and direction of the force that caused the fracture and we will try to confirm the hypothesis that basic biomechanical studies conducted within this research will provide answers to these questions. The studies will be conducted on over 100 specimens.

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LONG-TERM HEALTH CONSEQUENCES OF WAR EVENTS IN THE POPULATION AT LARGE

PROJECT OBJECTIVE:

This project is part of the Croatian Biobank Program Resource for the Studying Health and Disease in Population. The objective of the Program is to collect a target sample of 4,500 subjects representative of the demographic-social structure of the Croatian population, and to establish population registries with some 3000 individuals suffering from various diseases of public health significance, for further analyses to investigate the major genetic and environmental determinants of these diseases. The project importance lies in offering an opportunity to develop public health service and actions in the future in order to reduce the risk of particular diseases and to improve health care of the exposed population. The primary aim of the project is to contribute to the establishment of a Biobank through collection of a target sample of 1000 subjects from the eastern part of Croatia. The specific goal of the project is to investigate long-term health effects of war in the Croatian population by use of epidemiologic-analytical and experimental approach. At the national level, the health consequences of war will be assessed by analysis of the epidemiological data available, comparing the morbidity of diseases that are presumed to be potentially caused by war actions (e.g., specific types of malignant tumors). In addition to regional comparisons, the patterns of morbidity and mortality during the prewar, war and postwar periods will be analyzed. The experimental part of the project will include collection of 12 samples of 20 subjects each, representative of various risk groups and controls. For example, the samples will include different categories of war veterans and residents from the war devastated areas. By detection of elements that are or are not specified in the By-Law on Drinking Water (particular metals, e.g., depleted uranium), the association of their presence in water with their serum, urine and hair concentrations, and their potential health effects in the population living in the study areas will be estimated. The importance of the whole program reflects in the proposed wide collaboration of a number of internationally recognized Croatian scientists on the common idea, along with pronounced multiregional and multi-institutional character of the project, and concrete and feasible objectives that will characterize the new generation of quality information highly relevant for the creation of health and science policy.

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THERMALLY TARGETED DELIVERY OF THERAPEUTICS TO SOLID TUMORS

PROJECT OBJECTIVE:

Each human cell contains number of genes, called proto-oncogenes which mutation or overexpression leads to deregulated cell signaling and uninhibited cell division, characteristic for cancer cells. Recent progress made in molecular biotechnology, especially in identifying, and characterization of normal and pathogenic genes, has led to the development of antisense therapy by antisense molecules. Antisense molecules are short sequences of DNA or RNA which binds to their target mRNA and inhibit gene expression of disease-causing proto-oncogene. Two of the major obstacle in use of antisense therapy is inefficient cellular uptake and poor targeting to diseased site. We propose to develop antisense delivery elastin like polypeptide (ELP) vehicle which is soluble at 37°C, but aggregates when temperature is raised at 41°C. Intravenously delivered ELP carrying antisense molecule will be rapidly cleared under physiological conditions but they will accumulate at targeted disease states where local heat (41-43°C) will be applied. Our genetically engineered ELP have cell membrane permeability and can introduce intracellular antisense molecules independent from specific receptor. This thermally responsive polypeptide delivery vehicle will specifically deliver antisense oligodeoxynucleotides targeted against proto-oncogenes to a tumor site and inhibit proliferation of cancer cells. Development of the proposed polypeptide-mediated therapeutic delivery system would provide an alternative means to effectively substitute or augment present therapy technologies for cancer treatment.

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POLYMORPHISMS IN GENE FOR VITAMIN D RECEPTOR IN PSORIASIS AND ATOPIC DERMATITIS

PROJECT OBJECTIVE:

Psoriasis (PV) and atopic dermatitis (AD) are chronically, inflammatory, relapsing skin diseases, characterized with multifactorial genesis, with significantly growth in population prevalence, heredity and, in spite of divergent Th-polarisations divided pattern of genetic expression at the level transcriptoma. Today, there is consensus that is in both disease multifactors inheriting with variations in the family distribution. Besides connections PV with HLA genes on chromosome 6q21, supposes that participate other genes which are not in connection with HLA system, and among them are gene for vitamin D receptor - VDR gene. In the base of AD is atopy-condition witch is connected with multiply defects of genes, and makes individual disposed to beginning for one or more atopical diseases. Active forms of vitamins D3 (1, 25 (OH2D3)) besides its classical effects are realized other biological effects including the stimulation of cellular differentiation, inhibition of proliferations and immunomodulation. These last made VDR possible candidate for therapy of PV. VDR, who mediate in most of transcriptions effects of analog vitamin D, has been characterized with numerous polymorphisms within 12q12-14 region of genome, previously repeated combined with the risk of development of PV and asthma. In spite of pathogenetic and clinic cosegregation between asthma and AD, as well as PV and atopic manifestation, there is no available data about connection between VDR polymorphism with AD. Results of numerous studies suggest the connection between loci in some chromosomes identical for PV and AD with the general effect on the skin inflammation and differentiation. How vitamin D3 functions on this level, we begin with assumption that we could be able to find possible connection with polymorphism VD receptor in both diseases. From that point the aims of study are: 1. Exploration of the structure of connection between VDR polymorphism with risk and characteristics of PV in the ethnical homogeneous sample of the adequate statistical strength; 2. Haploid-analyses of risk-defining interactions effects VDR gene polymorphisms; 3. Analyses of connections between AD and VDR gene polymorphisms. Expected results would explain the interrelationship between polymorphisms in VDR gene and with risk of inclination to the PV and AD, family distributions of disease and possible pharmacogenetic, what means that it could be use in diagnostics, therapies and preventions.

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Project duration: 2007-2010
Programme type: National
Urolithiasis is one of the leading social and economical problems of modern society. It is estimated that in developed countries, 10% of males and 4% of females between 30 and 50 years of age have urinary tract stone disease. The recurrence rate with no treatment is 75% at 15 years. Urinary supersaturation and lack of inhibitors of crystallization in urine are considered important factors in pathogenesis of urolithiasis. Hypothesis and aim: Toxic effect of calcium oxalate is caused by free radical generation inducing injury of renal cells, crystal retention and stone formation. Antioxidants inhibit lipid peroxidation and oxidative injury thus inhibiting crystal-cell interaction and decreasing number of injured renal cells in cell cultures. In patients, those same antioxidants would decrease number of apoptotic cells in urine and there would be no cellular debris for crystal nucleation. Aim of this research is to determine toxic effect of oxalate in cell cultures, and to compare intensity of antioxidative effect in Madine Darby canine kidney (MDCK) cell cultures with intensity of antioxidative effect on recurrence rate in patients with urolithiasis. Conducting experiments: We will determine toxic effect of oxalates in canine renal cell cultures and potential of antioxidants to inhibit crystal-cell interaction (vitamin E, green tea, L-arginin). Furthermore, antioxidants will be also tested on urolithiasis patients with increased number of uroepithelial cells in urine, and their urine will be compared with urines of patients that were given placebo and healthy control groups. Uroepithelial cells in urine, inhibitory potential of urine, antioxidative status and oxalate concentration in urine will be followed in this research.

Expected results: Oxalate toxicity on renal epithelia is time and dose dependant. Adding antioxidants in renal cell culture with the presence of calcium oxalate, renal cell injury and apoptosis will be decreased. Effect intensity of antioxidants in cell cultures will be same as in patients. Antioxidants will decrease number of uroepithelial cells, enhance antioxidative status and decrease oxalate concentration in urolithiasis patients.

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Project duration: 2007-2010
Programme type: National
COMMON PATHWAYS FOR MICROCIRCULATORY DYSFUNCTION IN DIABETES MELLITUS AND HYPERTENSION

PROJECT OBJECTIVE:

Adequate peripheral tissue perfusion primarily depends on ability of resistant blood vessels to change their diameter in response to various vasodilator and vasoconstrictor stimuli and intraluminal pressure. Changes in vascular reactivity could be the risk factors for development of microangiopathy, impaired regulation of blood flow in peripheral tissues and development of tissue hypoxia and ischemia. Incidence of stroke and other cerebrovascular and cardiovascular diseases is higher in diabetic and hypertensive patients that in healthy population and could be a consequence of impaired function of microcirculation. Oxygen is crucial in the regulation of the local blood flow and tissue perfusion by affecting mechanisms involved in the regulation of the vascular tone, such as production of vasoactive metabolites of arachidonic acid, NO and by production of reactive oxygen species (ROS). Both diabetes and hypertension are conditions of high oxidative stress. In hypertension, intraluminal pressure is substantially increased, and leads to increase in ROS production. Alteration in expression of various enzymes (such as COX-2 and eNOS, NADPH oxidases), ROS, TNFα and other cytokines could possibly affect vascular structure and function. The underlying mechanisms of vascular dysfunction common to diabetes and hypertension are not completely understood, and are the focus of this proposed project.

The general goal of this project is to elucidate underlying mechanisms of vascular dysfunction and changes in blood vessel structure common to diabetes and hypertension in two animal models, streptozocin-induced diabetic rats and aortic-banding model in rats. This project will test hypothesis that ROS are in the common pathway of normal and impaired vascular control mechanisms of resistant vessels in response to vasodilator and vasoconstrictor stimuli. Additionally, ROS could affect cerebral blood flow regulation by affecting enzymes in various pathways mediating vascular reactivity. These collaborative studies will advance our knowledge regarding the early changes in microvessels in diabetes and hypertension and will provide information that can be used to explore new therapeutic options to prevent or reduce the development of microvascular dysfunction and remodeling in these two diseases.

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Project duration: 2007-2010
Programme type: Bilateral Croatian-Hungarian project
GENOME WIDE SEARCH LEADING TO PRETERM BIRTH IN VISEGRAD FOUR AND NEIGHBORING COUNTRIES

PROJECT OBJECTIVE:

Spontaneous preterm birth and low birth weight complications ~ 10% of pregnancies around the globe and is the leading cause of perinatal morbidity and mortality. This study will examine genetic variations – polymorphisms – that are associated with preterm birth (PTB) and low birth weight in Polish pregnant subjects. Specifically we will examine maternal and fetal single and multi locus associations, gene-gene interactions and gene-environmental interactions that may predispose to PTB and LBW.

Preterm birth (PTB) is a major determinant of infant morbidity and mortality that has been increasing in recent years. Worldwide there are approximately 13 million preterm deliveries per year, representing a major obstetrical challenge. The frequency of PTB ranges from approximately 5-10% in developed nations, but can be as high as 40% in some developing nations.(1-5) The vast majority of perinatal mortality occurs in infants born preterm with low birth weight (LBW). In addition, the risk of sepsis, necrotizing enterocolitis, periventricular hemorrhage, periventricular white matter injury and cerebral palsy is higher in preterm neonates than in full term neonates. Recent estimate by World Health Organization revealed PTB rate of ~7% in the eastern European Countries and 7.5% in Poland. Unfortunately the rate is on the rise in the past decade that warrants attention.

The implications of PTB are clearly more widespread than we know at present, making unraveling its etiology critical for improving the health status of children and adults worldwide. The problem in doing this stems from the observation that half of all preterm births occur in women with no known clinical risk factors. Traditional methods of predicting women at risk for PTB such as obstetric history, tocodynamometry, biochemical markers, and ultrasonography of the cervix have not decreased the incidence of PTB. Nor have current methods that include sonographic registration of the cervical length or biomarkers (e.g., human chorionic gonadotropin (hCG), fetal fibronectin (fFN), estrogens and cytokines). Defining risk factors prior to presentation has not been successful, using traditional criteria, making an alternative approach essential. The failure to predict PTB with any degree of certainty and the increasing rate of PTB in the developed countries reflects the poor state of knowledge about the pathophysiology of PTB. It has been suggested that, as long as the basis of preterm birth is unknown, PTB will increase. Menon et al has recently the etiologic and pathophysiologic heterogeneities further complicated understanding of preterm birth.

Tremendous knowledge has been gained in the past decade regarding various etiological factors, pathophysiologic pathways, genetic and bio-markers associated with PTB. Nonetheless, the knowledge gained has not been translated into effective screening and intervention, reflected in the non-decreasing rate of PTB and the dramatic ethnic disparity observed in PTB. This failure can be partly attributed to the fact that our current understanding of PTB – the causes, screen factors (clinical and biomarkers) – are inadequate. An alternate to clinical and biomarkers is to screen women early on during pregnancy or prior to pregnancy for genetic markers that are static markers. Understanding the variations in the genome and their association with PTB is expected to provide an early screening strategy that can be used for categorization of high risk subjects who can be monitored and intervened appropriately before the incidence occur. This early screening approach is expected to reduce the incidence of PTB

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Project duration: 2009-2010
Programme type: Standard Grant
RESEARCH NETWORK FOR WOMEN'S HEALTH AND CARDIOVASCULAR DISEASES IN THE VISEGRAD FOUR COUNTRIES

PROJECT OBJECTIVE:

Although there is variation in the distribution of lifestyle factors between the genders, they do not fully explain the differences in CVD incidence and suggest the existence of gender-specific genetic risk factors. The goal of this collaboration is to identify geographical variation and gender differences in genetic risk profiles for cardiovascular disease, and treatment outcomes.

1. Investigate geographical variation (USA and Europe) of gender differences in CVD prevalence and outcomes.

2. Identify geographical variation (USA and Europe) of gender differences in CVD diagnosis and management, including cardiac medications.

3. Investigate geographical variation (USA and Europe) of gender differences in percutaneous coronary interventions (with and without stent insertions).

4. Study the genetic risk profiles of cardiovascular disease (CVD) differ between the genders.) CLARIFY or SPECIFY

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Funding scheme: VISEGRAD FUND
Project duration: 2009-2010
Programme type: Standard grant
STANDARDIZATION IN TEACHING OF MEDICINE

PROJECT OBJECTIVE:

To bring standardisation and quality assurance to teaching of medical subjects and to introduce new content of studies (economics and management in health care) important for the health care market, through the use of new information technology, and by developing learning facilities and services necessary for building virtual and real life network connection, thus significantly influencing higher education reform strategy and strongly enhancing reform capacities at national level.

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Funding scheme: EC
Project duration: 2006-2007
Programme type: Tempus
BRIDGES IN LIFE SCIENCES
V4 REGIONAL NETWORKING
AND EXCHANGE FOR EU AND
NIH FUNDED RESEARCH
PROJECTS

PROJECT OBJECTIVE:
The RNM will bring together the best scientists funded by NIH, will encourage CEE scientists to participate in the calls of the FP7 Program which is necessary since they receive less scientific grant support from the EU than the contribution of the Central and Eastern European EU Member States to EU Research and Development budget.

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The EU as well as the NIH may wish to consider the outcomes and recommendations from the meeting when developing a strategy or a model to stimulate EU/NIH supported collaboration in the CEE region.

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Funding scheme: VISEGRAD FUND
Project duration: 2009 -
Programme type: Standard Grant
CAPACITY BUILDING IN TECHNOLOGY TRANSFER INSTITUTIONS IN ORDER TO ENHANCE RESEARCH COMMERCIALIZATION ACTIVITIES

PROJECT OBJECTIVE:

Main goal of this project is to strengthen cooperation between science and industry and foster commercialization of the research. Also this project aims to support emerging technology transfer activities across Croatia by providing assistance to the process of Continuing Professional Development (CPD) for Transfer of Technology Professionals (TTP) from University affiliated organizations who are developing a career in the technology transfer area.

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Continuing Professional Development (CPD) for Transfer of Technology Professionals (TTP) from University affiliated organizations who are developing a career in the technology transfer area.

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Funding scheme: EC
Project duration: 2008-2009
Programme type: PHARE
THE EFFECT OF NOVEL SMALL MOLECULES WITH POTENTIAL ANTI TUMOR AND ANTI INFLAMMATORY EFFECTS

PROJECT OBJECTIVE:

Project follows up 2 lines of investigation:

1) Assessing the mechanism of action for novel synthesized substances with antitumor effect;

2) Elucidating the role of TFF peptides; small peptides with protective abilities found in epithelia of the digestive tract.

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Project duration: 2007-2008
Programme type: Bilateral Croatian-German exchange project
EVALUATION OF LIBRARY AND INFORMATION SERVICES: PUBLIC AND ACADEMIC LIBRARIES

PROJECT OBJECTIVE:

All public services (including libraries) are in the new electronic environment subjected to market rules as well as the competition. Therefore it is necessary to redefine their activities and raise the service quality. Accountability based on the continuous evaluation of the organization performance turns out to be one of the significant factors for modern library performance.

Project's objectives are to:
- look into the views, preparedness and ability of Croatian public and academic library staff to measure their library's performance;
- single out dimensions of their effectiveness;
- identify measures of quality for public and academic libraries.
- determine the state-of-the-art of Croatian academic and public libraries. This data will be collected through questionnaire and analysis of library documentation (annual reports, statistical reports, etc.)

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- provide insight into views, opinions, preparedness, experience and eagerness of Croatian public and academic library staff to conduct evaluation activities in their libraries. This information will be gathered by questionnaire and through interviews with chief librarians/library directors.
- identify dimensions of effectiveness of academic and public libraries on the basis of the data collected through this project. It is our position that the sample (all Croatian public and academic libraries) will be big enough to come up with dimensions of effectiveness of those two types of libraries that are this project's object of research.
- raise the level of awareness of library staff that evaluation of library activities is as necessary and unavoidable as welcome and that the desired end-result is the higher quality of library services and user satisfaction.

Since so far in Croatia there has not been a single research of this scope among public and academic libraries, we hope that this project will come up with valuable information on present time state-of-the-art in those types of libraries, and manual on evaluation will hopefully contribute significantly to the begin of library commitment to raising the level of their service quality.

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Project duration: 2007-2010
Programme type: National
PROJECT OBJECTIVE:

Less than thirty years after Gutenberg's epochal discovery of the printing press, the cultural milieu in Croatia was able to successfully face the challenge of the new media. This was the Glagolitic milieu that had just reached the zenith of its five-century-long development. On February 22, 1483, the printing of the first Croatian book was completed – The missal according to the law of the Roman court, which was at the same time the first printed book in the Slav South. In addition to the missals, (the language of the printed Croatian Glagolitic missals is being researched in another project within the framework of the same research program) the most necessary books for the priests were the breviaries so that soon they were printed. Of the three printed Croatian Glagolitic breviaries, two are counted among incunabulums, and the third, the so-called Brozic breviary, printed in 1561. The first print of the Croatian Glagolitic breviaries was completed in 1491 and together with the Baromic breviary it enhances the early beginnings of Croatian and European printing.

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Thus, by printing their own liturgical books in their own Glagolitic script and the language of the Church-Slavonic liturgy of the Croatian editorial board, the Glagolitic clergy once again attested to their independence and inheritance of tradition on the one hand, and on the other, to their openness towards the positive influence of the European culture and civilization.

Previous research on the language of the breviary texts have shown that this deals with the Croatian Church-Slavonic language with a very archaic morphology, as well as with numerous newer characteristics at all language levels. Hypothesis: Newer language characteristics did not penetrate into liturgical texts equally as into non-liturgical, and there was a difference in intensity and type of innovation among individual liturgical books as well. It is expected that the results of the research will point out the direction in which the process of rejuvenescence of the traditional Church-Slavonic language as well as the difference in the intensity of the rejuvenescence, that is the Croatization of the language in particular codices. This could be very useful in shedding light on the problem of text ubification, and will also contribute to reveal the manuscript pattern/patterns which served for the printing of breviaries.

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Project duration: 2006-2011
Programme type: National
DIGITAL LIBRARY OF CROATIAN PRINTED HERITAGE (BY 1800):
STRUCTURAL PREMISES

PROJECT OBJECTIVE:

Project's main goal is presentation of books printed in Croatian by 1800, which would help to researchers and students to access them in a convenient way. Though number of the reprints of works printed by 1800 have been published, Croatia has no book series in which preserved printed heritage is systematically (chronologically, thematically) published in its original form. That resulted in marginalization of authors whose works were found to be aesthetically inconsequential, but also in the slow development of book history as a modern interdisciplinary science which includes reconstruction of the whole process of book production. New comprehensions on the possibilities of digitalization of printed books and common trend of heritage digitalization contribute to the creation of virtual library of Croatian printed books which will provide researchers with many advantages in comparison to classical reprints. It would enable fast insight to the work's content, and make possible to search more works by different criteria: e.g. author, sponsor, censor, printer, dialect, year and town of publishing, cost of publishing (if stated), theme, category of the work, etc.

What is most important, such library will also enable searching by key words meaning that researchers can review all works that, for instance, mention the question of Croatian dialect partition. Project's second goal is to follow the initiative of heritage digitalization initiated by the European Commission document “i2010: digital libraries” (published on September the 30th 2005). Stated document was preceded by the initiative of the European Commission president Jose Emanuel Barosso to create European virtual library that would enable users to access European cultural heritage. Initiative resulted in creating a project “i2010: digital libraries”.

Project concords with the basic principles of information society development presented in the project Strategy of the development of the Republic of Croatia “Croatia in the 21st century”. This project also encourages planning and realization of virtual library which will make using different information resources in digital surrounding easier. Such library will contribute to further development of information society and that will put the Republic of Croatia in the centre of the most contemporary European tendencies.

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Project duration: 2007-2010
Programme type: National
BOOK HERITAGE IN CROATIAN LIBRARIES: CHALLENGE OF RESEARCH AND INTERPRETATIONS

PROJECT OBJECTIVE:

History of Croatian libraries and its book heritage has still been insufficiently explored. Archival sources on librarians and all those that greatly contributed to development of library and information sciences in the 20th century still have been waiting for thorough and serious research. These facts have generated the crucial need for comprehensive and multidisciplinary research of the issue. Generally, the project objective is to collect all necessary sources relating to Croatian library and book heritage and put them in the overall Croatian/European historical, political, economic and cultural context. Only then library and book heritage can be correctly used and interpreted. Importance of this aim seems to be even more important in the digital world that has been recently developing.

The project is a part of a wider long-term programme of organization, interpretation and preservation of Croatian book heritage. Its direct objectives are as follows: research on history of Croatian libraries, both private and public, and their library collections, on biographies of the most distinguished Croatian librarians, on classification systems used in University Library in Zagreb (nowadays National and University Library), etc.

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The purpose of such an extensive research is to make some general as well as specific conclusions on cultural, educational and other links between the members of Croatian intelligentsia in the 19th and 20th centuries. Last but not least, the project will explore development, influences and connections between Croatian and other European libraries in the course of the 19th and 20th century.

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Project duration: 2006-2010
Programme type: National
COGNITIVE LINGUISTIC APPROACH TO POLYSEMY IN CROATIAN AND OTHER LANGUAGES

PROJECT OBJECTIVE:

The general goal of the proposed investigation into polysemous structures is a detailed account of cognitive and other mechanisms that lead to polysemy and functional effects attaching to polysemy in the process of communication. The starting point of the present research proposal are some widely accepted insights and answers to fundamental questions concerning polysemy that have been proposed within various theoretical frameworks, from structural to cognitive-linguistic approaches, and proceed towards providing answers to more specific questions that have far-reaching ramifications, both of theoretical and practical-descriptive nature. These questions can be grouped under three general headings concerning: the rise of polysemy (what is the role of metaphor, metonymy and other cognitive mechanisms?), 2. its instantiation in language systems (How do regular polysemy and metonymy on the one hand and ad-hoc polysemy and metaphor on the other relate? How present is polysemy in grammatical systems? Is the situation in Croatian the same as in other languages (Slavic, Germanic, Romance and Finno-Ugric?). 3. the limits of its functionality in linguistic systems in communication (Where are the limits of tolerance of polysemy as a phenomenon that leads to maximizing economy in the system, which is offset by increased processing effort?).

The phenomenon of polysemy will be approached as an essential parameter in establishing a semantic-typological characterization of Croatian and other languages. The results of the research project will have several levels of application: 1. Theoretical insights can, after their appraisal from the point of view of language teaching methodology, be incorporated into grammatical and lexicographical/lexicological descriptions of the languages involved, but may also serve as input for comprehensive cognitive linguistic accounts of these languages. 2. in designing the format of a module for the lexicographic presentation of polysemy 3. as input in optimizing the existing and planning new methods of language instruction and the design of language instruction materials, both in the context of teaching a mother tongue or a foreign language. 4. in automatic/machine translation, automatic sense recognition, 5. in training interpreters and translators.

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The phenomenon of polysemy will be approached as an essential parameter in establishing a semantic-typological characterization of Croatian and other languages. The results of the research project will have several levels of application: 1. Theoretical insights can, after their appraisal from the point of view of language teaching methodology, be incorporated into grammatical and lexicographical/lexicological descriptions of the languages involved, but may also serve as input for comprehensive cognitive linguistic accounts of these languages. 2. in designing the format of a module for the lexicographic presentation of polysemy 3. as input in optimizing the existing and planning new methods of language instruction and the design of language instruction materials, both in the context of teaching a mother tongue or a foreign language. 4. in automatic/machine translation, automatic sense recognition, 5. in training interpreters and translators.

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Project duration: 2007-2010
Programme type: National
PROJECT OBJECTIVE:

Literary-historical review of Croatian 18th century literature shows that it is mostly considered through several important integral parts: the intertwinement of the aesthetic and pragmatic functions of the text is intensified, literary historians speak about educators and poets; drama and theater life in Dubrovnik are fading away and school drama appears in northern Croatia; the work on lexicography enjoys interest. Primary genres include: epics (popularly-enlightening, historical, religious, humorously-comical), poetry of enlightening and occasional character, and drama (drama in French and Italian fashion and national drama in Dubrovnik, as well as scholastic Jesuit drama in northern Croatia). This period of marked stylistic pluralism comprises: enlightenment, rationalism, baroque, rococo, neoclassicism, pre-romantic movements, all of which only points at the diversity of the foundations of our literature in particular cultural environments. Project aims is to direct attention to secondary, marginal genres of Croatian 18th century literature, such as: sermons, prayer books, catechisms, books of lections, books of gospels, biographies of saints, separate song books or songs collections in combination with prayer-book, catechism, or some other content. Hypothesis: religious literature also contains parts that prove their literary-aesthetic refinement, and that, as such, actively participate in the creation of the Croatian national literary history.

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Expected results: the research should show that Croatian 18th century literature does not only contain sporadic examples of the prose of that period, but that it is precisely this genre gap that is filled with valuable prosaic segments from the religious literary works. Methods of result verification: on the basis of the collected data bibliographies would be created of those marginal genres that still have no bibliography (e.g. sermons), and the existing bibliographies would be updated. The bibliography would be accompanied with the publication of the selected most valuable fragments. These would be compared with data offered by the histories of older Croatian literature and other literature dealing with this subject matter. Importance of the proposed research: targeted topics and motifs oriented reading (directed at everyday life, woman, man, plant, animal...) of marginal genres of Croatian 18th century literature would break the silence about suppressed materials, vast in number, structured in prose form. We would begin talking about culture, which, as a pattern of living, is a crucial constituent part of the identity of man in a particular space and time.

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Project duration: 2007-2010
Programme type: National
PROJECT OBJECTIVE:

The general aim of the research is to investigate and describe the language of the periodicals in the border regions of Croatia in a time-span comprising three centuries: the second half of the 19th, the 20th and early 21st centuries. The research is directed at achieving the following specific goals: 1. description of the language peculiarities of magazines and newspapers in Slavonia and Syrmia from the late 19th and early 20th centuries and their comparison with the then language characteristics of the periodicals in other Croatian border regions and with the language standard in normative manuals of that time; 2. grouping language characteristics according to the functional styles they belong to: non-fictional (journalist), administrative and literary-artistic; 3. – in particular, description of the influence of the conversational style in comments, advertisements and in ephemeral materials (invitations, programs, etc.). The achieving of the above goals requires the description of particular language phenomena, e.g. nominalization, decomposition of predicates, the making of a list of the so-called secondary prepositions, i.e. common prepositional expressions; frequent phrases in particular newspapers, etc. One of the aims is also to compare the lists of such expressions in the periodicals of the 19th and early 20th centuries with those in the present day periodicals.

The final aim also includes the following: 1.- observing the direction of development of the singled-out morphological and syntactic characteristics and implying the further course of development, especially of the grammaticalized parts of speech;

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2.- comparing the frequency of appearance of some lexical units, concluding which words have crossed from active into the passive lexis and checking whether there are any opposite examples; 3.- grouping foreign words in the language of present day newspapers; 4.- listing and classifying phrases and idioms in the administrative and non-fictional style.

The research sets out from several assumptions: 1. that language characteristics of different functional styles (non-fictional, literary-artistic, administrative and conversational) can be found and described in the language of the periodicals; 2. that contemporary morphological, syntactic and lexical characteristics of newspapers and magazines differ from those of the second half of the 19th, early 20th and late 20th century; 3. that the language of local/regional periodicals (of Osijek, Ilok and Našice) shows some characteristics that are different in different localities (e.g. Osijek / Ilok), and that also depart from the standard language of a specific period; 4.- that in the language of periodicals the same language phenomena are confirmed, but on different examples (grammaticalization and appearance of prepositional phrases in the role of actual prepositions, nominalization,…); 5.- that already the magazines of the second half of the 19th century were economically oriented towards the reader, which is confirmed by advertisements and ads; 6.- that in some syntactic and lexical characteristics the language of advertisements and ads from the end of the 19th century coincides with the language of contemporary advertisements, while in some other (morphosyntactic) characteristics it differs from the contemporary language.

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Project duration: 2007-2009
Programme type: National
PROJECT OBJECTIVE:

This interdisciplinary research project investigates historical, linguistic, literary and religious centuries-old impulses between Croatian and Montenegrin-Mediterranean cultural circle (Boka Kotorska). Their abundance is continuously evident:

1. By the mid-9th Ct. the Duklja/Zeta coastal area is Christianised and Latinised by Catholic priests, and a rich medieval literature develops;
2. Venetian cultural influence (the Crnojevic and the Senj Glagolitic print houses, Humanism and Renaissance works);
4. Literary contacts of firm modernist avant-garde sensibility develop in the Yugoslav community: T. Ujevic (beneficiary of Montenegrin Government scholarship in Paris, issued in 1933 a poem collection “Car on the promenade” in Nikšić); two dissidents, S. M. Stedimlija and S. Drljević active in Zagreb; M. Krleža’s work (especially drama) well received in Montenegro; D. Cesarić, D. Tadijanović, G. Krklec and J. Kaštelan establish ideological and literary ties with Montenegrin poets: M. Banjević (professor in Gospić), R. Zogović, Lopićić brothers (N. Lopićić, professor in Split, published the novel “Don’t touch the palm”), B. Milačić (literary historian and critic in Zagreb, published several books on Croatian and Montenegrin literature); end of 70s of the 20th Ct. Ivan Meštrović, great admirer of Njegoš, builds the Njegoš Mausoleum on the Lovćen Mountain;
5. The new Croatian state; Montenegrin enclave in Peroj, Istria, was the subject of numerous scientific studies by both Croatian and Montenegrin philologists in the “Cultures in Contact” project; the homeland war reflected in the poetry of J. Brković and V. Nikolić, M Kovač’s prose, in essays by M. Nikčević, V. Koprivica, Dz. Sabljaković and E. Fišer, in the art works by D. Popović, V. Stanić and M. Pavlović, and in the films by K. Papić and V. Bulajić. Montenegrin Postmodernism is present in Croatia as well.

The main postulate of the project is to point out, in an interdisciplinary and comparative context, the centuries-old identities of numerous leading names of Croatian and Montenegrin culture. For example: Ideologically-cultural position of P.P. Njegoš towards baron Jelačić and political events in 1848, his relation and attitude towards the entire Illyrian Movement: towards Lj. Gaj and other leaders like I. Mažuranić, S. Vraz, M. Pucić, etc. The subject of research will be the relationship between B. Bogišić, V. Bukovac and many others writers and cultural experts that lived and worked in Montenegrin and Croatian cultural context.

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Project duration: 2007-2010
Programme type: National
CULTURE AND IDENTITY IN SLAVONIAN LITERATURE DOCUMENTARISM

PROJECT OBJECTIVE:

Research project by Ministry of Science, Technology and Sports of the Republic of Croatia *Culture and identity in Slavonian literature documentarism*, No. 122-0000000-3379 has been active since March 1, 2008. Research tied with the project is directed to cataloging material of unpublished manuscripts (journals, letters, memoirs, autobiographies) of Slavonian authors, which are found in the Museum of Slavonia in Osijek, Historical Archives of the City of Požega, Museum of the City Nasice as well in the Croatian State Archives in Slavonski Brod. Associates working on the project are looking thorough private documents and handwritten legacy of Croatian authors from Slavonia, bibliographically describing and systemizing the material. Manuscripts are being prepared for publication and in the same time a connection between literature from the theory of literature is being searched to establish a methodology in new analyses of known and less-known authors and their work. The intention is to show the congenial spirit of time from one era recognized in manuscripts from legacy and private documents with situation in Croatian and European context which implies the historical continuity of Croatian literacy. In this way, a space for analytical research of intercultural and multicultural impact in the global field of literature communications is being opened and with the experience of recognizing Croatian identity in the area inter-cultural communication a contribution to clearly cognition of impact from literature of eastern part of Croatian with Middle European circle and area of other near by countries and cultural complexes.

FACULTY OF PHILOSOPHY

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Project duration: 2008-2011
Programme type: National
CONNECTIONS BETWEEN THE CITIZENS OF DUBROVNIK AND SOUTH EAST EUROPE IN THE MIDDLE AGES

PROJECT OBJECTIVE:

The project has a historical and a multidisciplinary character. Its focal point is Dubrovnik, as the driving force of economic, social and cultural changes in south-east European countries. Dubrovnik itself depended in its development on the number of coal mines and markets in the hinterland, as well as in other south-east European countries. Gold, silver and lead mines, as well as other ore types were in great demand in Western Europe. Mines and markets in the hinterland were connected by caravan transport with Dubrovnik.

The project investigates all segments of economic and social development in south-east Europe. Dubrovnik was linked with the Balkans with road corridors. Dubrovnik and its hinterland were linked with road sea routes used for the transport of goods and people. The most intensive links were established in the 14th and 15th centuries.

FACULTY OF PHILOSOPHY

The project will cover the relations between Dubrovnik and the south-east European countries (Bosnia, Slavonia, Serbia, Hungary, Kosovo, and Macedonia) in its entirety, starting with the first contacts that by 1358 were mostly trade-related, to the time of the Turkish rule, when those contacts were significantly reduced.

We will also focus on the material culture, even though it is primarily the field of interest of art historians, ethnologists or literary historians. The historical resources of Dubrovnik’s Archives have an international character and they should be collected, systematically analyzed and presented.

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BIOETHICS AND THE PHILOSOPHY OF HISTORY

PROJECT OBJECTIVE:

The modern world that is determined by the faith in the mind and progress and emancipation, and it is fundamentally equivalent to the scientific and technological era in the world history, which is near its end. The end of the era, its finalization, is evident from the more recent historical situation in which the presuppositions it was based on were brought to extremes (mastering the nature based on the understanding of knowledge as power). After men have found themselves in a situation where they can in the constitutional sense change not only nature, but their own nature as well, it has become evident that this should also result in the redefinition of the notion of responsibility, which should encompass life in its entirety (biocentric rather than anthropocentric responsibility). The research should show the philosophical origin of science and technology, and the links between the philosophy of history and the postulates of the new age philosophy, as well as unsustainability of the definite interpretation of the world history.

This should open up new venues for other approaches and perspectives and result in a pluriperspective issue such as bioethics. From this pluriperspective we should articulate the contemporary problems of the world and historical break-down at the end of an era, and stress the philosophical and historical perspective as the basis for an orientation framework that would fit the new situation.

This task on the one hand calls for the analysis of the presuppositions for the growth of scientific and technical civilization (from F. Bacon to modern scientism), and on the other hand the introduction of those thinkers who critically examined and challenged those presuppositions.

For example, from Vic who thought that the limited power of creation legitimizes the limitations of knowledge, to Nietzsche’s views on perspectivism and holistic criticisms of modernism, and contemporary authors who write as a result of experience of facing the possibility of a global catastrophe. The research should contribute to an understanding of the new ear, and point to the possible global landmarks in the new historical situation. Furthermore, the research aims to create the philosophical and historical perspective within the bioethical methodical pluriperspectivism.

FACULTY OF PHILOSOPHY

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SLAVONIAN DIALECT

PROJECT OBJECTIVE:

Slavonian dialect is one of the stokavian Croatian dialects. It is spoken in the Slavonian Sava region, Slavonian Drava region, Croatian Danube region, and in some areas outside Croatian state borders, i.e. in Bosnia and Herzegovina around Orašje, in the western part of Bačka in the Danube region, and in some Hungarian settlements near the Drava river. The Slavonian dialect has become the focus of attention in recent times, however, there are still many issues that need to be investigated and examined in more detail.

The aim of the project is to describe the contemporary regional speeches of the Slavonian dialect, especially those that have not been the object of research in recent times (some speeches of the Požega, Slavonski Brod and the Slavonian Drava regions…). All the speeches will be audio recorded, which allows for subsequent reviews if necessary.

The speeches in the Slavonian Sava region were most exhaustively described in Stjepan Ivišić’s paper Današnji posavski govor (The contemporary speech in the Sava region) in 1913. Since then, most Croatian speeches, including the ones from the Sava region, have undergone many changes. This project aims to investigate the Slavonian dialect holistically, and record the contemporary situation of the Sava region speeches.

In most of those speeches the accent has been preserved, especially the fifth Croatian accent akut, and the lexis has undergone most changes, as could be expected.

The speeches of the Slavonian dialect are the most archaic of all Croatian stokavian speeches, so their description is of great importance for the Croatian dialectology. This work should not be delayed as dialects change and disappear. The archaic features of the Slavonian dialect help us reconstruct the development of the Croatian stokavian.

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Programme type: National
WATER PROTECTION OF THE KOPAČKI RIT – INTERACTION OF THE DANUBE AND THE FLOODPLAIN

PROJECT OBJECTIVE:

Natural floodplains, as one of the biologically most productive and rich in species ecosystems are still not enough investigated, although their intensive researches began after the publication of “flood pulse concept” (Junk et al., 1989). The stress in the current researches lies in determination of interactions of hydrological and ecological river processes and of its floodplains as the integral components of a dynamic system. It is supposed that the water localities in the floodplain depend to a great extent on the run off of the organic matter from the land during high water levels, so development of biota depend on the connectivity level of river and the floodplain. Also, in these kinds of conditions the structure of biotic communities changes according to the flooding and the drainage period. The aim of the suggested research is to determine the dynamics of the biocenosis development in the Kopački Rit floodplain and the Danube, as well as their connection to complex hydrological cycle of limnophase and potamophase. For that purpose the following parameters will be determined: the basic abiotic properties of the floodplain and the Danube biotop during limnophase and potamophase, the horizontal distribution of phytoplankton and bacterioplankton, temporal successions of phytoplankton functional groups, as well as the influence of the flood-caused disturbances on the establishment of the relatively stationary condition of phytoplankton; the role and importance of periphyton on artificial and natural substrates as one of the most sensitive indicators of the eutrophication process, the development of periphyton with regards to the flooding and drainage dynamics. The research of the fauna of the sediment and periphyton in the littoral zone of Lake Sakadaš and the Čonakut Channel with regards to their functional role as consumers controlling the periphyton biomass will be expanded. On the basis of the gained results the trophic state of the Danube and the flood plain in the conditions of potamophase and limnophase will be determined according to the abiotic factors and biological indicators. The understanding of ecological interactions between the floodplain and the Danube will be used in defining the measures of protection, with an emphasis on the water eutrophication and biological diversity protection.

Danube biotop during limnophase and potamophase, the horizontal distribution of phytoplankton and bacterioplankton, temporal successions of phytoplankton functional groups, as well as the influence of the flood-caused disturbances on the establishment of the relatively stationary condition of phytoplankton; the role and importance of periphyton on artificial and natural substrates as one of the most sensitive indicators of the eutrophication process, the development of periphyton with regards to the flooding and drainage dynamics. The research of the fauna of the sediment and periphyton in the littoral zone of Lake Sakadaš and the Čonakut Channel with regards to their functional role as consumers controlling the periphyton biomass will be expanded. On the basis of the gained results the trophic state of the Danube and the flood plain in the conditions of potamophase and limnophase will be determined according to the abiotic factors and biological indicators. The understanding of ecological interactions between the floodplain and the Danube will be used in defining the measures of protection, with an emphasis on the water eutrophication and biological diversity protection.

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Project duration: 2006-2009
Programme type: National
INTERACTION OF THE FUNCTIONAL FOOD INGREDIENTS WITH QUALITY

PROJECT OBJECTIVE:

Functionality is a leading trend in food production. Various additives, which can interact with other ingredients, are supplemented in order to achieve or enhance food functionality. The consequences of these interactions can have a significant influence on quality and health soundness of food products, as well as on needs of technological procedures used in production. The aim of this project is to establish the most important interactions between the functional ingredients in functional food made of cereals with ingredients that are commonly found in food products, and to determine and/or predict their influence on the quality of food products. For certain interactions measurable endpoints, which can be used in monitoring and quality control on different levels of production and processing of raw materials and on the level of final consumption, will be determined. The interaction characterization will be conducted with up to date laboratory methods, and quantification and prediction of results with classical (isobolograms, multivariate analysis) and modern statistical methods (fuzzy-analysis).

DEPARTMENT OF BIOLOGY

The targeted interactions of this project will be inhibitions and interactions of enzymes and/or enzymatic systems important for the quality and technological procedure of processing, synergistic/antagonistic interactions with potentially harmful ingredients, and influence on oxidative status. Special attention will be aimed on the ingredients such as tocoferol, inulin, beta-glucan, oligofructose and lysine in cereal and wheat products, as well as on the interactions with antioxidative enzymatic systems (SOD, POX, CAT, APX, MDHAR, DHAR, GR) and enzymatic systems which are important factors of technological processes (alpha amylase, diastase).

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Project duration: 2008–2011
Programme type: National
NUTRIENTS AND DEVELOPMENT OF FLOATING MACROPHYTES AND ALGAE IN EASTERN CROATIA

PROJECT OBJECTIVE:

Connecting the ecological and physiological parameters in situ and laboratory experiments gives a precise assessment of the effect of nutrients and pollutants on the development of floating macrophyte vegetation of freshwater ecosystems. The aims of our investigations are: 1) to determine composition, abundance and growth dynamics and changes of photosynthetic pigments of floating plants in wetland area; 2) to determine the nutrient concentrations in plants, sediment and water in situ; 3) to determine the effect of elevated concentrations of nutrients and toxic compounds on photosynthetic pigments and the activity of antioxidative enzymes, of selected free-floating macrophytes in laboratory conditions as well as on the growth of C. kessleri and R. subcapitata in bioassay. Elevated nutrient concentrations and pollutants will modify the activity of antioxidative enzymes and photosynthetic pigments concentration depending on their mode of action, before they have any influence on the plant growth. The results will be evaluated with several different experiments and published in science journals.

Abundance and development dynamics of individual floating macrophytes in situ is a reflection of interactions between nutrients and other ecological parameters in wetland area. This research will advance scientific understanding of physiological parameter responses and development of floating macrophytes in wetland waters, as well as the influence of nutrients and pollutants on development of floating macrophytes and algal growth in laboratory conditions. Because of the increased eutrophication and the amount of toxicants in the lowland area of Eastern Croatia, as a result of intensive agriculture, parallel field and laboratory investigations will contribute the overall estimation of changes in the aquatic plant species composition with main aim to preserve biodiversity and endangered and rare habitats that are of great importance for the Republic of Croatia.

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Project duration: 2008–2011
Programme type: National
GENETIC MARKERS AND ROLE OF ATTRACTION IN HAEMATOPHAGOUS DIPTERA ABUNDANCE

PROJECT OBJECTIVE:

Because of their similarity to the natural odour of domadars (breeding domestic animals), some chemical compounds attractants stimulate the sense cells of haematophagous insects and are therefore used in sampling. The effectiveness of traps used for sampling different haematophagous groups usually depend on the applied attractant. For example, by adding an attractant the effectiveness of traps used for sampling haematophagous insects belonging to the family of Diptera increases. However, haematophagous insects react differently to a particular scented attractants. To interpret the attractants influence on the particular groups of haematophagous insects properly, it is necessary to use a couple of different attractants. Haematophagous insects are numerous in flooded areas and take part in transmission of various kinds of diseases which first, is an important internal factor that influences population dynamics, as well as the environmental changes of the ecological system. Secondly, it is an important epizootiological factor. That is why it is very important to explore the influence of synthetic or natural attractants in order to find the most effective attractant which regulates the numerousness of individual haematophagous insects groups.

DEPARTMENT OF BIOLOGY

However to interpret the changes in the fauna of some groups of haematophagous insects the molecular analysis are needed in order to clarify the family relationships and the origin of fauna in the researched area. This study will answer the following questions: (1) which synthetic attractant or different combination of natural and synthetic attractants can be used as a reliable attractant for particular groups of haematophagous insects (2) what is the effective difference between natural and synthetic attractants (3) what kind of evaluation of the attractants influence can be made in protective and agricultural sense in order to protect domestic animals from haematophagous diptera (4) the genetic markers, will enable the insight into family relationships in the researched area, also genetic markers will be used to help in determination adult and larvae of the haematophagous diptera (5) and detection of changes in population homogeneity (6) seasonal dynamic and altitude distribution will be determined and dependence on plant communities (7) the results of molecular analysis will be application in explanation of taxonomic position some species and explanation of phylogenetic relations.

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Project duration: 2007-2010
Programme type: National
ENTOMOFAUNA OF THE KOPAČKI RIT

PROJECT OBJECTIVE:

Kopački rit is an important flooded area in Croatia. Because of considerable bird variety this area is protected with local laws and international conventions. However, little is known about insects in the Kopački rit area. Few papers that do focus on insects in Kopački rit are a few decades old. Those papers record the presence of 398 insects, which is symbolic. If we compare this to 284 registered birds, we can safely conclude that the number of insects is far too small. Investigations planned in this project should increase the knowledge about insects in Kopački rit, register the numerous species that live here and others that simply fly over this area. This research will focus on several groups of insects: mosquitoes (Culicidae), tiger beetles (Carabidae), horseflies (Tabanidae), sawflies (Symphita), water bugs of the Coleoptera order (Hydradephaga, Hydrophiloidea) and Heteroptera (Nepomorpha, Gerromorpha). As the flooded areas in certain ecological conditions produce enormous populations of certain species, which then migrate from the Kopački rit area.

DEPARTMENT OF BIOLOGY

Research will focus on the migrations of mosquitoes, water bugs and horseflies. Insect sampling methods will be done using classical entomological methods such as trapping containers, CDC traps and nets (insect attractants will also be investigated), and modern technologies for distance investigations (GIS). To monitor insect migration we will use the capture-mark-release-recapture method, which involves marking insects with fluorescent colours. The sampling will be done throughout the insect activity season and for the duration of the project. We expect that with this research we will come to new faunistic, ecological and ethological findings and determine rare, endangered, eudominant and dominant species, and their influence on surrounding areas. Research results are expected to indicate the value of Kopački rit as a rich and significant entomofauna of flooded regions, which have become something of a rarity in Europe.

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Project duration: 2007-2011
Programme type: National
BIOWETMAN

PROJECT OBJECTIVE:
A science based approach to understand biodiversity driven functions and services for improving wetland management

Within the Danube River Basin, about 80% of the former floodplains have been lost or are functionally extinct. The deterioration of the Danube wetlands has led to increasing management efforts and restoration activities of the riparian states during the last decades. However, the restoration of the ecological integrity of the Danube landscape on a large scale requires coordinated strategies among the different states, which have to be based on a scientific approach that combines landscape dynamics with key ecosystem processes and biodiversity. Such an interdisciplinary approach needs substantial preliminary work to balance the differences in methodology, know-how and data accessibility among the scientists of the participating Danube countries.

The aim of the project BIOWETMAN was to initiate a network of scientists among different riparian states of the Danube in order to develop an integrated restoration approach for the Danube River Basin (DRB) which links wetland biodiversity to wetland services on a landscape scale. Based on selected case studies along the DRB, the significance of wetland biodiversity for ecosystem functions and services, with special regard to water quality and nature conservation.

DEPARTMENT OF BIOLOGY

The objectives of the project were as follows:

- Establishment of a network between the respective institutes in the participating countries and coordination of the network activities to the national and international management orientated networks;
- Identification of appropriate case studies along the DRB;
- Identification of key wetland characteristics, with special consideration of the hydrologically and socially driven pressure – impact situation;
- Analyses of the linkage between biodiversity and ecosystem functions/services, including aspects of climate change;
- Identification of key research questions and the structure of a joint research project;
- Development of potential future cooperation projects on the subject of wetland biodiversity - wetland functions – wetland management in accordance with EU 7 FP priorities or related research programs.

Data of selected case studies were collected and analyzed as to common wetland characteristics regarding hydrology, morphology, topography, water quality, and fauna and flora. Anthropogenic impacts on ecosystem services and functions were assessed, and a typology of the selected wetlands was established as a base for further biological and ecological distinctions and comparisons.

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Project duration: 2008–2009
CHEMICAL SENSORS FOR BIOMEDICAL, FOOD AND ENVIRONMENTAL APPLICATIONS

PROJECT OBJECTIVE:

The increased interest in biomedical diagnostic research, advanced food processing and food analysis, as well as increased concerns with the toxic effects of chemicals in the environment, have led to the necessity of monitoring of various chemical and biological species. This requires portable, fast-response analytical devices/sensors that are robust and with sufficient sensitivity and long lifetime.

The main goal of the project proposed is development of the new redox sensors and surfactant sensors.

The project will comprise the isolation, characterisation and chemical modification of redox compounds from biological materials, synthesis of new types of ion-pair based surfactant sensing materials, as well as development of new electrochemical sensors for measurement of redox properties and redox compounds in biological materials, and surfactants concentration in environmental and industrial materials.

The principle of redox sensor construction is based on the chemical, biocatalytic or bioelectrocatalytic oxidation of analyte converting it into the corresponding stable reduced form. The changes of the analyte concentration, and/or the product concentration and/or the concentrations of the oxidized/reduced mediator form should be correlated with the electrode potential or electric current changes, measuring directly or indirectly analyte concentration.

Surfactant sensor containing an ion-pair as ion-exchanger is based on the selective charge transport across the boundaries of the membrane, resulting in electrode potential changes related to the concentration of the surfactant.

DEPARTMENT OF CHEMISTRY

The expected results of the investigations include:

- isolation of redox compounds from biological materials, their chemical and physicochemical characterization,
- modification of isolated redox compounds and application of newly modified redox derivatives as sensing elements in development of a new redox sensor,
- development of a new method for measurement of redox properties and determination of redox compounds in biological materials,
- synthesis of new types of ion-pair based surfactant sensing materials,
- construction of the new, more specific, more sensitive, more durable, faster and cheaper surfactant sensors.

The investigations proposed should contribute to the application of the new sensing materials for recognition of redox compounds and surfactants, introducing of the new measuring principles and new faster and cheaper analytical methods for their determination.

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CHEMICAL SENSORS FOR BIOMEDICAL, FOOD AND ENVIRONMENTAL APPLICATIONS

PROJECT OBJECTIVE:

Determination of biogenic compounds as well as the redox state provides a means by which the quality of food product can be established rapidly and inexpensively by using chemical (optical and/or electrochemical) sensors. The principle of redox sensor construction is based on the chemical, biocatalytic oxidation of analyte converting it into the corresponding stable reduced form. The changes of the analyte concentration should be correlated with the electrode potential or electric current changes, or changes in optical characteristics, measuring directly or indirectly analyte concentration. Biogenic compounds, such as volatile amines are arising during the deterioration of food. Besides conventional methods their concentration could be measured by using enzyme based sensors. The selective biocatalytic process inside the sensing layer results in small inorganic molecules (e.g. carbon-dioxide, ammonia) that could be detected by chemical sensors.

DEPARTMENT OF CHEMISTRY

The project will comprise the characterisation and chemical modification of redox compounds, the development of electrochemical sensors for measurement of redox properties and redox compounds in biological materials, as well as the development of enzyme based optical/electrochemical sensors for the control of food freshness.

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Programme type: Bilateral Croatian-Hungarian project
NONLINEAR PARAMETER ESTIMATION PROBLEMS IN MATHEMATICAL MODELS

PROJECT OBJECTIVE:

The goal of this project is theoretical and applied research referring to the parameter estimation problem in nonlinear mathematical models. Special attention will be put on mathematical models which are often used in applied research (agriculture, economy, electrical engineering, biology, biotechnology, medicine).

In theoretical research stress will be placed on the following open problems in nonlinear mathematical models: the existence problem of optimal parameters, the uniqueness problem of optimal parameters, the problem of choosing a numerical minimization method and the problem of determining a good initial approximation. These problems are extremely difficult even for the simplest nonlinear models and there exist little theoretical results about them. Therefore, within the theoretical research certain nonlinear models that often occur in applied research will be especially studied. For them, we will try to solve the aforementioned open problems, improve and/or adjust the existing and develop new minimization methods. Thereby, special care should be taken of convergence and complexity of new methods.

This research project is planned to be actively included into a future joint doctoral degree study in mathematics with four universities (Zagreb, Osijek, Split, Rijeka), and several PhD degree candidates attending that programme are planned to write their doctoral dissertation falling into the scope of research within this project.

Applied research refers to testing theoretical research results as well as application of obtained theoretical results to other sciences.

DEPARTMENT OF MATHEMATICS

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Project duration: 2007-2011
Programme type: National
PROJECT OBJECTIVE:

The goal of this programme is the research referring to various theoretical aspects of the parameter estimation problem in nonlinear mathematical models (existence, numerical, statistical), as well as application of the obtained results in other scientific fields carried out through collaboration mentioned in individual projects. Special attention will be given to mathematical models used frequently in applied research (agriculture, economy, biology, biotechnology, medicine, physics, electrical engineering, mechanical engineering and civil engineering).

The programme unifies, co-ordinates and directs research of the following four projects: P1- Nonlinear parameter estimation problems in mathematical models, P2- Statistical aspects of estimation problem in mathematical models, P3- Passive control of mechanical models, and P4- Sampling series, Mathieu series and special functions.

DEPARTMENT OF MATHEMATICS

Theoretical research results will make a scientific contribution to numerical analysis, optimisation theory, statistics, linear algebra and applied mathematics. This research programme is planned to be actively involved into a future joint doctoral degree study in mathematics with four universities (Zagreb, Osijek, Split, and Rijeka). Several PhD degree candidates attending that programme are planned to write their doctoral dissertation falling into the scope of research within this programme.

Applied research refers to testing theoretical research results as well as application of the obtained theoretical results to other sciences.

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Parameter estimation in statistical models is a problem that has been studied from the very beginning of statistical analyses and that still plays an important role in model-based modelling and statistical inference. Model improvement is pretty much directed towards satisfying complex hypotheses of real situations. In that way, from application demands there constantly arise new models which should be analysed from the point of choosing a suitable parameter estimation method, analysis of estimator properties, existence of estimators depending on the given data, numerical methods for calculating estimators, defining methods for the analysis of model quality, testing hypotheses on compliance of the model with real data, etc.

The goal of this project is to analyse parametric statistical models in which there is interest in practice, which have not been studied so far, and for which project collaborators possess knowledge and skills enabling them to research such models. E.g., we will analyse the possibility of determining the border of uniform distribution on a bounded convex support if data are measured with additive error. Such problems can occur e.g. due to refraction of the light if it is necessary to determine real borders of an object from a shadow, and it is of special interest for precise measurements. In case distribution of additive errors is known, it is possible to analyse efficiency of the maximum likelihood method by analysing regularity conditions, existence of solutions and numerical procedures for their calculation. Furthermore, we will analyse some nonlinear regression models with long-memory errors in terms of estimator properties obtained by the least squares method and the least modules method, robust variants of parameter estimators in generalised linear models, etc.

Results obtained by this research refer to analyses of selected estimator properties (consistency, bias, efficiency, asymptotic normality, etc.), definition of confidence intervals for parameters, definition of model quality measures for the purpose of comparison with similar models, definition of statistical tests for testing hypotheses on model adequacy and parameter values. Research results will be applied to real data and sent for publication to international or Croatian publications and presented at international conferences. The importance of this research lies in its strictly mathematical foundation and great possibilities of applying results in all fields of science.

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Programme type: National
PASSIVE CONTROL OF MECHANICAL MODELS

PROJECT OBJECTIVE:

Within this project will be studied passive control of mechanical models mainly mechanical and electrical vibrating systems, with particular interest in parameters' estimation that will ensure the best control of oscillations of such systems. Such systems are described as a systems of ordinary differential equations of second order $M x'' + v D x' + K x = 0$, and the basic issue that we deal with is: how to determine the "best" damping so that a mechanical system "fastest calm down". As a part of the problem we will specifically study the problem of optimization of dampers' viscosity and as the second challenge the problem of optimization of the dampers' positions. One possible criterion for such optimization is so called criterion of minimization of total energy, which amounts to the minimization of the trace of the solution of Lyapunov equation $AX + XA^* = -CS$, where $CS$ (and $XS$) are symmetric matrices, and the matrix $A$ depends on the matrices $MS, DS$ and $KS$. It is known that the Lyapunov equation $AX + XA^* = -CS$ and the Sylvester equation $AX + XB = -CS$ are two matrix equations, which often can be found in applied and technical sciences. Existing algorithms for calculating the solutions are often time demanding while on the other hand the existing perturbation theory is very difficult to apply in the sense if one wants to determine the accuracy of existing algorithms, so it would be important to seek new and improved algorithms and construct appropriate perturbation theory.

DEPARTMENT OF MATHEMATICS

In the proposed project we will develop a new perturbation theory and corresponding improved numerical algorithms which will be applied to dynamic systems. Finally we will study and apply all possible structures of the solutions, which are the consequence of the structures of matrix equations, so far insufficiently explored. As the final result of the project, we expect that we will be able to more efficiently and reliably solve practical problems such as optimization of damping in mechanical systems in mechanical and civil engineering. For example, we expect to construct algorithms for optimization of the viscosity of passive dampers (Stockbridge dampers) for vibrations of high-voltage cables, and algorithms for optimization of the dampers' viscosity in civil engineering structures (eg. bridges, concrete or masonry structures).

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Project duration: 2007-2011
Programme type: National
RADIOACTIVITY IN AN ENVIRONMENT – DETECTION AND APPLICATION

PROJECT OBJECTIVE:

The radioactive noble gas radon ($^{222}\text{Rn}$) is generated from alpha decay of radium ($^{226}\text{Ra}$) mainly contained in minerals of soil and building material. Radon diffuses in atmosphere and together with its short-lived progenies is the main source of natural radiation. Long-time exposures to radon and its alpha emitting decay products ($^{218}\text{Po}, \, ^{214}\text{Po}$) increase the lung cancer risk not only among miners, but among the population who live in houses with elevated levels of radon concentration. This positive relationship between indoor radon and lung cancer occurrence shows that radon is one of the major risks for public health. Investigation of the correlation between radon in soil gas and indoor radon will enable determination of the influence of soil, building materials as well as type of construction (existing of cellar, for example) on indoor radon level. Most of the European countries made their own national indoor radon maps. The main goal of this research project is preparation of radon map for Croatia which would enable the recognition of the areas with elevated radon levels. With our results of measured indoor and soil gas radon we are participating in generation of European atlas of natural radiation which is coordinated by Joint Research Centre of the European Commission.

DEPARTMENT OF PHYSICS

Variations in time series of radon in soil gas or radon in groundwater could show the relation between radon exhalation and tectonic disturbances in Earth’s crust. Radon anomalies could be used as earthquake precursors despite the fact that changes in radon concentrations could also be influenced by meteorological parameters. It is expected the investigation of radon variations in soil gas and detection of radon anomalies will enable prediction of earthquakes (M>3) at distances up to hundred kilometers from measuring sites.

An aircraft crew and frequent flyers are exposed to elevated levels of cosmic radiation of galactic and solar origin. At aircraft altitudes and temperate latitudes, representative values of the main components of ambient dose equivalent are: neutrons 55%, electrons and positrons 20%, protons 15%, photons 5% and muons 5%. The detection of these neutrons is a big scientific challenge because the sensitivity of detectors shows a great dependence on the neutron energy. It is expected to develop a reliable track-etch neutron dosimeter using at the flight level of about 10 km, where the fast neutron component is rather higher than the one on the Earth surface.

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