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THE REGULATORY ROLE OF LAW IN AGRICULTURAL WATER MANAGEMENT

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1. ANTECEDENTS OF THE RESEARCH AND OBJECTIVES

The importance of the topic as well as my personal attachment gave me the inspiration to write this dissertation. Both my previous experience as a captain of a ship and my current job as a farmer and water management expert make me want to carry out further research and in-depth study of the topics outlined below.

The purpose of my research was to find out how freshwater resources and the economic advantages and burdens related to them are divided between the participants of the economy. Furthermore, I studied the influence relevant laws have on the yield of crop production through agricultural water management, and I examined the reasonability of these laws with regard to the economy as a whole.

Objective: To analyse the system of connections between **Law – Water Management – Agriculture.** It requires the **analysis** ensued by the **synthesis of the three factors** in order to demonstrate their common effects.

To achieve this objective, the following tasks should be completed:

1. Clarify the importance of water management.

2. Give a historical overview of Hungarian water regulation and water management.

3. Communicate the achievements of outstanding Hungarian specialists of the area.

4. Give a description of the legal system of Hungarian and European water regulations.

5. Conduct an experiment on a specific plot of farmland to examine the economic effects of precipitation and analyse its results to calculate costs, yield, efficiency, turnover and profits.

6. Analyse the effects of natural precipitation on national average crop yield.

7. **Assess the direct and indirect effects of water legislation** at various levels of life, i.e. **the levels of *plants*, *animals*, *humans* and *society***.

2. MATERIALS AND METHODS

The complexity of the topic of **water – law – agriculture** indicates that the application of the usual materials and methods will not be successful. On one hand, the accepted research methods of the three disciplines should be applied (***water management, law, agriculture***), but only partially, and only to the extent which is required by the topic. On the other hand, we should examine the results with a view to the interaction between them, as they exert their effect jointly in real life.

The data used came from both primary and secondary sources. The area examined was considered when deciding about the usefulness of the data received: whether data coming from primary or secondary sources was used depended on the area being examined.

Naturally, sources in Hungarian and foreign literature provided basis for the theoretical importance of **water management**. They were updated, and their Hungarian relevance, international connections and importance were analysed.

The examination of Hungarian **water regulation** and water management is based on secondary sources, shedding light on the beginnings, stages, institutions, internationally renowned achievements and excellent Hungarian authorities of historical development.

The **legal system** is also based on secondary sources (Hungarian, foreign and EU); the analyses into these sources cover their opportuneness, content and scope, as well as proposed amendments to laws, their root causes and

circumstances, and the amendments themselves. The contrastive analysis of Hungarian and European laws – **legal compliance, wrongly regulated areas, - economic impacts** – point out the legal harmonization relating to today's water management.

The connection between **precipitation and crop yield** was established using data published in official statistics as the ten-year (1996-2006) national average. The analysis covered the yield of the most important field vegetables (sugar beet, potato, wheat, corn), observing the annual total precipitation (mm/y) and average crop (t/ha), as well as examining their **minimum** and **maximum values** and the **connections** between them.

Based on **specific field experiments** *(carried out on the 42.6 hectare field lot no. 0400/4 in Kisújszállás in the years 2003 – 2004 – 2005)* I managed to determine the amount of water *(mm) (precipitation and water utilized through the soil)* and the yield *(t, and kg/ha).* Both methods are described in detail in Appendix 1 *(p.126).* The analysis of the data covered technical data *(kg/mm/ha)*, the amount of water used in crop production *(litres/kg)* and economic efficiency. To calculate economic efficiency, I also used model numbers beside the data ***(Balogh, 1978)***. The effects of both surplus water and water deficiency were examined.

The calculation of irrigation costs to cover for water deficiency is based on data obtained from a company selling irrigation systems. These calculations can be found in *Appendix 2. (p. 138).* The irrigation costs of different equipment types and the rate of return concerning different cultures and prices were examined.

Some of my primary *(water management, ship captain and farming experience)* and secondary *(related to hydropower stations, shipping, social advantages and disadvantages)* experiences are also included in the **analysis of the indirect effects of water management**.

The effect mechanism of water regulation is demonstrated through a model *(picture 5, page 74)*, which is based on scientific knowledge *(geography, plant and animal biology)*. It is followed by the analysis of the directions, size and areas of connections at microeconomic and macroeconomic levels, as well as an analysis based on social interconnections. Numerous data and events provide proof for the modelled results of the mismanagement of water *(the glory and fall of ancient Egypt, the root causes of the migration of ancient Hungarians and the occupation of the Carpathian basin, as well as the sad results of devastating floods in Southeast Asia, New Orleans and many other geographical locations).*

3. RESULTS

It can be stated that water is an element of all aspects of life and that each aspect is directly and indirectly interconnected. The connections between the aspects – **plants, animals, humans, society** – are based on domino principle, i.e. the fall of any domino entails the fall of the entire system. Water resources can be used and misused *(e.g. the glory and fall of ancient empires that were based on irrigation cultures)*. The proper use of available water resources is manifested in careful management of water. A society's decision to choose between temporary advantages or long-term development depends on its maturity. It entails that we have to invest in water, which means we have to make sacrifices of intellect, material, finances and time.

In Hungary, **the effect of the amount of precipitation can be clearly seen in the specific yields of main plants in both positive and negative directions**. The crop average fluctuations *(a difference of nearly the double)* of non-irrigated cultures *(wheat, corn)* are parallel with fluctuations in the amount of precipitation, while cultures with larger ratio of irrigated areas *(sugar beet, potato)* show smaller deviations (1.6 times). With 600-700 mm precipitation in Hungary, we relatively rarely have to consider the harmful effects of surplus precipitation *(water)*, but water deficiency can and must be made up for by growing drought resistant types and by irrigation, especially in the case of more intensive cultures *(sugar beet, potato, field vegetables)*.

Surplus water and its harmful effects can only be seen in two cases in Hungary. The first is when the harmful surplus water is caused by a flood affecting large areas of land. The elimination of this exceeds the country's capabilities, and we can only mitigate or ward off such situations in

cooperation with the neighbouring countries. This area is a government-level task and belongs to governmental power. In the second case, which is unfortunately more and more frequent, the harmful surplus water comes from stagnant groundwater. The causes are clearly local *(neglected ditches, drainpipes, canals),* so the solutions should be local, too. The task is the responsibility of local farmers and water management associations formed to solve the local tasks of agricultural water management. Its burdens are carried and advantages enjoyed by people farming in the specific area. This was the reason for passing the legislative order 48 of 1957 regarding water management associations. The roots of the association movement go back to the 19th century and originate from the unwritten laws of voluntary association of the interested parties ***(Tamás, 2003)***.

Water balance examinations carried out on farmland in the years *2003 – 2004 – 2005* indicated that the yield data varied significantly each year, even though the same agricultural technology and the same nutrition were applied on the same type of plants. In 2003, 165 mm water deficiency reduced the yield by one and a half tonnes per hectare. It means that one mm water deficiency caused: 9 kg/ha yield loss. In 2005 the surplus water was +32 mm, which also resulted in -0.8 tonne yield loss per hectare, meaning 25 kg/ha yield loss per one mm surplus precipitation.

The examination conducted provides information on the financial relations of the measured yields. What we can see in today's Hungary is that, unfortunately, prices dramatically plummet when the yield is high and it is also true vice versa (see the average yield and prices of 2007 and 2008). As farmers and farming companies are interested in profit, it entails that their aim is not

necessarily to increase yield. This, in turn, often means that lower yield causes higher profits *(because of the ensuing high purchase prices)*, and a conflict of interest is formed between the producers *(farmers)* and the national economy.

The basis of the economic analysis is that the majority of production costs do not change in non-irrigated conditions, but the profit and income are dependent on yield and prices, which depend on precipitation.

Table 7 below shows the effects of favourable or unfavourable changes in yields on production value and profit.

Table *7:*

The effect of yield changes on production value in case of different purchase prices

Name	Yield reducing effect of 1 mm precipitation difference mm/kg/ha	Value loss and profit difference (HUF /mm/ha)		
		25	40	55
		Wheat price (HUF/kg)		
Precipitation deficiency (– 165 mm)	- 9	225	360	495
Surplus precipitation (+ 32 mm)	- 25	625	1 000	1 375

(Source: own calculation, 2007)

The data in the table indicate that high product purchase prices cause the role and importance of water to grow, while low product purchase prices cause it to decrease. For instance, a 50 mm precipitation difference *(which occurs almost every year now)* at a wheat price of HUF 25 causes HUF 11,250 value and profit loss in the case of water deficiency and HUF 31,250 in the case of surplus precipitation. Obviously, these numbers jump to more than the double if the price of wheat is 55 HUF/kg. These differences can be used for two purposes. Firstly, they can be used to cover the costs of draining surplus water *(water management association membership fee)*, and secondly, they can cover the costs of irrigation.

An important element of high quality water management is water storage.

A useful way of hill and highland water storage is creating valley reservoirs and shower reservoirs by constructing dams at right angles to the length of valleys.

In agriculture, fallen precipitation is stored in the ground by means of reasonable soil cultivation. The other possibility is **moderate damming** in riverbeds. Using dams to regulate the water level of rivers can **optimize the level of groundwater in the area near the rivers** *(Soroksári-Duna, Kvassay and Tasi dams, Rába - Ikervár, Hernád - Gibárt, Tiszalök etc.).* It has a favourable effect on agriculture, enhances water travel as well as recreation, provides residential and industrial water, and the dams can be used as a facility for generating electricity.

The often no more than symbolic operation of water management associations should be turned into real functioning conducted as **economic companies managed along the rules of civil law** ***(Nochta 2004 and 2005, Nochta –Kovács - Nemessányi 2006 and 2008).***

The state with its power has to create a system of rules to serve the whole of the society. The shortage of natural resources will necessitate restrictive lawmaking. In the three-member "*orchestra*" of natural resources, the economy and law, the "*conductor*" is necessarily the state.

4. CONCLUSIONS

It is widely known and accepted that water is the basis of human life. The beginning, development and decline of all ancient societies were determined by water. Building and maintaining irrigation canals, as well as adjusting the required water levels were under state control, being the second most important centrally controlled and monitored activity after the military. Later, soil quality deteriorated due to unvaried irrigation. As a result, the developed ancient societies disappeared as spectacularly as they were formed.

Certainly, we must not forget the disadvantages, either; ***"surplus water"*** is destructive. This is the reason why developed societies call for **legal regulation** to help **water control** and reasonable water management with the aim of making the advantages predominate over the disadvantages.

Hungary's opportunities regarding foreign policy have changed reasonably in the last 89 years. **Water Framework Directive** 60/2000 of the European Union forms an opportunity to create a more favourable water management and economic situation **in the whole of the Danube basin** by treating it as one geographical and water management unit and with the help of **inter-regional cooperation**. **A really big step forward would be taken if decision-makers realized that the economic region surrounded by the Carpathian Mountain Range also comprises a natural geographical unit which only works efficiently if the economy suits the natural geographical features, and *subdividing it without reason causes economic disadvantages*. These economic disadvantages will only**

deepen in the more and more intense economic competition of the 21st century. International economic competitors are *interested,* while the local population is *uninterested* in maintaining, deepening and conserving these disadvantages. Water Framework Directive 60/2000 and the inter-regional cooperation programmes of the European Union can be **effective tools of self-defence** for the local population of the Central Danube Basin in order to ***increase economic independence and competitiveness***.

By the end of the 19th century the principle of **forced association** had appeared in water regulation, which has relevance for today as well. This principle means that all the owners of the floodplain were obliged to join the association. **Forced association that is in ratio with the degree of interest is still part of the essential water related legal principles.**

An **important aspect of agricultural export** could be the fact that the largest tourist industry centres of the European Union are located on the European shores of the Aegean and the Mediterranean Seas. Between the months of April and October these resorts need large quantities of high quality food products. **Szeged could be an important place to ship Hungarian 'winter salami', ground paprika and bottled wine from** (with special regard to the Tokaj wines, which represent a unique quality in Europe). An important part is played in the foreign trade of high quantities of agricultural products by the European Channel linking the Danube with the Rhine and the Rotterdam Reloading District. Therefore, to **preserve the navigability of the rivers of Hungary is an important task** as well.

The optimal water level of rivers can be ensured with **moderate damming**. The riverbeds and floodplains already exist, therefore no construction is needed. Rivers with optimal water level have a positive effect on the level of groundwater in the areas near the river. Having **optimal groundwater levels** is one of the best ways **to optimise the profitability of crop production**. Because of the increasingly unpredictable precipitation distribution due to the global climate change, it is an important task to **storage and preserve the fallen rainwater**. Only water that is really unnecessary should be allowed to drain. The **cheapest way to storage water** is to conduct reasonable soil cultivation to store water **under the ground**; but other, **technical methods will be increasingly important** too.

Water regulation has four important levels. The first is great water regulation, involving the state-owned and state-managed main waters, i.e. bigger lakes and rivers. The second is small water regulation, which involves the smaller rivers and lakes managed by associations of interested parties, i.e. water management associations. The third level, managed by **local governments**, is the regulation of water coming from rainwater and the upper aquifer. The fourth level is comprised of activities related to water resources in **areas in private property**. ***Every participant at each level has to accomplish their responsibilities.***

Water is a renewable natural resource. The question of whether it should be private or public property is not to be ignored. **In the interests of the public, strict rules are needed to regulate the use of public property and protect it,** such as other *renewable* ***natural freshwater resources*****.** The

lack of such rules means it soon turns out that public property is not a good solution.

We can state that Hungarian water control has been based on regionalism for a long time, meaning that the ***"principle of regionalism"*** attributed to the European Union was already used in the Hungarian water control system when the European Union did not even exist.

On the basis of the above it can be stated that the institutional framework of modern agricultural water management in Hungary is available. The institutional system is based on a regional approach, far preceding the thousand-year-old county-based approach of public administration. However, we still have to wait for the practical execution due to the different interests of and power struggles between the "county – region" dual system.

It can be stated that water is an element of all aspects of life and that each aspect is **directly and indirectly interconnected**. The connections between the aspects – ***plants, animals, humans, society*** – are based on *domino principle*, i.e. **the fall of any *domino* entails the fall of the entire system**. Water resources can be used and misused *(e.g. the glory and fall of ancient empires based on irrigation cultures)*. A society's decision to **choose between temporary advantages or long-term development depends on its maturity**.

In Hungary, **the effect of the amount of precipitation can be clearly seen in the specific yields of main plants in both positive and negative directions**. The crop average fluctuations *(a difference of nearly the*

double) of non-irrigated cultures *(wheat, corn)* are parallel with fluctuations in the amount of precipitation, while cultures with larger ratio of irrigated areas *(sugar beet, potato)* show smaller deviations (1.6 times). With 600-700 mm precipitation in Hungary, we relatively rarely have to consider the harmful effects of surplus precipitation *(water)*, but water deficiency can and must be made up for by growing drought resistant types and irrigation, especially in the case of more intensive cultures *(sugar beet, potato, field vegetables)*.

Water damage relief is more feasible than high-cost irrigation. Obviously, in the event of water damage relief it is important to have somewhere to drain the surplus water. Therefore, it is **imperative** to have **regularly maintained public drain systems**, which means that **harmonizing national and regional interests** with those of the **local farmers** cannot be avoided.

In conclusion: efficient water management emphasizes multi-purpose use. Reservoirs have an increasing role to play in creating spectacular scenery and widening the choice of recreational facilities. River dams give opportunities to power generation, water travel and shipping. The unfavourable tendencies in climate change *(temperature rise, drought, fluctuations in the amount of precipitation)*, and the ensuing shortage of food and water indicate that governments cannot relinquish the regulatory role *(and force)* of law in water management.

When scientific evidence clearly shows the threat of natural disasters and that catastrophes with serious economic and social damages can be expected, people in responsible positions do not do

anything even though the results of scientific researches show methods of prevention, too. *(The tsunami in Southeast Asia was predictable on the basis of satellite images, yet, there was no one to alert the population to evacuate immediately. Based on the weather forecasts in New Orleans, the flood was to be anticipated, and so was the storm in Budapest in the evening of 20 August 2006. Still, no one alerted the people to do anything they could for their own safety).* **These events are incomprehensible, but I trust that Hungarian decision-makers will take the recommendations of the Va-Ha-Va (Change – Impact – Response project) research seriously in the future. The laws of nature exist objectively and cannot be explained differently depending on one's political persuasion.**

Finally, I would like to draw attention to a very important conclusion:

Natural resources, just like "millions of educated heads" are primary resources of the economy. If people in a specific geography lose possession of their local natural resources, their economic situation will be like that of those living in colonised territories. Therefore, under no circumstances must the local population waive their right to retain ownership of freshwater resources *(and it is true for soil too)* ***as renewable natural resources. So it is proper to say that not only the quality and the quantity but also the ownership of freshwater resources*** *(and soil)* ***should be retained.***

5. NEW RESEARCH RESULTS

- The principles of Hungarian water regulation *(regionalism, unity of law and practice, focus on the interests of the economy and the public)* comply with the latest requirements and already complied with today's European integration guidelines when the European Union did not yet exist. Legal regulation will be improved by the strengthening of its ***"enforcing and restrictive"*** character and the creation of a ***"standardized water code"*** due to the limited natural resources including freshwater. The often no more than symbolic operation of water management associations should be turned into real functioning conducted as **economic companies managed along the rules of civil law.**

- ***I calculated*** – using the same agricultural technology – the ***effects*** of water ***deficiency*** *(-9 kg/mm/ha)* and ***surplus water*** *(-25 kg/mm/ha)* ***on yield***, and my results show that ***precipitation*** that is ***more than necessary*** causes larger specific ***yield drop***. *(The way I see it, the reason is that the plant types used in Hungary have been bred to resist drought rather than high precipitation).* In the relatively balanced average precipitation of the last ten years
(441-808 mm/year between 1996 and 2006) **precipitation and nationwide yields showed a parallel tendency**.

- Water is not only a decisive factor in, but also the basis of the existence of **plants – *animals* – *humans* – *society***. These four levels are more

and more closely tied to water and each other; if any of them is damaged, it will destroy the entire four-level system similarly to the ***"domino principle"***.

- ***Laws*** supporting ***water damage relief*** and ***artificial re- supply*** of water **reduce** ***yield fluctuations*** in crop production; consequently, farsighted ***legislation reduces the fluctuation of economic effects.***

6. RECOMMENDATIONS

(THEORY AND PRACTICE)

- It would make irrigation more widespread if agricultural producers could reclaim the excise included in the price of the gasoline they use for operating their irrigation systems. The current legal environment does not make it possible.

- From time to time, farmers are given exemption from water usage fee, which is a ***minor help*** compared to the total costs they have to pay.

- There is no state law or local governmental regulation stipulating that farmers have to clean and maintain drainage ditches. Such obligation could be derived from the obligation of ***keeping lands in a cultivated order***.

- In water management associations, the farmers' ideas on water management plans should be considered too. It is a misguided practice when farmers are forced to pay association membership fee in the form of tax, and only have a symbolic say on the operations of the association.

- Occasional government subsidies are used for water damage compensation, but ***no money is allocated for prevention***!

The increasing demand for food in the world will induce the enlargement of irrigated lands with controlled water supply systems. Low water management and irrigation costs together with a rise in food prices

will probably solve the economic problem caused by the high costs of water management and irrigation. But until it happens, simple, cheap and effective solutions should be found. Such solutions are the drainage of surplus water with the help of gravity, loosening the subsoil and deep loosening, and, in cases where the landscape makes it possible, flood irrigation once a year out of the vegetation period.

Facing the consequences of the already ongoing **global climate change**, **further recommendations are as follows**:

- The direction of EU and national legislation does not need changing, because it is appropriate and serves the purposes of the economy; however, **fundamental systemic, organisational and fund distribution changes are needed at the *implementation level.***

- The valuable water management experts laid off **earlier should be given jobs again**.

- The size of ***financial resources should be reassessed*** to meet the increasing challenge posed by weather change.

- The interests and tasks of participants of the economy should be **harmonised** with the laws.

- At the moment, water management affairs belong to the competence of several different ministries, while the National Water Management Chief Directorate is subordinated to the Ministry of Environment and Water. The structure in which the water industry was coordinated by the National Office of Water Management should be restored. The **National Office of Water Management was a government office with national competence**. It was not

under the coordination of a certain specialist ministry, while getting orders from four other ministries at the same time. On the contrary, the National Office of Water Management controlled and coordinated the water-related activities of the different ministries. **It was a system justified by the *strategic importance* of water management, which is even more emphatic today, in the age of global climate change.**

- It is advisable to create a ***standardized water code*** in order to harmonise rules and eliminate disharmonious regulations experienced mainly at lower levels of legislation.

7. SCIENTIFIC PAPERS, PUBLICATIONS, LECTURES (CONFERENCES, SYMPOSIUMS, MEETINGS) IN THE TOPIC OF THE DISSERTATION

Year 2005:

1. Contributor to the book **Dolgozatok a Gazdasági jog témaköreiből (Essays on Economic Law)**. Published: by the University of Kaposvár, January 2005.

2. Lecture: "Environment, Regional Competitiveness and Sustainable Development" Conference, May 2005, Pécs. Title: **The Regulatory Role of Law in Agricultural Water Management**. **English abstract** published in the conference paper in January 2006.

3. Lecture: III. Erdei Ferenc Scientific Conference, Kecskemét, *August 2005*. Title: **Quality Water Management of Historic Hungary. English abstract** published in the conference paper in January 2006.

4. Lecture: Agriculture in Central Europe – Possibilities and Risks XLVII. Georgikon Days: *(September 2005)* in Keszthely. Title: **The Regulatory Role of Law in Agricultural Water Management**. **English abstract** published in the conference paper in January 2006.

5. Article published in the issue of Délvilág daily circulated in Southern Hungary *(Makó, Csongrád, Szentes and its area)* Title: **A Dam: Would be Useful at Csongrád.** Page, 12 of the 26 October 2005 issue.

Year 2006:

6. Lecture held **in German,** at the III. International Conference organised by the Faculty of Agricultural and Food Sciences of the University of West Hungary in Mosonmagyaróvár on 6-7 April 2006. Title: **Das Wasser als Basis fűr die Biologische Produktion** (Water as the Basis of Biological Production). Published: in the publication peer-reviewed by the Scientific Committee in April 2006.

7. Lecture at the "Tavaszi Szél (Spring Wind)" Conference organised by the University of Kaposvár on 4-7 May 2006. Title: **The economic role of Law in Agricultural Water Management.** Appeared: in the peer-reviewed Conference Paper in May 2006.

8. Lecture at the II Conference on Environmental Sciences in the Carpathian Basin organised by the University of Pécs, on 1-2 June 2006. Title: **Floods, Groundwater and Drought Damage in Hungary**. Published: in the Conference Paper in June 2006.

9. Specialist scientific essay **with English abstract** published in the journal 'Gazdálkodás'. Title: **Qualities and Questions of Hungarian Water Management**. Pages 66-72 of the 4th issue *(August),* Year 50 *(2006).*

Year 2007:

10. Specialist scientific essay **in English** published in the **peer-reviewed** journal Acta Kaposvariensis. Title: **Quality Water Management of Historic Hungary in the European Integration** (A Magyar vízgazdálkodás történeti értékei az Európai-integrációban) Pages 209-214, January 2007.

11. Lecture **in English** in the Veszprém Chamber of Forensic Experts on 27 September 2007. Title: **Water Reserve, Cultivating Plants, Biological Production, Transpiration, Evaporation (**Víztározás, növénytermesztés, transpiráció, evaporáció). Published: in the Journal of Forensic Sciences, P. 11. October, 2007.

Year 2008:

12. Specialist scientific essay **with an abstract in English** published in the **peer-reviewed** journal Acta Kaposvariensis. Title: **Magyarország vízrendszere és hatása az agro – ökológiai potenciálra (The Water System of Hungary and its Effect on the Agroöcological Potential)**. Pages 59-65, March 2008.

Year 2009:

13. Specialist scientific essay published in 2nd Issue of the 1st Year of the **peer-reviewed** journal “Trianoni Szemle”. Title: **The Economy and the freshwater-supply, like natural resource, in Carpathian-Basin (A gazdaság és édesvíz-készlet, mint megújuló természeti erőforrás, a Kárpát-medencében)**. P. 88 – 99.