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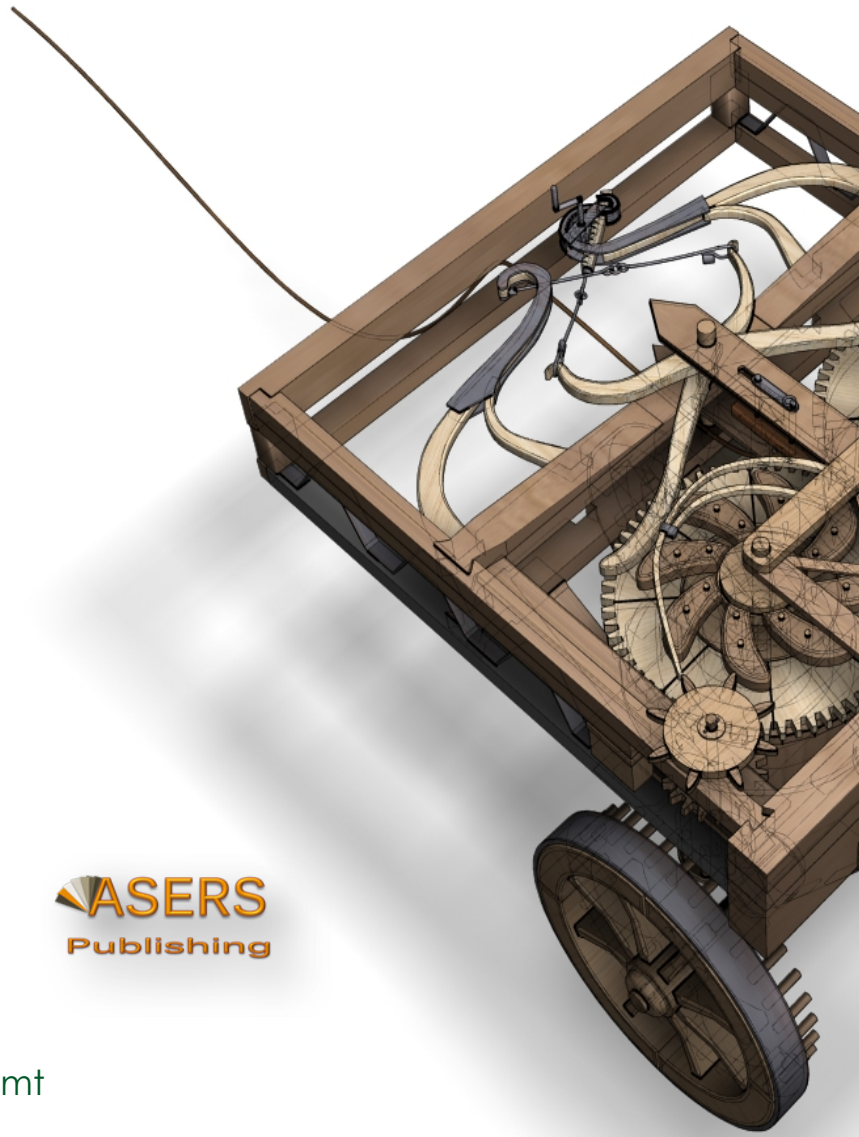

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The Impact of Management Skills of Agricultural Entities in Relation to Economic Efficiency and Natural-Climatic Conditions in Slovakia

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Abstract:

Agriculture is the production area which is dependent on the conditions of the natural environment. This fact significantly affects the production orientation and the effectiveness of the agri-food sector. The aim of this paper is to evaluate the development in the categorization of agricultural plots by the regional differentiation of Slovakia at the NUTS IV level (districts) and draw attention to probable development of differentiation of districts in primary agricultural production in Slovakia, while ensuring the sustainability of the economic performance of the given sector. On the basis of completed analysis, we can conclude that natural and climatic conditions have a dominant influence on achievable productivity and economic efficiency of the agricultural entities in ensuring the sustainability of the economic performance of agriculture in different regions of Slovakia

Keywords: natural-climatic conditions; spatial econometrics; agricultural primary production; sustainability of agriculture

JEL Classification: Q13; L25; M21

Introduction

The agricultural production activities provide both livelihood for the inhabitants of towns and villages, but also raw materials and starting materials for the industrial production as well as employment for a relatively large portion of the workforce or other resources. The agricultural sector as well as other sectors of the processing industry must make optimal use of resources and use them with the highest level of efficiency.

After the year 1990 (after the entry into new market environment), the agricultural entities entered on the road of difficult structural, economic and social changes. The measurable improvements were reflected only in

some aspects of technical performance and competitiveness. There were created new forms of business, the number of subjects increased and their average concentration was reduced. Subsequently, the entry of Slovakia into the European Union opened a large European agricultural market to Slovak agricultural producers and simultaneously removed all barriers to domestic market. It led to new challenges in terms of productivity and economic efficiency of domestic agriculture (Dubravská 2013, Širá 2013, Grznár *et al.* 2009, Bielik and Rajčániová 2004).

1. Literature review

Since land is a production factor just like labor and capital, the concept of productivity and efficiency with emphasis on the spatial dimension can be applied. The concepts such as spatial dimension of productivity and efficiency of land that are related but not identical concepts come to the foreground. The term productivity of the land represents the volume of production of companies produced on one part of the land.

On the other hand, the spatial efficiency reveals information about efficient use of land in the production process. The company is inefficient if it uses more land than is necessary for the level of output, or vice versa inputs of labor and capital or production possibilities curve (technology). In other words, the enterprise is inefficient when operates below the production possibilities frontier, which also includes land as a production factor (Metzemakers 2005).

The relations between climate changes and agriculture are complicated and varied. Factors that affect the climate are continuously changing and this phenomenon has multidimensional impact on human livelihood. From all areas, currently the agriculture is highly dependent on climatic conditions. In view of these conditions, also indicators related to agricultural sustainability such as volume, yield, area and production value are changed. If the sustainability of agriculture is appearing as vulnerable, there will also a fluctuation in economic indicators such as the total quantity of production, trade margin of crops and finished products or wage rates (Alam *et al.* 2013).

The main climatic factors that affect the economic efficiency of agriculture can be included (Iglesias *et al.* 2009, Bobuľská *et al.* 2015, Fazekašová *et al*. 2014): elevated CO2 and O3 concentration in the atmosphere, intensity of rainfall, temperature and heat stress, the impact of extreme events, such as floods or droughts, changing sea level and others.

The agricultural sector has a multiplier effect on socio-economic and industrial structure of each nation because of the multifunctional nature of agriculture. Multifunctionality of the new European model is shown in its main functions (Sortino and Chang Ting Fa 2009):

- production function - to produce quality food in compliance with food security both in terms of quality and also in terms of quantitative perspective;
- environmental function - to produce positive externalities, reduce pollution and reduce all negative externalities produced by agriculture;
- function of rural development - in this case, this function points to agriculture supporting the sustainable development of rural communities, in line with their history and local culture.

Climate change has an impact on crop and livestock production, water balance, inputs and other components of agricultural systems. Yield of crops and livestock are directly affected by changes in climatic factors such as temperature, rainfall, frequency and severity of extreme events such as droughts, floods and windstorms. Climate change can also change the type, frequency or intensity of pests of various crops and livestock as well as the availability and timing of water supply for irrigation and severity of soil erosion. Over time, people adapted the farming systems and practices to changing economic and physical conditions. This fact was supported by the adoption of new technologies, changing mixture of crops or changing institutional arrangements. Climate change adaptation at farm level can be accomplished in terms of planting and harvesting of crops, in crop rotation, in the choice of crops and crop varieties for cultivation, in water consumption for irrigation, in usage of fertilizers as well as in the technique of soil tillage. These adjustments are the natural consequences of the producers to maximize return of their soil fund. Each adjustment of the company can reduce potential yield stemming from climate change or, on the other hand, improve yields if the climate change is beneficial. On the market level, price and other

changes can indicate additional opportunities for adaptation. Through trade so at the international as well as national level, it can lead to a redistribution of stocks of agricultural commodities from regions of relative abundances to regions of relative deficiency (Adams 1998).

The agricultural soil represents the most valuable (irreplaceable) natural resource, in which the physical, chemical and biological processes are still ongoing. It is a place where is created the agricultural reproduction process. The soil is an essential production condition because it provides space for producing and is an essential production factor, because it determines the existence of two main sectors of agricultural production (crop and livestock). The scarcity of soil (as a production factor) is in the fact that the agricultural entities and national economies can dispose with the soil only in a certain amount. This fact ranks the soil among precious resources that affect determination of prices of agricultural products (Kotulič 2007).

The optimal use of production factors in relation to productivity and economic efficiency of the agricultural entities as well as their determinants are examined by a number of domestic and foreign authors in many published scientific studies (Biondo and Bonaventura 2014, Chrastinová and Burianová 2012, Střeleček *et al*. 2011, Sojková *et al.* 2008, Dinar *et al.* 2007, Juřica *et al.* 2004, Rosochatecká 2002, Kalirajan and Shand 2001).

Slovak agriculture has experienced several institutional and economic changes in the last two decades. These changes had a significant impact on performance, structure and size of Slovak agriculture (Matejková *et al.* 2008, Pokrivčák *et al.* 2006). However, despite the aforementioned tendencies, the Slovak agriculture is characterized by differentiation of achieved economic results, regarding the size of agricultural enterprises (measured by the number of employees) and size of agricultural land, the legal form of enterprises and natural conditions.

2. Methodology

The aim of the present paper is to evaluate the development in the categorization of agricultural plots by the regional differentiation of Slovakia at the NUTS IV level (districts) and draw attention to probable development of differentiation of districts in primary agricultural production in Slovakia, while ensuring the sustainability of the economic performance of the given sector and create a spatial map of less-favored areas (LFA) at the district level.

Delimitation of less-favored areas (LFA) is determined according to the criteria of Regulation (EC) No. 1257/1999; Article 16-21 with taking into account the natural, economic and demographic conditions of the Slovak Republic. The basic unit for the inclusion of agricultural land to mountain and other disadvantaged areas is the municipality; into the areas with specific disadvantages the cadastral area and into areas with environmental restrictions it is territory called NATURA 2000. At inclusion of the district among districts with worse natural conditions (LFA) and among districts with better natural conditions (NON-LFA), we conducted the expert overlap of individual territories and the prevalent area has become a guiding solution for the inclusion of the district.

The present highly specialized issue fills a gap in the area of the examination for the reporting period, which was specific by the integration processes associated with entering the Slovak Republic to the European Union. We assume that natural and climatic conditions have a dominant influence on achievable productivity and economic efficiency of the agricultural entities in ensuring the sustainability of the economic performance of agriculture in individual regions of Slovakia. This analysis confirmed our assumption.

The starting point for the realization of analysis was processing of the relevant selected results of operations of business entities working the soil for a longer period of time. Anonymised data were summarized for individual districts of the Slovak Republic, while they monitored the available data for the period from 1998 to 2008. The economic and financial indicators of primary agricultural production for the monitored period were analyzed from the data of agricultural enterprises. These data were ensured by the Ministry of Agriculture of the Slovak Republic in the form of Information sheets and they were obtained from company Radela, Ltd. The evaluated file included 2509 subjects of legal and natural persons with up to 19 even over 20 employees. The information sheets capture data from agricultural enterprises which cultivate 81.3% of the area of utilized agricultural land of Slovakia (1,930,570 ha) and form a set which is not exhaustive, so some results may have a particular validity for evaluation analysis.

The analysis processing was realized in a computer program STATISTICA, NCSS and SYSTAT. For cluster analysis were selected the following parameters: costs, added value, yields with subsidies and subsidies. The data of these parameters represented the cumulative values for selective entities of the individual districts for ensuring of comparability over time (in individual years, the different number of entities from the district was involved in the selection) and in the space (the individual districts are not homogeneous units, since they also differ in size) and so the monitored parameters were converted to the level parameters. The conversion was carried out on 1 ha of agricultural land, the permanent worker and unit labor costs. The mutual combinations of the original four parameters with three recalculated parameters were obtained by a total of 12 parameters, which formed the criteria for cluster analysis (Yields with subsidies / Number of employees; Yields with subsidies / Wage costs; Yields with subsidies / Acreage of agricultural land; Subsidies / Number of employees; Subsidies / Wage costs; Subsidies / Acreage of agricultural land; Costs / Number of employees; Costs / Wage costs; Costs / Acreage of agricultural land; Added value / Number of employees; Added value / Wage costs; Added value / Acreage of agricultural land).

The quality of the clusters, respectively their degree of credibility is assessed using a variety of techniques, which are based on two criteria - cophenetic correlation coefficient (CC) and delta parameter (Řezanková *et al.* 2009).

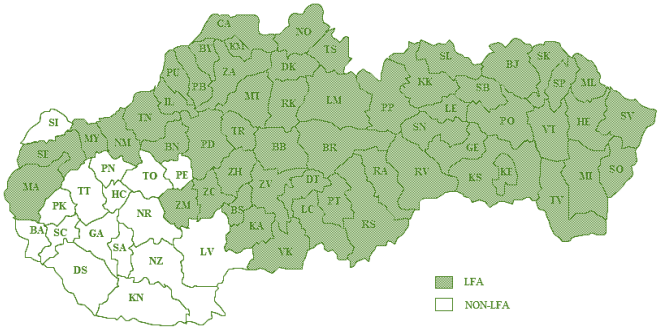
3. Case studies

The agricultural production in Slovakia is realized in different natural conditions, which are one of the crucial factors of the different economic efficiency. This fact significantly affects the production orientation as well as efficiency of production. On the basis of soil and climatic conditions, such as categories of soil, soil type, soil depth, graininess, altitude, exposure of the soil blocks, as well as climatic conditions (average annual temperature, annual rainfall, wind) and many others, the Slovak territory is divided into areas with better natural conditions (productive areas) and areas with worse natural conditions (LFA) (Chrastinová and Burianová 2012).

We distinguish three basic types of disadvantaged areas: 1. mountain areas, 2. other disadvantaged areas and 3. Areas with specific disadvantages. Agricultural soil classified in mountain areas is located at an altitude of 600 m and in combination with high slope also at lower altitudes. Farming in mountain regions is very limited due to the short growing season and low annual average temperatures. Here is applicable mostly an extensive type of farming and production is more oriented to livestock than crop production. Other disadvantaged areas are characterized by low profitability of their soil. The areas with specific disadvantages are located there, where are waterlogged soil, extremely dry soil, skeletal soil, soil of the flysch zone and less productive soil (Buday and Vilček 2013).

On the basis of methodology and the expert judgment of individual territories was created spatial map with worse and better natural conditions at the NUTS IV level (at district level), which shows the following Figure 1.

Figure 1. Specialized regionalization of Slovakia according to natural conditions suitable for agricultural production at the NUTS IV level



Source: Own processing

where: Bratislava I (BA1), Bratislava II (BA2), Bratislava III (BA3), Bratislava IV (BA4), Bratislava V (BA5), Malacky (MA), Pezinok (PK), Senec (SC), Dunajská Streda (DS), Galanta (GA), Hlohovec (HC), Piešťany (PN), Senica (SE), Skalica

(SI), Trnava (TT), Bánovce nad Bebravou (BN), Ilava (IL), Myjava (MY), Nové Mesto nad Váhom (NM), Partizánske (PB), Považská Bystrica (PB), Prievidza (PD), Púchov (PU), Trenčín (TN), Komárno (KN), Levice (LV), Nitra (NR), Nové Zámky (NZ), Šaľa (SA), Topoľčany (TO), Zlaté Moravce (ZM), Tvrdošín (TS), Žilina (ZA), Bytča(BY), Čadca (CA), Dolný Kubín (DK), Kysucké Nové Mesto (KM), Liptovský Mikuláš (LM), Martin (MT), Námestovo (NO), Ružomberok (RK), Turčianske Teplice (TR), Veľký Krtíš (VK), Zvolen (ZV), Žarnovica (ZC), Žiar nad Hronom (ZH), Banská Bystrica (BB), Banská Štiavnica (BS), Brezno (BR), Detva (DT), Krupina (KA), Lučenec (LC), Poltár (PT), Revúca (RA), Rimavská Sobota (RS), Stará Ľubovňa (SL), Stropkov (SP), Svidník (SK), Vranov nad Topľou (VT), Bardejov (BJ), Humenné (HE), Kežmarok (KK), Levoča (LE), Medzilaborce (ML), Poprad (PP), Prešov (PO), Sabinov (SB), Snina (SV), Spišská Nová Ves (SN), Trebišov (TV), Gelnica (GL), Košice I (KE1), Košice II (KE2), Košice III (KE3), Košice IV (KE4), Košice - okolie (KS), Michalovce (MI), Rožňava (RV), Sobrance (SO).

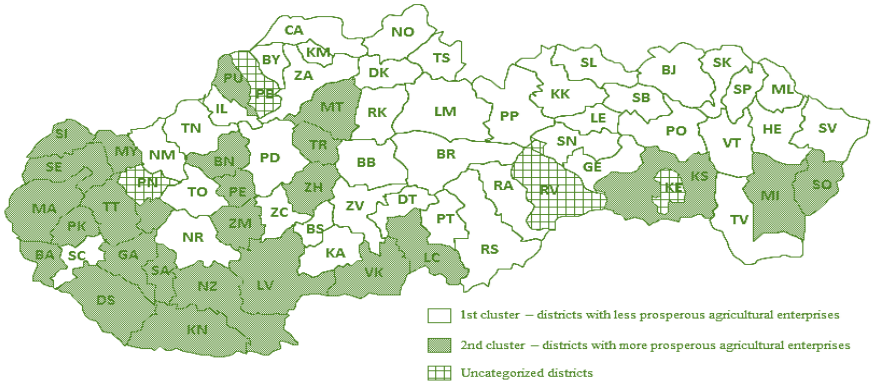
On the basis of the conducted analysis, we can summarize the distribution of districts into two large and many numerous clusters. Other clusters contain from one to two representatives (through verification analysis via k-means clustering with a pre-defined number of clusters 6). The number of representatives in other clusters corresponded with a given analysis and the distribution of districts into clusters with the exclusion of extreme low numerous clusters is content of Table 1.

Table 1. The inclusion of districts to the resulting clusters

Cluster	The representatives of cluster	Number of members	The most appropriate representative
1.	BB, BJ, BR, BS, BY, CA, DK, DT, GL, HU, KA, KK, KM, LE, LM, ML, NM, NO, NR, PD, PO, PP, PT, PU, RA, RK, RS, SB, SC, SK, SL, SN, SP, SV, TN, TO, TS, TV, VV, ZA, ZC, ZV	42	KA
2.	BA1, BA2, BA3, BA4, BN, DS, GA, HC, IL, KN, KS, LC, LV, MA, MI, MT, MY, NZ, PE, PK, SA, SE, SI, SO, TR, TT, VK, ZH, ZM	29	GA

Source: (Own processing.)

Figure 2. The groups of districts with more and less prosperous agricultural enterprises in Slovakia



Source: Own processing

In the analysis of selected economic indicators for the monitored period 1998 – 2008 using the methods of cluster analysis, we can conclude that the best companies were included among group of districts of the second cluster. The most appropriate representative was represented by a set of enterprises situated in the district of Galanta (GA).

A group of districts of first cluster represents the districts with less economically prosperous enterprises, where we found the most appropriate representative in the district Krupina (KA). The inclusion of agricultural enterprises into groups of districts with more and less prosperous agricultural enterprises in Slovakia is shown in Figure 2. On the basis of the conducted analysis can be clearly defined two relatively contiguous areas in Slovakia (at the level of districts), which are characterized by differences in achieved indicators of the productivity and

economic efficiency. The districts of 1st cluster achieved quantitatively higher mean values than the districts of 2nd cluster in only three parameters from all monitored parameters of clustering. In all monitored cases, it was a ratiometric indicator with subsidies (subsidies to worker, subsidies to wage costs, subsidies to acreage of agricultural land). At 12 ratiometric indicators (on the basis of which the analysis was realized) were three variables with parameter "subsidies" in the numerator, and thus the entities working the soil in districts of 1st cluster cashed usually always much direct support calculated per unit in all ratiometric indicators of subsidies. In general, it can be stated that the districts of 1st cluster (in addition to a higher average level of support in all relevant indicators of subsidies) are concentrated in the northern part of the territory of the Slovak Republic. The higher value of the indicators so can be directly related to worse natural, climatic or production possibilities of the territory, which are compensated by increased direct support of the entities of a given territory. In all other monitored ratiometric indicators, the agricultural entities of districts of 2nd cluster achieved better mean values than the entities of districts of 1st cluster.

The results lead to the conclusion that the entities at districts of 2nd cluster receive the lower direct support in the form of subsidies, but they compensate it by higher economic performance in all other parameters. The natural-climatic conditions determining sustainable production capabilities of the territory are a global indicator, which in our opinion essentially indicates the affiliation of districts into relatively homogeneous cluster (based on the pattern of the dendrogram and parameters of tightness of dendrogram transhipment), due to the fact that there were the entities of districts with a heterogeneous set of microeconomic indicators (at NUTS IV level). A group of districts of 2nd cluster is composed mainly of representatives of agricultural enterprises of districts of southern Slovakia, thus from the districts with better production conditions (Adamišin *et al*. 2015, Adamišin and Kotulič 2013).

Conclusion

While ensuring the sustainability of economic performance of agriculture in the Slovak Republic, the land market will play an important role. Currently, the land market seems to be unbalanced and characterized by a large aggregate supply of the land of a large number of residents who do not intend to continue with farming on the soil. It is the offer mainly of the urban population (Kotulič 2006, Kotulič 2007). Due to the impossibility of complet identification of land, the land market is realized in large part in the form of lease relationships. The sale and purchase of land is restricted to building land and gardens. More recently, it can be seen an increased demand for land, respectively after obtaining the land for rent. In the future, we can expect interest in the purchase mostly small and very small land with a view of expansion of small farms (gardeners, cottage owners, etc.). The land market will evolve toward rental of land by natural persons and the State (Slovak Land Fund).

Natural and climatic conditions are an important factor determining the sustainable economic performance of entities working the soil. The entities of districts of 1st cluster are unable to achieve economic performance of the entities of 2nd cluster (of course to the exceptions). It is not possible to identify the factors of economic success of agricultural enterprises which could be stimulated (or inhibited) with only targeted human activity. Other factors have a direct impact on the economic performance and efficiency to a limited extent, but this does not mean that we should deal with them. For example, the effective management of the agricultural entity even in worse weather conditions can be a good inspiration not only to other companies in the neighborhood. The validated effective elements in the management could be applied in entities operating in better conditions and so can contribute to an even higher economic performance of the individual entities or agriculture as a whole (Adamišin *et al.* 2015, Adamišin and Kotulič 2013).

In the case of radical liberalization of trade in agricultural commodities will be districts with better natural conditions placed at the forefront in ensuring the sustainability of the economic performance of agriculture in Slovakia.

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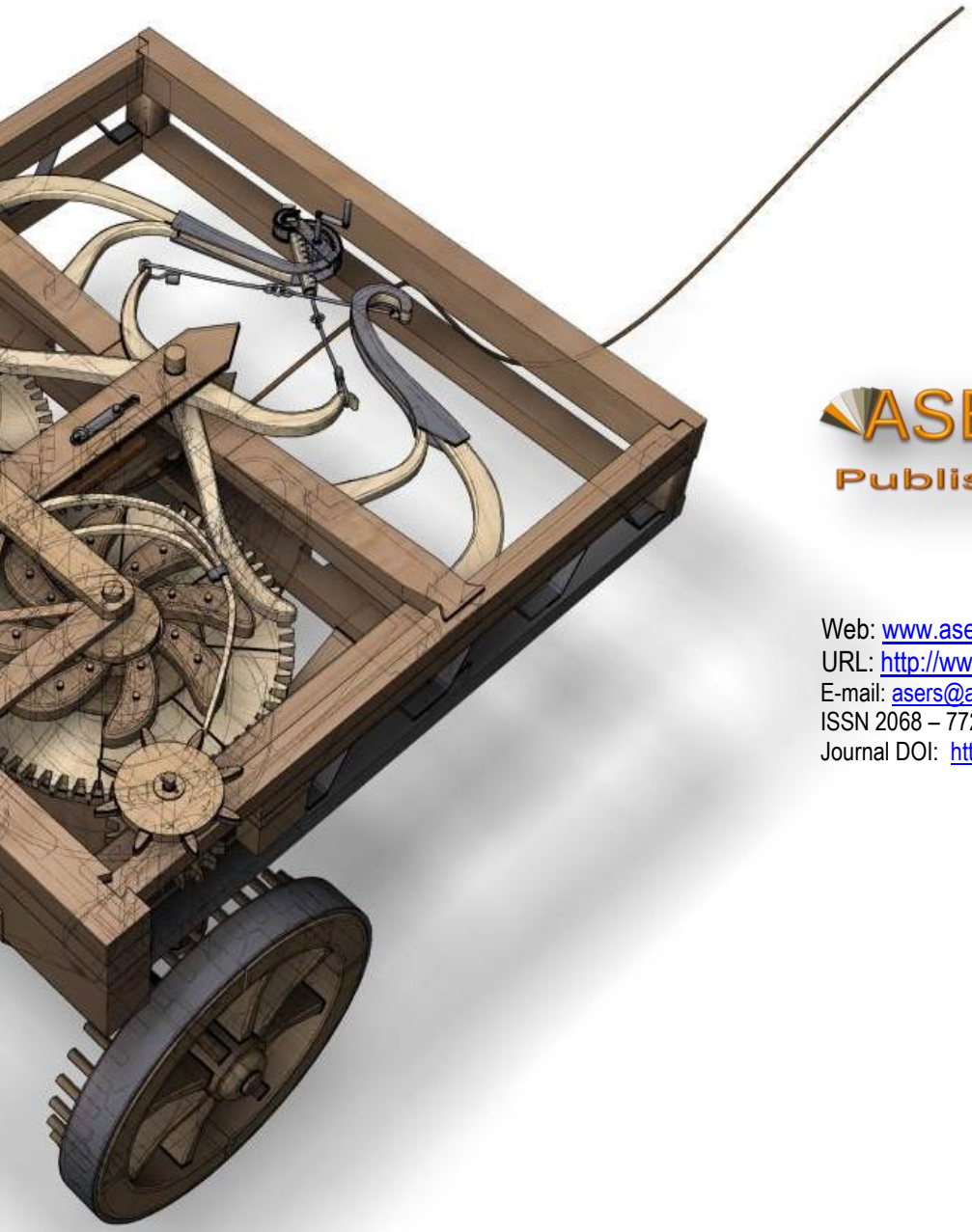

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