Cadastral Survey in the Process of Modernization and Actualization of the Croatian Cadastre System and it`s Adjusting with Land Management Register

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Key words: Digital cadastre, Land management, Cadastral survey, Cadcom Ltd.

SUMMARY

Inthe last decade countries in transition note increase of the real estate market, a trend which has not bypassed Republic of Croatia. Mentioned trend Croatian cadastre system welcomed with real estate records which in a particular area dates backto the time of the Austro-Hungarian Empire and graphical methods of land surveying.
Conditions inmost cadastral municipalities has not been updated for more than 150 years and the divergence between cadastral system and land management register became a regular occurrence. For more than a few cadastral municipality land management register has never been established.
All that resulted with the inability for fast implementation of economic projects (e.g. European Union stimulating funds), difficulties in handling real estate transactions, large number of illegal buildings, etc.
In order to regulate the situation in the real estate registration and modernization of land administration in Republic of Croatia, State Geodetic Administration and Ministry of Justice in cooperation with the local authorities started withcadastral surveys of cadastral municipalities.Cadastral survey has been proved to be an effective tool in the process of modernization and actualization of the Croatian cadastral system and its adjusting with the land management register. Republicof Croatia plans to continue with renewal and modernization of the Croatian cadastre system with the goal to develop an efficient real estate market.
The process of cadastral survey is described in the examples for cadastral municipality Sali and Božava, projects which lasted for a period from 2011. to 2013. and where the last survey was done in the 19th century.

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1. INTRODUCTION – CONDITIONS OF CADASTRE AND LAND MANAGEMENT

Since Croatia gained independence State geodetic administration (SGA) was faced with the problem of its historical heritage (Figure 1) in the form of cadastral system that doesn´t match with the real situation in the field and with the land management register.
Establishment of cadastre and land management register throughout history took place at different times and under different conditions because some parts of Croatian territory were under the authority of different countries. Because of that, features of cadastre and land registers were changed in accordance with the historical events. Each state form brought their own rules and regulations for keeping and updating cadastre and land register and their content.

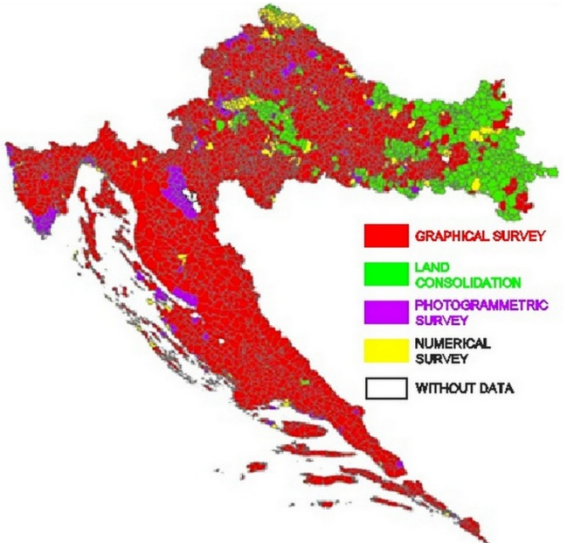

Figure 1. Cadastral heritage after gaining independence (Barišić, 2010.)

The existing cadastral data differed according to the time in which they were made, and therefore in the methodology of createing cadastral maps (reliability and accuracy of data), the scale of the display, etc. At that time condition of the existing data could be divided in relation to the period of origin on:

–Austro-Hungarian cadastre – data from that period were made after proclamation of the Imperial Patent in 1817. ordering surveys, land classification, and preparation of the cadastral record in all lands of the Empire. For Croatian territory surveys lasted from 1818 until 1884, and it was split in four projection systems: Viennese, Krim, Kloštar-Ivanić and Budapest. A unit of length was 1 hvat, for the surface 1 square hvat (1sqhv = 3.59 m^2) while the scale of cadastral map was 1:2880. For Dalmatian area scale of cadastral map was calculated so they could eliminate error caused by triangulation and

it was 1:2904. Surveying was performed using plane table method, and since the cadastre was made for tax purpose, land with lower income was measured with less attention and accuracy. Buildings were not subject of taxation, so they were measured approximately, and within dense settlements were displayed almost schematic.
– Yugoslavian cadastre – organization responsible for cadastral services decided to perform cadastral survey for areas that were not covered by any survey, and after for areas that had Austro-Hungarian cadastral survey. As the Croatian territory was included in the Austro-Hungarian survey in the beginning there was no cadastral offices and consequently noeffective maintenance of existing cadastral register. First land consolidations started in the 30s of last century, most of them were made in the 60s and 80s of the last century, and were continued till 90s with the total coverage of slightly more than 10% of the territory of Croatia. Except land consolidation, numerical and photogrammetricmethods of surveying were also used for production of cadastral register but the total area measured using these methods is modest in it`s size.

On the other hand, although the land management register was established in the 19th century basingon graphical cadastral survey during the Austro-Hungarian Empire, in the period between the first and second world war was poorly maintained. In last polity with the system of social ownership, role of private property and indirectly land management register was systematically ignored for half a century. In addition to that with tax legislation there was prohibition of registration and transfer of property rights without prior tax payment. To avoid paying taxes new owners weren`t enrolling their rights in the land management register.
SGA and Ministry of Justice (MoJ) recognized that poor condition and lack of promptness in land administration brings immeasurable losses for individuals, companies, organizations, local governments, in fact to economy and society as a whole. A common conclusion was that actualization and modernization of land administration is the investments that costs money, but ultimately brings benefit in many respects.

1.1 Process of Transformation

The process of transforming land administration began with the adoption of the Law on land management register in 1996 and the Law on state survey and real estate cadastre in 1999. Existing cadastral register which was founded by former regulations for each cadastral municipality will remain in force and shall be conducted in the existing content while it is being replaced with a new register.
It was decided to continuewith Germanic approach of managing land administration. Cadastre will offer data about parcels, buildings and other structures and their features. Rights on real property registered in the cadastre will be registered in land books.
In addition to regular activities and a number of bilateral projects, certainly one of the most important parts of the transformation process was “Real Property Registration and Cadastre Project“ funded by a World Bank loan, European Union grants and RoC State budget funds, with the primary objective of building an efficient land administration system in order to develop an efficient real estate market. The project called "Organized Land" was launched in 2003, the estimated duration of the project was five years, and given the importance of reform and excellent results was extended till the end of year 2010. (URL)
The World Bank has decided to continue with the support of this important reform and has

approved loan for the new project, which started in late 2011 with planned project duration of 4 years.

Process of transforming the land administration consists of several stages, and one of the first phases was to transform cadastral and land management data from analog to digital form. By the middle of 2010 in the Central database was stored cadastral plans for 98% of cadastral municipalities in the Republic of Croatia (Figure 2) and was transcribed and verified 99.4% of land management register data (Figure 3). Cadastral and land management register are now operating and are maintained in digital form. Although this process has increased tenfold efficiency of administration which was the purpose of digitalization, the quality of the data remained the same.

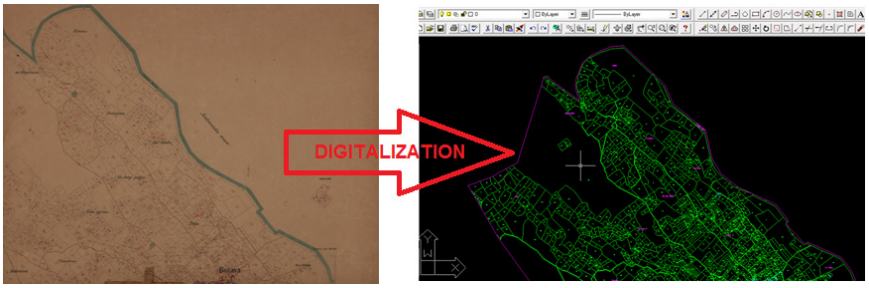

Figure 2. Origin and product of digitalization process of cadastral maps and land administration register data

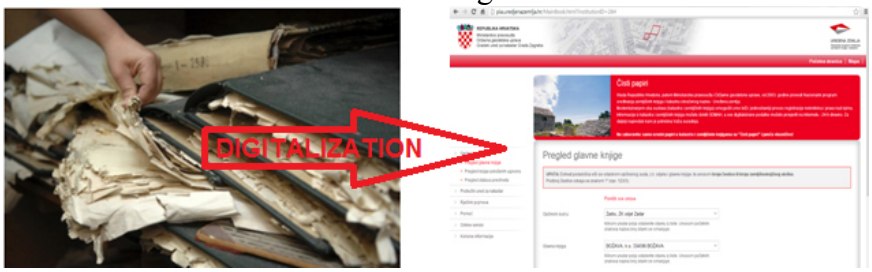

Figure 3. Origin and product of digitalization process of land management register

Process of modernization and actualization of the Croatian cadastral system and its adjusting with the land management register so they could reflect the real situation in the field was done and still is working in the following ways:

– Cadastral survey – ensures harmonized cadastral and land management data which represents real situation in the field

– Technical reambulation– limited collection and processing of data with the same purpose as the cadastral survey

– Individual transformation of cadastral parcel

Cadastral survey is the process of collecting and processing all necessary data in order to form cadastral parcels, record buildings and other structures, note special legal rights in the field and the land use, in the purpose of making new cadastre of real estate. (Law NN 16/07)

Technical revision is done while comparing the cadastral map with ownership registers and digital orthophoto is established that for a maximum of 30% of cadastral parcels need new survey. On the other side cadastral survey is done when the result of the comparison is that more than 30% of cadastral parcels need new survey.

Since the implementation of the cadastral survey or technical reambulation is needed in the most cadastral municipalities priority have been given to cadastral municipalities of greater interest (municipalities on the coast and near the border). The decision to start new cadastral survey or technical reambulation brings SGA in agreement with the MoJ. Selection of contractor is based on the lowest offer through procurement procedure.

2. CADASTRAL SURVEY

After selecting a company that will perform the works on new cadastral survey, contractor and investor signed a contract for the term of 24 months in which contractor agrees to finish all work.
Company Cadcom Ltd. in the year of 2011 started work on 2 new cadastral surveys, first for cadastral municipality of Božava and second for the part of cadastral municipality of Sali. Both municipalities are located on Long Island in the County of Zadar.
Last cadastral survey for municipalities, which were subject of, works date in the time of Austro-Hungarian monarchy. They were measured with graphical methods of survey and have scale of cadastral map 1:2904. Figure 4 is showing area of survey with certain characteristics of cadastral municipality.

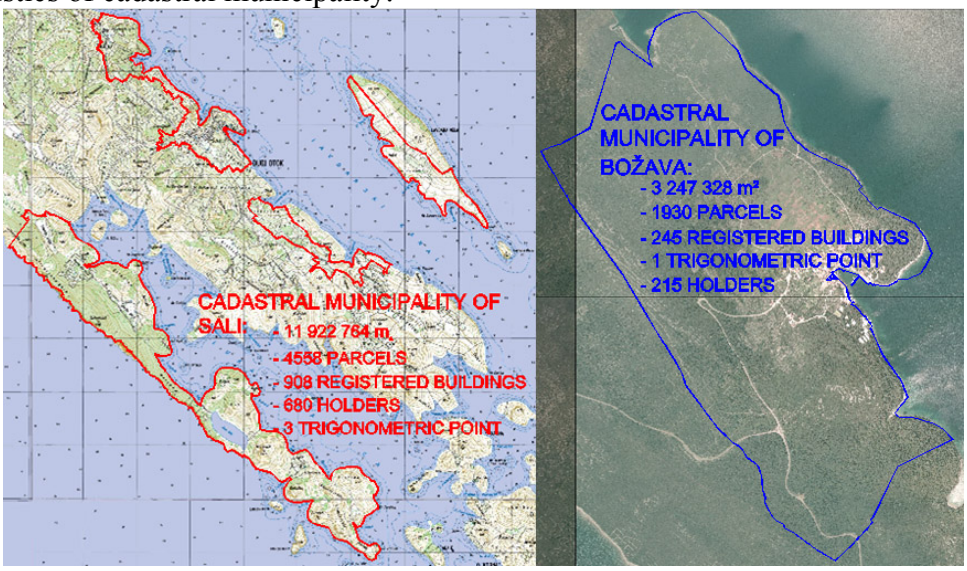

Figure 4. Area of survey, for Sali on the left and Božava on the right

Investors of the work defined that geodetic supervision will be one person from Head office of SGA and one person form Regional cadastre office of Zadar. Their task is to control that all phases of cadastral survey are performed in accordance with the prescribed laws and regulations.
About the beginning of new cadastral survey, all owners and holders and all interested parties shall be notified by publication in the NN and in local media.

2.1 Field Phase - Data Collection

In the preparation phase of field works all the available originals such as digitized cadastral map, evidentiary lists, topographic maps etc., were used. With using octocopter we

madedigital orthophoto (DOF) and digital terrain model (DTM) exclusively for the purpose of planning field works.
DTM and DOF are providing insight into the configuration of the terrain, building densities, which surfaces are cultivated and which are under forest, etc. Based on these data survey methodology of individual parts can be determined. Also it is possible to define a plan of parcels identification, make a preliminary design of geodetic points network (with control on the field) and at a later stage of works it could be used as a control of measurements. Figure5 is showing an example of model used for planning field activities.

Figure 5. Model of Božava used for planning field activities

After having a defined plan of works on the cadastral survey, "citizens' gathering"was organized at which all interested parties were acquainted with the defined plan of works, and the obligations that they have as holders or holders representative.
According to a defined plan of parcels identification official notice to join the identification of their property were sent to people evidenced in available evidentiary lists. Instructions how to properly mark property boundaries were sent as a part of notice with few other leaflets. Since available evidentiary lists in a certain percentage does not match with the real situation, people have been informed about works through notice boards or in a Field Office that was opened for the needs of cadastral survey in the Municipality premises. Because of the poor connection between island and mainland terms of identification were held from Friday to Sunday so due to business obligations less people would be prevented in their presence. Official notice about terms of identification were sent at least 20 days in advance so people could prepare on time. For people who weren`t able to be present at the time of identification, spare terms were enabled but only with appointments in advance.
Simultaneously, work started on establishing geodetic points network, which will be used during the measurement and for subsequent maintenance of cadastral municipal documentation. Methods of point stabilization, density, methods of measurement and accuracy of geodetic network are prescribed by the "Regulations of the cadastral survey and technical reambulation". Establishment of the geodetic network started after Central Office of the SGA approved the preliminary design of network. All geodetic points were permanently

stabilized, and their coordinates were measured using satellite measurement methods (except "high point" which is measured using terrestrial method). Prescribed accuracy of geodetic points established for the cadastral survey is between 2-5 cm horizontally and vertically.
Identification of cadastral parcels was done according to a predefined plan in way that the area of the project is divided in the groups. The size of groups depended on the density of cadastral parcels, configuration of the terrain and whether it is inhabited or not inhabited part of the project area. Figure 6 is showing an example of dividing area in the groups with the each term of parcels identification.

TIME SCHEDULE			
Group NO	Date	Day	Time
	17.11.2011	THURSDAY	/
1,2	18.11.2011	FRIDAY	10.00-13.00
3,4	18.11.2011	FRIDAY	13.30-16.30
5,6	19.11.2011	SATURDAY	09.00-12.00
7,8	19.11.2011	SATURDAY	13.00-16.00
9,10	20.11.2011	SUNDAY	08.00-11.00
11,12	20.11.2011	SUNDAY	13.00-16.00
	21.11.2011	MONDAY	/
	22.11.2011	TUESDAY	/
	23.11.2011	WEDNESDAY	/
	24.11.2011	THURSDAY	/
13,14	25.11.2011	FRIDAY	10.00-13.00
15,16	25.11.2011	FRIDAY	13.30-16.30
17,18	26.11.2011	SATURDAY	09.00-12.00
19,20	26.11.2011	SATURDAY	13.00-16.00
21,22	27.11.2011	SUNDAY	08.00-11.00
23,24	27.11.2011	SUNDAY	13.00-16.00

Figure 6. Divided area in the groups with terms of parcels identification

During the parcels identification, geodetic expert records identified parcles on sketches. Property holders or their representatives prior to the scheduled term of identification were required to mark the points that define the boundary of property with visible permanent markings on the way that was described in the notice and which is defined by the regulations. For each identified parcel person or people who claimed that they are owners and their share in the property were recorded (right of ownership will need to prove in later stage of works). For each property holder following data was collected: ID number, address of residence and contact. If a parcel contains building, geodetic expert is required to ask for the document which proves the legality of the construction, or log illegally constructed building to building inspection if the owner can`t prove the legality of the same. Address of the parcel and possible legal regimes if it exists were also recorded during the identification.
In phase of planning field works it was defined that for cadastral survey of both cadastral municipalities firstly will be performed parcels identification which are located in the inhabited area, second phase will be to identify agricultural area around the inhabited part and in the third phase of identification, area which is untreated and mostly forested. The reason for this organization of work is because for inhabited area is the greatest interest and the response of property holders are high (in the first phase of work has identified almost 100% of the parcels, with response of holders over 80%). Also in these areas, fences mostly define properties so preparatory actions for holders do not require a lot of invested time. The high

response rate in the early stages of work allows geodetic experts to establish direct contact with people whose role in the process of cadastral survey is crucial for the quality execution of the task. In this way in the early stages of work, people are provided with additional clarification regarding the process and any lack of clarity is eliminated. In other phases of work response of people and the percentage of labeled property was slightly lower, but still higher than expected (over 50 %).
After process of parcels identification is finished and all necessary information has been collected, geodetic surveyors can start with process of measuring marked property boundaries, constructed buildings and recording of land use.
The maximum allowed deviation in a measurement are 0.1m for inhabited area, 0.2m building land outside the built up area, and 0.4m for the remaining land. During the survey following methods of measurement were used:

–terrestrial methods for part identified in the first phase of works that included inhabited area

–combination of photogrammetric and satellite methods for part of the project identified in the second phase of work. In order to use photogrammetric methods people additionally had to mark the boundaries with waterproof paint.Since the period between first and other phases of work was more than two months people have had enough time to prepare.

–combination of photogrammetric and terrestrial methods for part of the project identified in the third phase of works, which includes upland, untreated and mostly forested terrain.

Photogrammetric method of surveying was done on a model that was developed as part of the process of developing the DOF and the DTM. In the process of cadastral survey prescribed regulations are defined by making DTM and DOF with 10 cm resolution. Aerophotos were produced in late winter just before flourish of vegetation.

2.2 Office Phase - Processing of Collected Data

At this stage of the works data collected in the field is processed and are preparing for the process of Public review.
Attributes that define them are added to all collected field data, so for example each measured point is uniquely defined by it`s number, type, method of origin and with the way of stabilization. Similar is with property holders who are defined with ID number, address of residence and contact number.
Preliminary design (PD) of numbering the parcels, also PD for division of the cadastral maps on detailed sheets and PD for division of measurement sketches are submitted for review to SGA.Also as part of the survey were included in the determination of the maritime domain and the contractor was required to prepare a "Proposal of maritime domain" which needs to be approved from "Department of Tourism and Maritime Affairs" of Zadar county.
Digital cadastral map (DKP) is made according to the prescribed specifications.With topological processing of DKP following data on cadastral parcels are obtained: the number of parcel, surface and the way of use, address of the parcel and from which parcels of old survey has formed a new one. These data combined with a holder's database is used to create evidently lists and supporting registers that are used in the process of Public review. As an

addition to the evidently lists and supporting registers contractor made sketches of measurement by which holders on Public review gain insight into the measured situation. In case of disagreement with the measured situation they may give their objections.

2.3 Analysis of Cadastral Survey

Contractors finished all the actions in the designated period of 24 months. Figure 7 is showing the chronological sequence of all actions on the cadastral survey made on Long Island.

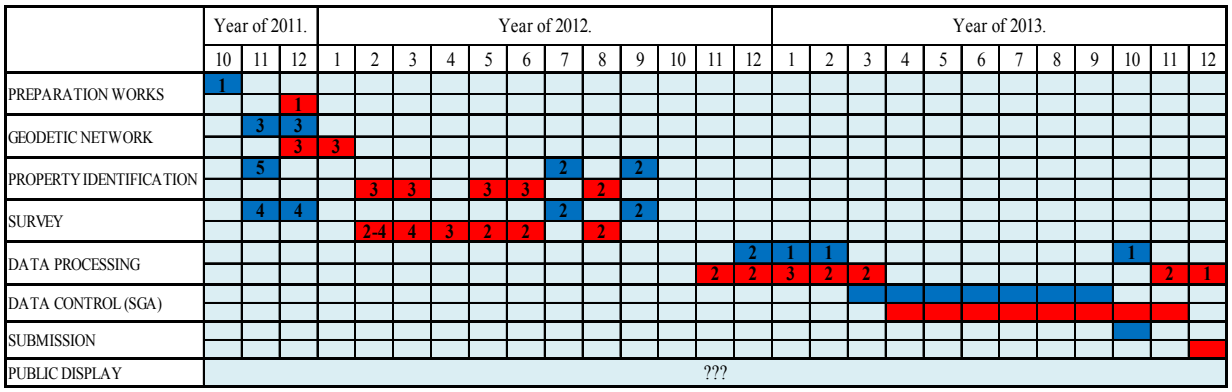

Figure 7. Chronological sequence of all activities on CS Božava(blue) and CS Sali(red)

In the figure blue highlighted cells indicates activity on cadastral survey of Bozava and red one activities on cadastral survey of Sali. Number inside highlighted cells is related with number of geodetic experts who participated in that phase of the task. The sequence shows that the field phase of the work took part in half of the designated period, and the other half was office phase and data control data.

Total measured area is 1599 ha. Terrestrial and satellite measurement methods were used for 40% of the area, while photogrammetric and other methods of survey were used for 60% of the area.

	Cadastral municipality of Sali			Cadastral municipality of Božava		
	Austro-Hungarian survey	New survey	diff. [%]	Austro-Hungarian survey	New survey	diff. [%]
AREA OF THE PROJECT [ha]	1192	1270	6,5	325	328	0,9
NUMBER OF PARCELS	4558	5813	27,5	1930	2506	29,8
NUMBER OF OWNERS	941	1476	57,0	215	260	20,9
NUMBER OF REGISTRED BUILDINGS	908	1965	216,4	245	376	53,5
POINTS IN GEODETIC NETWORK	3	67	/	1	20	/

Table 1. Contet of “old” and “new” cadastre for CM Sali (left) and CM Božava(right)

Table1 is showing that the content of previous and future cadastral register in higher percentage differs in that part which mostly depends on holders, and that the changes that

were made on the field were not updated in the official registers.

2.4 Public Review

After the contractor has collected and processed all the necessary data for cadastral municipal documentation, in the process of public review this data becomes official. In the process cadastre and land register commissions jointly conduct a public review procedure by inviting persons who are recorded in the evidentiary list as holders. The persons participating in the public review may give their objections as to the status recorded on the basis of surveys and the corresponding commission is obliged to consider all objections. People who claimed that they are property holders during the fieldwork need to prove their right to land registrar commission.
During the survey, the land registry clerks produce new land registration files containing the data on cadastral parcels and titleholders and reflecting the actual situation. After the production of all files for the cadastral municipality where the survey has been conducted, the MoJ passes the decision on opening a new land register and closing the old register. At the same time, the SGA Head Office passes a decision to start using the new cadastral municipal documentation as official, after which the process of new cadastral survey is officially finished (Final Project Report, 2010).

3. CONCLUSION -IMPACT ANALYSIS OF NEW CADASTRAL SURVEYS AND THE "PROJECT" IN GENERAL

Process of cadastral surveys is required activity forestablishing harmonized land administration registers, which are the reflection of actual situation in the field.
According to Final Project Report of "Real Property Registration and Cadastre Project" till September of 2010 total of cadastral municipalities with harmonized data were 2.63%, 2.00% of cadastral municipalities were in process of Public Display and4.36% of cadastral municipalities were in process of survey. The report also states that the administrative bodies responsible for land administration reduced backlog of cases, increased efficiency and reduced their costs.
According to "Real Estate Market Study in the Republic of Croatia"of December 2009. The effects of finished new cadastral surveys on the level of local government units are noticed on budget funds of local government units, zoning and town planning, communal activities, investment and economic potential of the unit, maintenance of land administration and the quality of service, satisfaction of end users, etc.
For these reasons, activity of SGA and the MoJregarding modernization of land administration and raising the quality of services, which consequently results in the modernization of society as a whole, is logical and justified.
The only remaining question is whether or not it will continue to be recognized by those who provide financial resources.

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BIOGRAPHICAL NOTES

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During the college he got Dean's award in 2008 for his work: "Alternative way of studying – using interactive and multimedia concepts".

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