POSSIBILITIES TO AUTOMATIZE THE PROCESS OF ELABORATION THE CADASTRAL DOCUMENTATION

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Abstract: *The paper emphasizes a few possibilities that topographer can utilize for automatization of the elaboration process of cadastral documentation. The work means are described exclusively only using the Microsoft Excel software and those which this program works in with Microsoft Word software. The article outlines also viewpoints regarding the automatization of certain topographical calculations concerning parcelling of lands.*

Keywords: *automation, cadastral documentation.*

1. Introduction

The elaboration of the cadastral documentation requires, as we know, to run over a process where a series of annexes have to fill in based on the measurements of land, data about beneficiary or its necessities, etc. The number of annexes has been higher with the change of law. Thus, the order 634/2006 settled the elaboration way of cadastral documentation with 18 annexes. Later, the order 134/2009 modified the 5 and 18 annexes and it asked a supplementary annex, the 19-th. In 2009 the order 415 comes out also with four new annexes from 20 to 23. Finally, the order 785/2011 asked a new annex and the number of annexes is now 24. In this situation, a considerable time is necessary to elaborate with good results any type of cadastral documentation.

An easy analysis of the annexes from order 634/2006 with the next changes and additions emphasizes that we have essentially the following cases:

- annexes where text and numerical data only need to fill in;
- annexes that consist of graphs, text and numerical data (directly completed and on the other hand resulted from calculations);
- annexes that are filled with text and numerical data, the last being result of graphical determinations (annex no. 10).

The idea of automatization of the elaboration or accomplishment process of cadastral documentation begins from a practical necessity and we propose to solve a few important topics as:

- obtainment of a short time for this action;
- ensurance of the correctness in the introduction of data;
- avoidance of the accidental omissions given by routine or other causes;
- elaboration of all pieces from documentation in a unitary way;
- automation of pagination, etc.

In the next pages a few possibilities to achievement this process are outlined.

2.   Utilization of Microsoft Excel software

Microsoft Excel is an extremely useful program with tabular calculation, being used for organization of data, calculation, engendering of reports based on numbers or to create different graphs (Tamaş&Tereşneu, 2009). There are a few facilities that recommend it:

- the simplicity in addition of various graphs at data sets from the worksheet and the different images inside also;
- the possibility of grouping for more commands and actions in macro-instructions, giving a decrease of risk in this way in appearance of application errors;
- the access at VBA (*Visual Basic for Applications*) code associated with this program, by introduction of fineness modifications (Ionescu&Tereşneu, 2011).

In the following paragraphs the way to complete the annexes (and other pieces) specific to dismemberment documentation of a property in many lots is emphasized.

We approach two possibilities to solve the enunciated problem. First refer to getting a work register that in its first sheet enables the introduction of data regarding identity of the beneficiary (fig. 1), address where the work is done and the type of work. In this sheet cells with static data (information that can't be modified at other work) and cells with data that can be taken over other sheets of register (information that can be modified at every work) occur.

BENEFICIAR									
Nume si prenume beneficia	MALUSELU NICOLAE								
	Adresa beneficiar								
Localitate	ZARNESTI								
Strada	DIANA	Numar	-	Bloc	4	Scara	A	Ap	15
Judet	BRASOV								
	Adresa lucrare								
Localitate	BRAN-PREDELUT								
UAT	BRAN								
Strada	PREDELUT	Numar	291A	Bloc	-	Scara	-	Ap	-
Judet	BRASOV								
	Date identificare beneficiar								
CNP/Cod fiscal	1480107085021								
BI/CI		seria	BV						
		numar	488796						

Fig. 1. Introduction sheet of data

In the second sheet annex no. 1 can be obtained. We have to select the page at A4 size with the adequate margins and then the template is filled by direct input. The identifiability data of the beneficiary of work can take using the equal symbol, selection of the page with general data, selection of the adequate cells and by press of *Enter* key. In the fig. 2 we can see that to introduce the name of beneficiary on the formulas bar an utilized for this point relation comes into view (*=Date_Introdus!C12*). The process occurs again to all data from this annex are filled in. A distinct viewpoint is on the heading that assigns the current number of the achieved work. A *VBA* sequence is created and by a meter variable the precedent value is increased with one unit. The cell that indicates the moment of increment with a unit is the one that contains the personal numerical code of the beneficiary. Every change of this parameter causes automatically the modification of the current number of the work. At the beginning of each year when a new register with achieved works is started, we have to reset the meter variable. The annexes no. 3 and 5 are completed in a similar way, with any difficulty because of these simple data that are taken from initial sheet.

To create the annex no. 10 there are data that are brought from the general sheet, but we have situations where different calculations are necessary. It is the case of approximative distances from important objectives of the area. This viewpoint will be explained at the elaboration of the framing map in the area.

Fig.2. Automatic input of annex no.1

Fig. 3. Putting together of the pieces from documentation in one sheet

Concerning the elaboration of location and delimitation maps according to annexes no. 11 and 16 we have to create distinct worksheets where data from general sheet are written or are taken. The *ArcMap* software is used for the graphic part. A heading table is specifically created for every annex by the same rule that was explained at the variant exclusively using Microsoft Excel software: the general (static) data are introduced and the data that have change at every different work, are taken from general sheet. At the table with the position

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below the graphic part we have to proceed analogous with the mention that we have to utilize the formulas for dismemberment of land as the sum of obtained parcels to be equal with initial surface (the case of annex no. 16), and introducing of outline coordinates of each parcel and other specific data of annex no. 11.

Finally, a new worksheet called *Doc_Dezmembrare* (fig. 3) is obtained and it brings together all necessary pieces of this kind of documentation. Distinct sheets are obtained before this stage for all required information of documentation (inventory of coordinates, land book in the variant of annex no. 14, data that were brought with GPS system according to annex no. 15, scanning of various pieces as extract from landed certificate, older maps, etc). In this way the number of pages can get and another header note can be added and one to individualize the work.

Another possibility to automation the elaboration of cadastral documentation using *Microsoft Excel* software is to apply at macros. A *macro* is the result of registration of a series of functions from *Excel*, that is associated with a combination of buttons and one command key optionally, both with the aim to use them in the next series of actions, with other information eventually (Ionescu&Tereşneu, 2011).
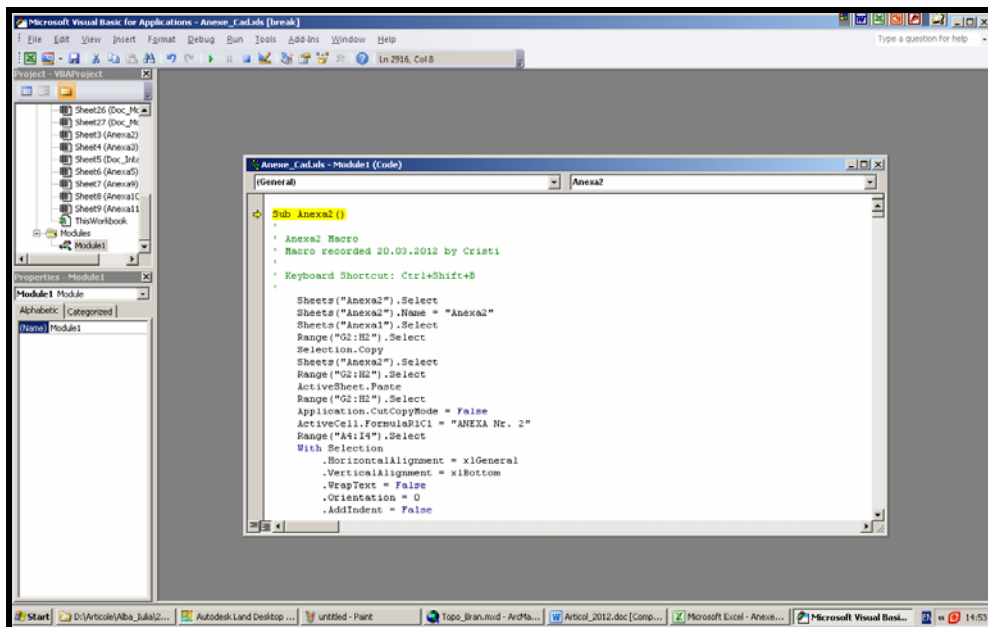

Fig. 4. *VBA* code of a macro to automation the filling of the annex no. 3

3. Mixed utilization of *Microsoft Excel* and *Microsoft Word* software

A much more interesting possibility and helpfully in the same time is to use *Microsoft Excel* software like a file for the data entrance only. This file is connected with other word file by *OLE* facility where we will get the going out data (fig. 5). The *OLE* facility makes possible the relation between data from worksheets or different registers (or between sheets from different software even). In this relation there are active connections and one change of the source brings the modification of destination (Tamaş&Tereşneu, 2009). To create a connection between those two files we have to proceed in this way:

a) We have to open both files (word file with the templates of all anexes and other required pieces for each type of documentation and excel file where the particular data are inputed);

b) In *.xls file, sheet with general data, the cursor is located in the cell that includes the name of the beneficiary of work and *Copy*;

c) We pass in *.doc file, a text area associated to the space of the name of beneficiary, is selected, *Paste Special, Paste link, Formatted Text (RTF), OK*;

d) The b) and c) steps are reiterated for all variable boxes from *.doc file;

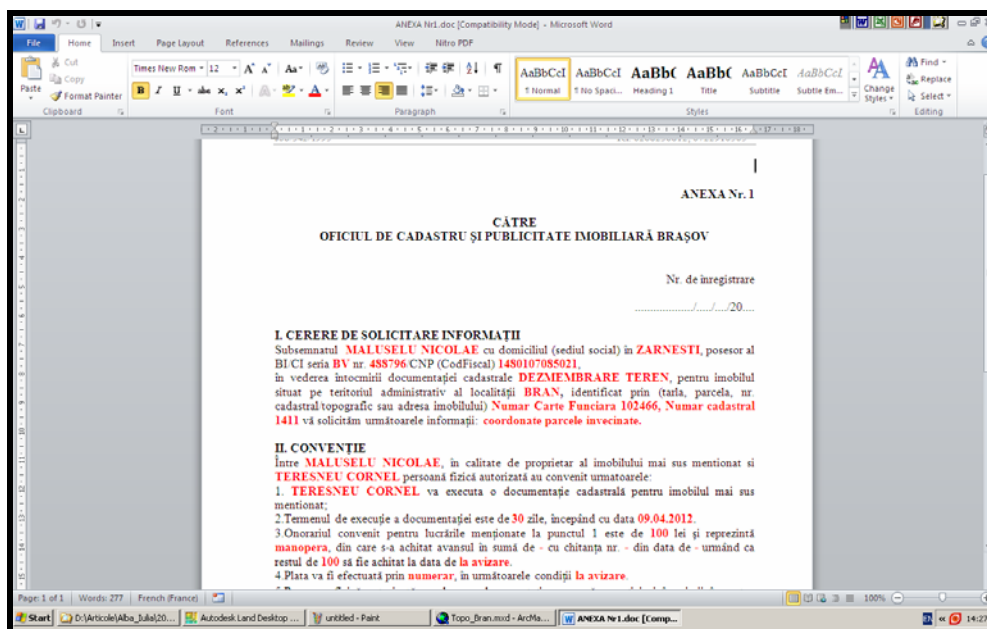e) The *.doc file has to be saved and closed.

Fig. 5. Input of annexes by *OLE* facility

A such of approach becomes remarkable by elegance and homogeneity of the all pieces of documentation. As we know, *Microsoft Word* software being specialized in text editing, can offer many possibilities for the elaboration of the final information: we can individualize header and footer notes with elegance, we can obtain the pagination for all documentation, etc. The problem of graphic part is still unsolved. Those pieces are from the systems where they have been created and they are located in the corresponding pages watching to maintain the correct scale of the maps only. This tandem of the word and excel files is copied every time in the new folder and at the opening of word file we have to accept always the variant with bringing up-to-date of the connection with excel file.

4. Utilization of GIS software for automatization of the elaboration process of the pieces with graphic data

In the mentioned case of the way for automatic input of dismemberment documentation the next pieces with graphic data exist:

- Annex 16 – Location and delimitation plan with the proposal of dismemberment;
- Annexes 11 – Location and delimitation plan for each new real estate;
- Map of framing in the area – making evident the distances to the nearby most important marks.

About elaboration of annex no. 16 – Location and delimitation plan with the proposal of dismemberment, first, we have to solve the problem of parcelling according with the land. Three categories of known principles will be assumed: cadastral, urbanism principles and

requirement of beneficiary (Boş&Iacobescu, 2007). At the national level we have to work with software products on *Autodesk,* and as we know, *AutoCAD Land* module benefits commands and specific possibilities for parcelling by obliged point (*Swing on Line*) and, parallel parcelling also (*Slide Bearing*) (Tereşneu&Ionescu, 2011). Those that are accustomed to this module, know that using this commands we can't have always the correct result of the size of obtained parcels. Other variant much more comfortable to apply and very secure and accurate is to use *TopoLT* module that bring supplementary costs. By this reason we propose to exemplify an easy method that doesn't require other costs for parcelling of land. A *Scilab* application that is *free,* was created from this point of view. In this language the program for dismemberment of initial parcel in smaller parcels with known size is as it follows (Tereşneu et al, 2009):

```
// Calculul coordonatelor x,y ale unui punct V
//  situat pe o latura a unui poligon V1,V2,...,Vn
//  astfel incat suprafata parcelei V1,V2,...,V
//  sa fie egala cu o suprafata data SP
// i=nr.varf poligon; v=nr.pct.stabilit
// ss=sup.subpoligon ViVpVu; s=ss-sp
// xi,yi,xp,yp,xu,yu=coord.pct.initial,penultim,ultim
// dxup,dyup,dyiu=delta x/y puncte u-p/i-u
  clear; clc;
  n=8;
  xv=[90,160,280,380,400,310,170,100];
  yv=[270,350,360,300,190,110,100,170];
  x=[0,0,0,0,0,0,0,0]; y=[0,0,0,0,0,0,0,0];
  sp=10000;
  st=62350;
  i=1;  v=1;
  xi=xv(i); yi=yv(i);
  while i<n-1 do
     ss=0;
     while abs(ss)/2<sp do
        j=i+1;
        k=i+2;
        if k>n then k=1;
        end;
        xp=xv(j); yp=yv(j);
        xu=xv(k); yu=yv(k);
        ss=ss+xi*(yp-yu)-xp*(yi-yu)+xu*(yi-yp);
        i=i+1;
     end;
     ss=abs(ss)/2;
     disp(" ss=");
     disp(ss);
     s=ss-sp;
     dxup=xu-xp; dyup=yu-yp; dyiu=yi-yu;
     y(v)=(yp*dxup*dyiu-dyup*(xp*dyiu+xi*yu-xu*yi-2*s))/(dxup*dyiu+dyup*(xu-xi));
     x(v)=dxup*(y(v)-yp)/dyup+xp;
     disp(" x=");
     disp(x(v));
```

```
    disp(" y=");
    disp(y(v));
    xi=x(v);  yi=y(v);
    v=v+1;
  end;
```

The particularization of this program can be established very easy modifying the values for: number of the vertexes of polygon, their coordinates, the surface of one resulted parcel and the total area of the parcel that will be dismembered. Keeping the principle of this program, corroborated with the corresponding principles of the parallel parcelling, they become to elaboration in the *AutoCAD Land* module of the specialized commands that can elegantly and safely solve the parceling of land. The facilities of *AutoLis* were utilized for this target (Tereşneu et al, 2009).

Other problem that was automatically solved is the operation to establish the label of outlines of properties with the cadastral or topographic numbers of neighbors. The exemplification is made by *ArcMap* software. We have to work for this in the drawing that brings together all obtained maps by expert in the respective place and adding the received data for the current work from *OCPI* according to the request by annex no. 1. In the *GIS* database we have to create boxes that are keeping the cadastral or topographic number of each parcel. A *VBA* script is created for construction of a polyline using *Rectangle Tool* and this will detour all surface of the studied parcel (fig. 6). When this polyline intersects certain polygons, the crossed arcs will get automatically the labels with the cadastral and topographic number of the sectioned parcel (fig. 7).
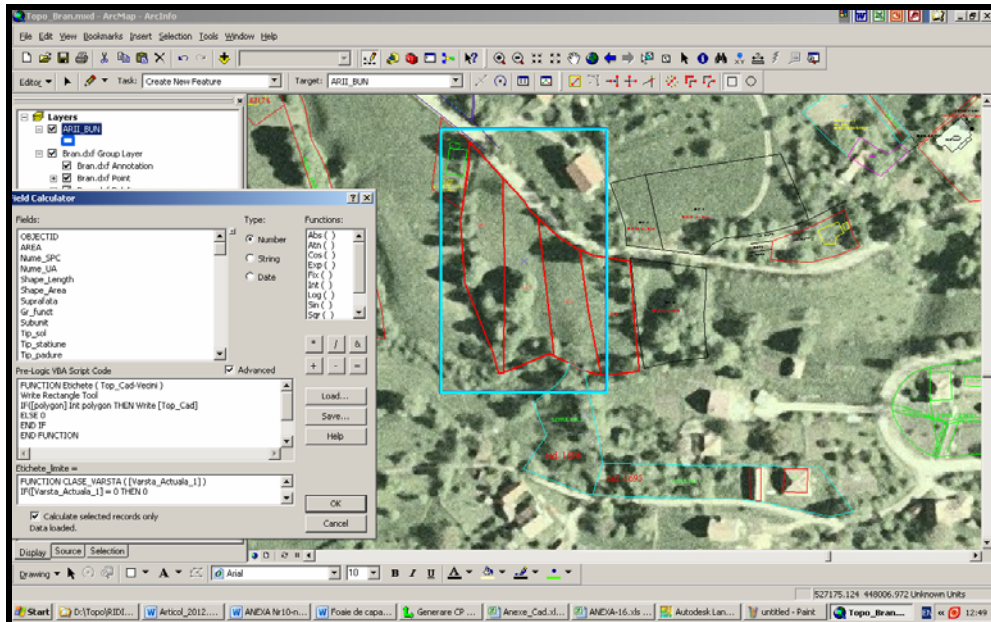

Fig. 6. *VBA* script for the automatically establishment of labels at the neighbors in *ArcMap*

Another important viewpoint is to elaborate the map of framing in the area. This can give a general orientation of the parcel in the large space of studied UAT (or of the respective place) and certain evident marks also and the distances from this. To solve this, a *VBA* script is created and it can perform next actions:

- identifies the certain parcel;
- finds its center of weight;

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- finds the most 3 known points (fig. 8). Those can be points from the national geodesic network or other marked points by user in the corresponding layer. The materialization can get specifying the name of the point and its coordinates using *Sterographic 1970* system;
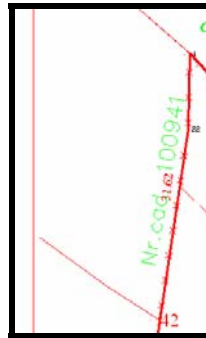

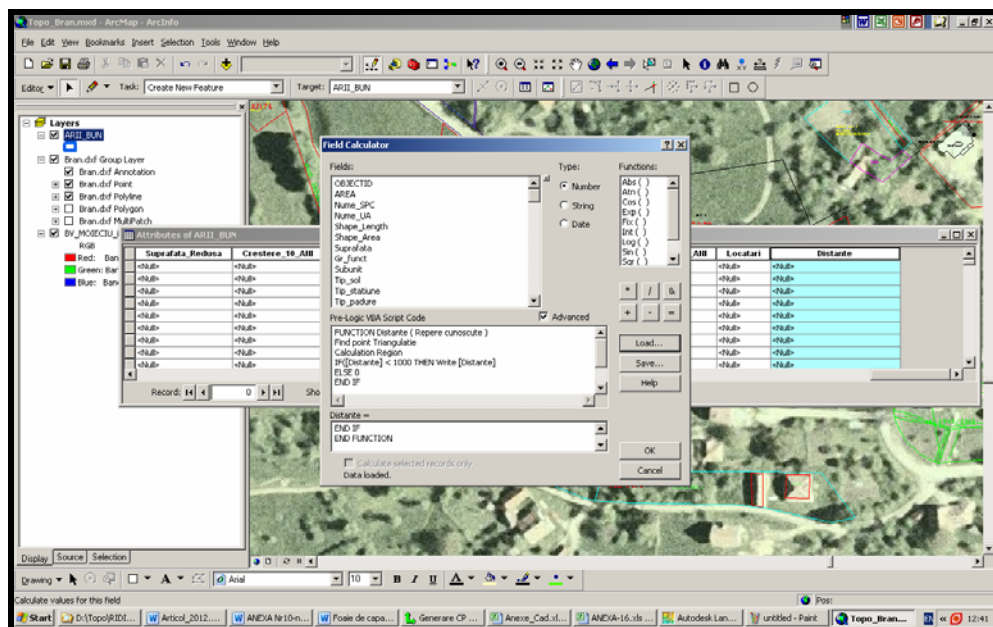Fig. 7. Establishment of label for an arc with cadastral number

Fig. 8. Script *VBA* to find the known neighbors

- marks and gives the labels for the found points with existing information from database;
- gives the labels of the distances from the center of weight of the parcel and those 3 identified marks;
- establishes the due space of the map of framing in the area for the 1:5.000 scale and with *Clip* function can cut up this area from the entire space;
- exports the corresponding area to A4 size in a new *layout*;
- inputs the distances and found marks bellow of the figure (fig. 9).

All the graphic pieces of the documentation are exported in the program were they have been created (*AutoCAD Land* or *ArcMap*) as **.pdf* file or **.jpg* file in need. They are imported in *.xls or *.doc file (depending on the chosen method). The only viewpoint that we have to emphasize, is the bringing of the figure in the new page size at the corresponding

scale. Working in this way we have the situation where all pieces of documentation are in the same file, the printing of this one being the last action.
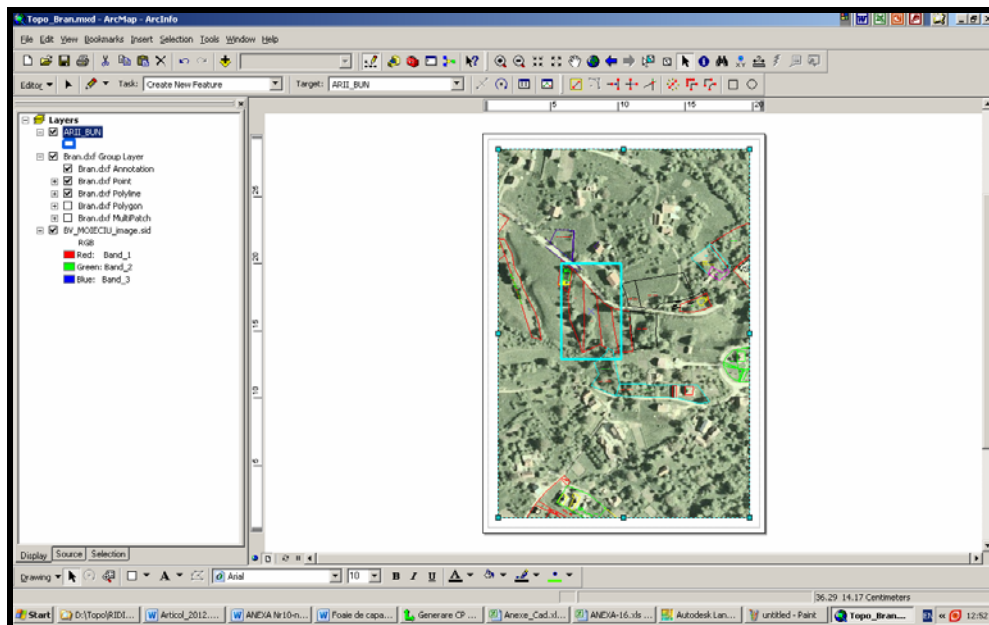

Fig. 9. The automatic elaboration of the map of framing in the area using *ArcMap*

5. Conclusions

The elaboration of the cadastral documentation is a process that requires much time and a lot of attention. To decrease the work time without reduction of quality or even to have better results for each documentation, many variants had proposed for work. First proposal is to use *Microsoft Excel* software for input all pieces that include numerical and text data. This is a comfortable, simple with an easy utilization and a good efficiency. The user can utilize every time a template where data about beneficiary and measurement have to be filled in, the all specific pieces of the documentation being automatic brought. A *GIS* software can be used to process the graphic data, the resulted map coming in *.xls file. The method is the same in case of the map of framing in the area, the last pieces that are completed in the mentionated file are the scanned ones (extract from landed certificate, other maps etc).

Another elegant variant is the one where the initial data are filled in *.xls file, the result of processing being exported in a *.doc file. This manner to elaborate a documentation is useful and causes a professional format of data. The graphic part is solved as the earlier case.

Finally, to get an easy solution in the processing of graphic data, a few proposals were outlined in this paper such: utilization of *Scilab* language to solve the problem of the parcelling of lands, utilization of *AutoLisp* facilities to mark them on the map, and other opportunities which the *ArcMap* software can bring to the user in automatization of the elaboration of topographic maps.

6. References

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