

# Land Consolidation in Morocco: Situation and Perspective

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**Key words:** Land Consolidation, Land Reallocation, GIS, Morocco, Situation, Perspective.

## SUMMARY

Land consolidation plays a significant role in the countryside of Morocco. It has offered farmers the opportunity for higher income and improved working conditions. It has proved to be appropriate solution to problems of small plots, sometimes irregularly shaped and distant from homestead, and where problems of water management as well as of access to countryside do exist. However, land consolidation project in general, and land reallocation particularly, are time consuming and less accurate when using traditional methods.

The main objective of this paper is the evaluation of the situation and the problems of Land Consolidation in Morocco. The technical steps and the various methods used in Land Consolidation are described also.

The development of a specific Geographic Information System is proposed to solve the problems of Land Consolidation in general, and land reallocation in particular.

## RESUME

Le remembrement est une opération dynamique et plurielle, qui joue un rôle primordial et très significatif dans le développement de l'agriculture du Maroc en général, et dans le développement du monde rural, en particulier. Le remembrement rural est un outil d'aménagement de l'espace rural qui tend à constituer des parcelles continues, régulières, aussi rapprochées que possible du siège de l'exploitation, jouissant d'accès indépendants, de l'écoulement des eaux et de travaux d'amélioration foncière. Cependant, son élaboration avec les méthodes conventionnelles exige un processus de longue durée, et en particulier au niveau du recasement; ce qui a un impact négatif sur la région à remembrer et sur les objectifs du remembrement initialement fixés.

Cette étude a comme objectif principal l'évaluation de la situation et des problèmes d'un projet de remembrement au Maroc. Les différentes étapes techniques sont décrites également.

Le développement d'un prototype de SIG est proposé dans le but de résoudre le problème d'un projet de remembrement en général, et celui du recasement parcellaire en particulier.

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## 1. INTRODUCTION

Since the beginning of the Sixties, Morocco always attached a great importance to the agricultural sector in general and the irrigation in particular, by investing in the big, small and average hydraulics. Moreover, the policy of the National Program of Irrigation of one million hectares acquired considerable economic and social dimensions.

Somehow, the land consolidation contributed to this effort granted for the benefit of the agriculture, by guaranteeing a better productivity, the stability of the rural population, the creation of jobs, and the development of the economy.

Despite of all these results and despite that Morocco acquired an experience of more than forty years in land consolidation (irrigated and non irrigated areas «Bour»), it remains, however, below expectations and planned projects. Several factors contributed to this situation, such as the drought, the degradation of the agricultural lands, the legislative texts of the land consolidation, etc.

To describe better the situation of the land consolidation in Morocco and its experience on the matter, an evaluation of the current state is imperative, in order to analyze the problems and the constraints which block the good progress of the projects of land consolidation.

The technical steps and the various methods used in Land Consolidation are described also. The development of a specific Geographic Information System is proposed to solve the problems of Land Consolidation in general, and land reallocation in particular.

## 2. BRIEF HISTORY OF THE LAND CONSOLIDATION IN MOROCCO

Although officially the rural land consolidation started only in 1952, the Moroccan farmers made exchanges of plots of land amicably well before, for the land consolidation of their properties, for the family reasons (intimacies) or to get closer to their village “douar”.

Another event which marked the history of the rural land consolidation is the one which was realized in 1950 by the Office of Béni-Amir Béni Moussa. To make them profit from the irrigation from Bin El Ouidane's dam, the regions of Krazza and Béni-Mellal benefited from the procedure of the out-of-court settlement (amicable) land consolidation.

However, and since there was a gap in the law, this operation was complicated during years and raised numerous difficulties which were resolved thirty years later.

The first legislative texts «Dahir» which regulate the land consolidation were published on March 8<sup>th</sup>, 1952 and the ministerial decree on March 10<sup>th</sup>, 1952. Through this first «Dahir»,

the State tried to intervene better in a given geographic space and to organize better the operation of the land consolidation.

Each time that a new project of land consolidation became necessary for a particular region, it was necessary to publish a new «Dahir» as a preliminary that makes applicable the «Dahir» of 1952. From 1952 to 1962, five «Dahir»s were promulgated.

This procedure proved very heavy for its application to the other perimeters which are favourable to the land consolidation, since it was necessary to wait each time the publication of a new «Dahir». In 1962, the legislator promulgated «Dahir» N° 1-62-105 (June 30th, 1962) which overruled and replaced above mentioned «Dahir»s and which could be applied to the entire territory of Morocco. This «Dahir» was completed and modified by «Dahir» N° 1-69-32 (July 25, 1969). The above mentioned «Dahir» carries two essential characteristics, in particular:

- the opening of the operations of land consolidation is done by ministerial decree and not by «Dahir»;
- the field of application was extended to the zones no favourable to the irrigation (non irrigated areas «Bour»).

The texts published in 1962 and 1969 specified the various stages of the technical and administrative procedures of a land consolidation project, and gave the absolute power to the commission of land consolidation. This power could be cancelled by the Supreme Court only.

### **3. SITUATION OF THE LAND CONSOLIDATION IN MOROCCO**

By analyzing the texts which regulate the rural land consolidation in Morocco, it is the «Dahir» of June 30th, 1962 and its decree of application that generalizes the land consolidation on all the territory, in irrigated zones as well as in non irrigated areas. In practice, the operation of land consolidation remains dominated, qualitatively and quantitatively, by the irrigated land consolidation. It is only in the late 70's that land consolidation started to take effect in the non irrigated areas.

#### **3.1 The land consolidation in irrigated areas**

The land consolidation in irrigated zones remains the most dominant. The state reserved to it a very particular attention all over these last forty years. The land consolidation in irrigated contributes in a very important way in the national economy, generally, and in the agricultural sector, in particular. It constitutes an angular stone in the exports of Morocco and provides employment for a wide rural population.

During the last twenty years, Morocco knew several consecutive years of drought. However, with the policy of dams' constructions, and the strategy of the irrigated agriculture, the "disaster" was avoided. However, if the essential effort in investment is devoted to the land

consolidation in irrigated areas, it nevertheless faces with several constraints and delays, which is completely contrary to the ambitious objectives of the land consolidation projects.

The situation of the sectors of the rural land consolidation irrigated is summarized in the following table:

**Table 1:** Situation of Land Consolidation in irrigated areas (DAHA, 2005)

ORMVA / DPA	Surface Area of Land Consolidation projects (ha)			
	Approved	Achieved	In Progress	Projected
ORMVA Doukkala	69 881	16 000	28 400	-
ORMVA Loukkos	26 684	-	4 000	-
ORMVA Haouz	30 958	-	8 100	-
ORMVA Gharb	126 292	9 000	16 000	24 330
ORMVA Souss M	22 209	-	-	-
ORMVA Tadla	75 158	3 300	-	-
ORMVA Moulouya	58 300	7 600	-	-
DPA Al Hoceima	5 424	-	-	-
DPA Oujda	1 306	-	-	-
DPA Fez	-	3 500	7 550	-
DPA Essaouira	500	-	-	-
DPA Taounate	-	-	6 700	-
<b>TOTAL</b>	<b>416 712</b>	<b>39 400</b>	<b>70 790</b>	<b>24 330</b>

ORMVA: Regional Agriculture Office

DPA: Provincial Agriculture Direction

### 3.2 The land consolidation in non irrigated areas «Bour»

Taking into account the importance of non irrigated areas as Useful Agricultural Surface (UAS) and the number of farmers who live there, Morocco undertook the first experience of land consolidation in non irrigated areas in the late 70's.

However, this strategy remains insufficient if one compares it with the important potential that these non irrigated areas represent, and with the factor of the Moroccan who remains always attached to his land.

Moreover, the farmers in non irrigated areas do not profit from the same advantages as those their colleagues in the irrigated zones. In spite of these factors, the texts of the irrigated land consolidation are applied to them.

**Table 2:** Situation of Land Consolidation in non irrigated areas “Bour”

ORMVA / DPA	Surface Area of Land Consolidation projects (ha)			
	Approved	Achieved	In Progress	Projected
O. DOUKKALA	21 000	7 500	-	-
O. LOUKKOUS	6 520	-	7 000	-
O. GHARB	7 500	-	18 000	-
O. Tadla		280	5 000	
DPA TAZA	-	-	5 000	-
DPA KHEMISSET	-	-	10 000	-
DPA SIDI KACEM	-	-	8 000	-
DPA EL HAJEB	30 000	-	-	-
DPA TETOUAN	5 000	-	-	-
DPA FES	-	-	4 000	-
DPA TIZNIT	-	-	4 500	-
DPA TAOUNATE	10 000	8000	-	-
DPA SAFI	4 500	-	-	-
<b>TOTAL</b>	<b>83 520</b>	<b>15 780</b>	<b>61 500</b>	<b>0</b>

#### 4. DIAGNOSIS OF THE CURRENT SITUATION

By examining the two tables above (table1 and table 2), and which are the synthesis of the compilation of a certain number of studies (Equiter, 1996) and Hydro-Agricultural Management Direction (DAHA, 2005), this reveals that, until today, the efforts of the authorities in the field of the land consolidation is concentrated mainly in irrigated areas.

Indeed, since the end of the sixties, Morocco had for objective a National Program of Irrigation of one million hectares, which should be reached towards the end of the twentieth century. A set of dams was built and which constitutes one of the essential vectors of the development of the irrigated perimeters.

The UAS of Morocco exceeds the nine million hectares. However, the opened areas to the operations of land consolidation is only 900 000 hectares, that is less than 10 % of the UAS, while the irrigable potential is estimated at 1300000 ha (Bensouda, 1998). .

For the remainder of the UAS, it is dependent on the rains and its distribution. Despite of all the efforts made in the land consolidation, the re-allocated and approved surface is only of about 490 000 ha, nearly 5 % of the total UAS irrigated, and about 90 000 ha only in non irrigated areas.

The following remarks could be also brought out from these tables:

- The re-allocated area in irrigated zones is about an annual rhythm of 15 000 ha/year (period between 1952-2004).
- The land consolidation in non irrigated areas touched the area is about an annual rhythm of almost 10 000 ha/year, over one period 25 years only.
- The rate of realization of the projects of land consolidation is very weak if one compares it for example with that of France which reached the rate of 300 000 ha/year over a period of 40 years.

## 5. PROBLEMS AND CONSTRAINTS

It should be underlined that Morocco acquired a considerable experience at the level of the irrigated land consolidation. However, the rhythm of realization of these projects of land consolidation is very slow and consumes a lot of time for the State and for the farmers.

These delays are inevitably reflected on the completion date of the various phases in general, and on the approved phase in particular, which blocks all forms of transactions to the beneficiaries.

The origin of these delays is due to the complexity of the operation which brings in various contributors, and which touches a fundamental element for farmers: *the property*. Another constraint of size is the opinion of the Ministry of the Interior. This instruction (ministerial decree) creates an important delay in the progress of the various stages of a project of land consolidation.

Compared with the land consolidation in irrigated, the land consolidation in non irrigated areas is very recent. The first attempt was carried out in the zone of El Hajeb in the late 70's. Although the land consolidation in non irrigated areas does not offer the same advantages as the land consolidation in irrigated, the same legislative texts are applied to it, by imposing the same constraints to the beneficiaries.

The problems and the constraints which block the good progress of these projects are of administrative, legal, technical, and social orders:

- Stagnation of the texts which regulate the land consolidation generally.
- The texts were initially established for the land consolidation in irrigated, which creates bad interpretations of a certain number of articles for the land consolidation in non irrigated areas.
- In general, the established exchange values of the soils are under or over estimated.
- Delay at the level of land-surveying maps and plans.
- Deficiency of planning and programming of the projects.
- Insufficiency of expertise of a certain number of DPA and ORMVA in the field of the land consolidation in non irrigated areas.
- Delay in the publication of the ministerial decree
- The representation of the farmers in the Commission of the Land consolidation is insufficient.
- Lack of detailed social and economic studies, and the impact of the land consolidation on the region.
- Most of the technical parts are realized with conventional methods.

Moreover, and in the absence of an integrated project, the land consolidation in non irrigated areas becomes less attractive and less rewarding for the beneficiaries.

The most touched perimeters by the projects of land consolidation, as well in non irrigated areas and in irrigated zones, are concentrated in Gharb and Doukkala regions (Atlantic coast). This can be explained by the agricultural vocation of these two regions.

## **6. PROPOSITIONS**

Through this very summary presentation of the Moroccan experience in the land consolidation, it emerges that the general objectives of the land consolidation are the same in all other countries (such France, The Netherlands, Germany, etc.). However, this mode of land organization which allows the development of the rural economy, and a new distribution of the land with a better fragmented configuration, distinguishes itself between Morocco and these countries by the following points:

- Evolution of the texts which regulate the land consolidation in the advanced countries, in the same way as their economic and social evolution. While in Morocco, we can notice a certain stagnation of texts.
- The environmental and ecological factors in any project of land consolidation are taking into consideration in the European countries
- The clear predominance of the administration in Morocco in the various commissions, and consequently the negligence of the opinion of the farmers
- The presidency of the project is assured by a representative of authority, instead of a judge as in France.
- The soils are classified without the concerned farmers.
- The surveying plans already exist in the countries of Europe; they need updating, while in Morocco one must establish all the necessary maps and surveying plans. This involves an enormous delay in the realization of the projects of land consolidation.

- The rate of land consolidation in the European countries exceeds by far that recorded in Morocco.

At the end of these remarks, we considered useful to present certain number of suggestions and propositions, by taking into account the studies already realized in the same framework (Essadiki, 2001):

- Need for revision and update of the texts regulating the land consolidation so that they are more flexible in the control of the various projects and more adapted to the current needs.
- Simplify the procedures and reduce the periods of execution.
- The respect of the texts of the land consolidation, especially with regard to the durations of the decisions of the commission of land consolidation and the complaints.
- Give a very particular attention to the land consolidation in non irrigated areas, and change texts as a consequence.
- Incorporate the projects of land consolidation in non irrigated areas in integrated projects.
- Associate the farmers in the various decisions, in general, and in the classifications of the soils in particular.
- Involve private companies in the control of the project.
- Use the new techniques of input, data processing and analysis.
- To take into account the ecological factors and of the landscape in particular, and the environment in general.
- To carry out social and economic studies and investigations in the concerned region with the land consolidation, before initiating the project of land consolidation.
- Inform and make sensitive the farmers on the beneficial results that a project of land consolidation can bring (produce).
- Organize training courses for the benefit of the farmers.
- Take into account the specificity of each region of the country, both in the social and economic standing.
- To make imply the local communities and other organizations in the financing of the projects of land consolidation.
- Adapt the laws to the new orientations of the State in decentralization, in regionalization, in disengagement and in encouragement of the not participation of the State.

The development of a specific prototype for the technical steps of a rural land consolidation of Morocco, within the framework of a Geographic Information System (GIS), will help a lot in accelerating the process, especially where we deal with multi-criteria data analysis.

## **7. LAND CONSOLIDATION AND GIS**

Most often, a land consolidation project is based on legal, administrative and technical tasks. Among these technical operations, we can distinguish:



- Land-surveying tasks;
- Social and economic investigations;
- Soil studies;
- Network studies (water management and network access to fields);
- Reallocation procedures;
- Implementation..

One of the most important and decisive technical steps is land reallocation. It is the synthesis, the analyzing and the decision making step. All the land consolidation process is identified in this application. However, this step still lacks a good approach for handling large volumes of data. Given the mass of data and the diversification of documents, some of difficulties arise at various levels:

- The manipulation of diverse documents (land-surveying maps, soil type's maps, and hydraulic network maps).
- The data treatment.
- The preferences (wishes) of farmers for a particular spatial location.

In other words, in a land consolidation project, one can find qualitative and quantitative data. Taking in account all of these factors and parameters, a new methodology approach was developed integrating the steps of land consolidation and land reallocation in a G.I.S framework taking into account the conditions of present day Morocco.

The developed methodology is composed of three main steps:

- 1) Designing of a conceptual model for all phases of the land consolidation project;
- 2) Establishment of the landowners list to be reallocated inside a block or "Temporary Land Reallocation";
- 3) Development of a specific GIS prototype for the purpose of solving the issues of land consolidation and land reallocation.

## **7.1 Land Reallocation process**

Land reallocation is a very important technical stage in the land consolidation process. It is also a lengthy process. This procedure consists of four main operations (Essadiki, 2001):

- Preliminary calculations
- Temporary Land Reallocation
- Definitive Land Reallocation
- Implementation

Before starting land reallocation, the operator needs various documents in order to carry out a number of preliminary calculations (Essadiki, 2002):

- Parcels maps before land consolidation,
- Social and economic impact surveys,
- Soil types maps,
- Hydraulic network maps.

The following calculation steps should be undertaken (figure 1) :

1. Calculation of the parcel areas and their values, before land consolidation, by digitizing parcel limits and their soil types.
2. Calculation of the block areas and their values by digitizing the area of all soil types within the blocks.
3. Calculation of the required public use land value (roads, hydraulic networks, etc).
4. Calculation of the reduced values of landowners.

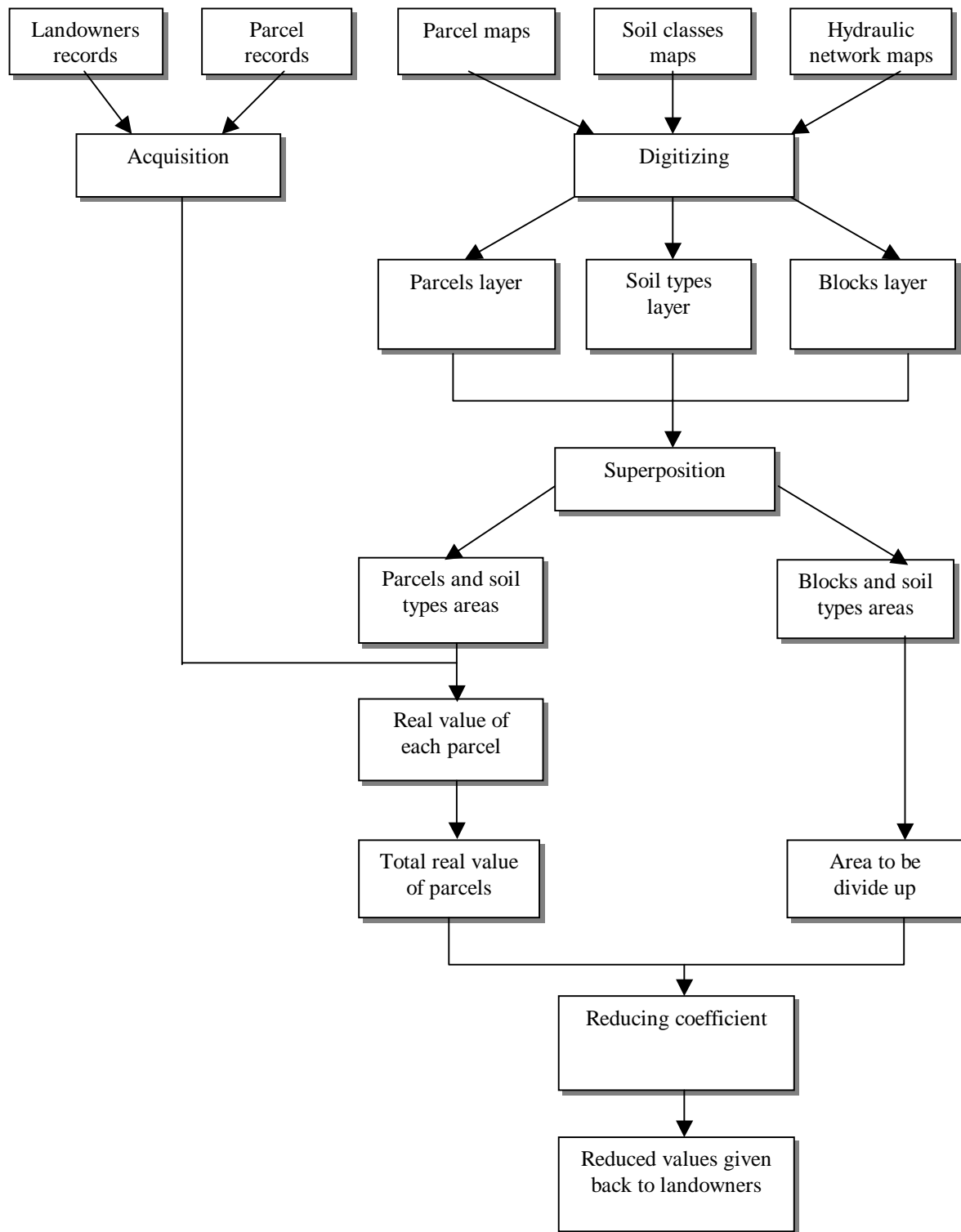
In theory, the total land value of all the land parcels should be the same as the total value of the blocks. In practice, it's impossible to have this result, because of digitizing errors. All these calculations will be needed for the following steps of the land consolidation procedure.

#### 7.1.1 Temporary Land Reallocation

The "Temporary Land Reallocation" allows determining approximate localization of owners inside the hydrographic network frame (blocks) and the landowners list affected in each block, taking in account factors used below:

- Existing "plus-value" e.g., building, house, well, or rock mass.
- Existing parcel within the "block".
- Land owners requirements and wishes.
- Existing of a dominant class of soil inside a "block".
- Existing of a parcel with a value higher than the mean of all parcels of a specific area.

The determination of landowners list is time consuming using conventional methods. To resolve this problem, a survey model (or questionnaire) for Land Reallocation becomes an absolute necessity and a sine qua none condition for a good data management, and consequently a success for a land consolidation project. Before the elaboration of the survey model to determine the landowner list inside blocks, a survey was established and sent to different persons involved in the land consolidation project (administrations, private companies, state departments, etc).



**Figure 1** Calculation steps of Land Reallocation

### 7.1.2 New approach for “Temporary Land Reallocation”

From the results, a model was developed by assigning weights for each block, taking in account priority criterions and different constraints. Consequently, every criterion is attributed with a value in function of its quality and its importance (Essadiki, 2002). With this method, landowners possessing the maximum of points will be the first selected inside a specified block. The operation is repeated by iteration until the land consolidation operator is satisfied.

Once the approximate position of new parcels and the landowner lists are established, the following step will determine the exact position of parcels inside the blocks.

### 7.1.3 Definitive Land Reallocation

The “Definitive Land Reallocation” is involved to know the exact position and the “definitive” localization of each landowner’s parcel in a concerned ”block”. It’s more than a geometric problem, because the operator has to take in account more than one constraint:

- The value of the new parcel.
- The value of the block.
- The soil classes.
- The “plus value”, such as a house, well, or other features
- The types of irrigation network (“trames” in French).

The developed model allows dividing the block according to these frames, to take into account the priority order, and to define the limits of each parcel with its coordinates, with respect to the exchange values and to different appreciation constraints. At this stage, the implementation of land reallocation could be carried out.

### 7.1.4 Development of the prototype

Due to the complexity of the land consolidation process, the use of data analysis tools is very important to accomplish the different technical steps of a project. For this, a prototype was developed using the Simple Macro Language (SML) based on PC Arc/Info. This prototype is used to deal with complex tasks in the acquisition, processing, querying, analyzing, displaying, and archiving the spatial data base.

## 8. CONCLUSION

The legislation on the rural land consolidation in Morocco is recent if one compares it to those of the European countries which appeared in the beginning of the 19th century. The experience of these countries in land consolidation passed several stages, while passing by the improvement of land itself, for a better profitability and a productivity of farms, and by arriving at the land organization which takes into account certain number of factors, such as the protection of soils, the ecological balance and the environment generally.

The texts which regulate the rural land consolidation in Morocco submitted only some small modifications and know stagnation for more than forty years. It appears that it is time to revise the texts in force so that they are adapted to the present needs and more flexible in their applications and their interpretations.

Moreover, and in most of cases, the methods used for the treatment of the projects of land consolidation are very conventional. The executor is in front of several maps and plans to handle and to be treated and manipulated, the data of owners to be synthesized, and farmers' wishes to be satisfied. The use of the new data processing methods in general and the SIG in particular, proves to be essential to solve such problems in order to accelerate the process.

The new method of the “Temporary Land Reallocation” was developed by quantifying all qualitative data and thereby facilitating the use of the ArcInfo GIS software. When an actual project was tested using this application the results were achieved in only a few days instead of the weeks required originally.

Hence, the utilization of GIS is essential for the success of such projects, especially when dealing with multi-criteria data analysis.

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## **BIOGRAPHICAL NOTES**

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