

The Future of the Egyptian Survey Authority in the Evolution of the National Geospatial Data Infrastructure

Its vision, achievements and lessons learned.

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1. Introduction

The Egyptian Survey Authority (ESA) is responsible for the standardization and production of all surveys and mapping activities in Egypt for which the government is providing the funding. It is also responsible for the surveying and mapping component of the national cadastre. ESA celebrated its 100 th anniversary in May 1999, a good time to reflect on why it was created in the first place.

The creation of ESA was part of the general development in the second half of the last century to replace incidental project oriented mapping with systematic mapping. That is the production and maintenance of a regularly laid out system of adjoining maps covering the whole country based on a national geodetic datum and projection, and uniform specifications in what came to be called national topographic systems. The implementation of these systems required an accountable organization, highly specialized staff and a reasonably stable budget to secure the continuity of operations. The national and strategic importance of the resulting maps and surveys for the effective functioning of governments put the execution of the related tasks in government controlled organizations. Arguments which are still being used today in justifying the continuing mandates of NMA's. Thus Egypt progressed on the basis of a very long tradition of accurate surveying and mapping which began in the time of the Pharaoh's into the era of new systematic map production concepts in pace with the advanced countries of that time. Hence ESA has a century long history of providing the stewardship of the production, archiving, and distribution of official systematic national surveys and maps. Thus it is also the custodian of essential and irreplaceable land information documentation of the country.

These new concepts of more than a century ago responded to the requirements for economic development and the industrial revolution. They provided a coherent and continuous picture of the national landscape. They also made the organization and portrayal possible of information already available in different places in scientific and technical reports, or incidental surveys or maps in a consistent spatial framework, and thus make it more generally and easily accessible. Arguments which have resurfaced more recently in the discussions about National Geospatial Data Infrastructures.

There are a number of important reference points in the history of ESA, some of which are relevant to this paper. The first was the mandating of the modern land registration system in 1923, which enlarged the activity of ESA significantly, but unfortunately was

never adequately financially supported. The second was the introduction of photogrammetry and electronic surveying methods into the map production process after WWII which improved overall efficiency substantially.

The third stems from a combination of factors. Emerging from a period of economic hardship in the 1960-1985's, it became evident that the surveying, mapping and cadastral demands placed on ESA to support the new economic development could never be met with the technological and human resources then in place. At the same time IT began to impact all of Egyptian society, the demands for products and services increased and also started to change. The organization was in no position to respond to these new conditions. The information technology began to put remote sensing, surveying and mapping capacity, until then the undisputed domain of ESA, or in the hands of client or newly created organizations. As in other countries this raised questions about the continuing mandates of NMA's. It became evident that a radically new vision of the future of ESA had to be articulated to ensure it could fulfill the mandates it was entrusted with by Government in the longer term. Given this vision it needed to embark on a long road of development which would profoundly affect the organization and all of its 12 000 staff members. See ESA (1995)

As ESA has experienced the development process it can be divided into four distinct steps:

1. Based on the authority of the current mandate a significant financial injection was negotiated with international assistance for *technical modernization necessary to revitalize ESA*;
2. Successes in efficiency improvements of the existing surveying and mapping, as well as cadastral production lines due to the technology improvements provided the credibility for the *development of a strategic plan* in which a new mandate to establish the backbone for Egypt's National Geospatial Data Infrastructure (NGDI) could be elaborated and justified;
3. The new mandate had to reach beyond the automation of existing production processes to a renewed responsiveness to the client community and the modern demands of government in general. We needed to enter *a stage of "informatization"*.
4. Recognition that the road of development will continue and that we shall stay on it as long as we assure our continued relevance and responsiveness to the country and our clients. ESA accepts that this is a task never finished, but this acceptance requires not just new and competitive technology or increased financial support, it demands *a change in attitudes of the whole organization, led from the top*.

2. Technical modernization of ESA.

The first project was based on a grant of USAID of USD 41 million. It included :

- A management and organization development program,
- An equipment and facility modernization program,
- A training program,
- Crop mapping program,
- A cadastral surveying and mapping program,
- An aerial photography program,

- A geodetic and control survey program,
- A base mapping program,
- A system support development program,
- A land information system pilot program,
- A financial and administrative program,

The Equipment and facility modernization program included a base mapping system (USD 3 295 000), computer equipment and software (USD 1 565 000), vehicles and spare parts (USD 1 237 000), orthophoto system (USD 546 000), printing press(USD 243 000) and miscellaneous survey and support equipment in more than 140 procurements. Operating supplies were about USD 650 000 and operating supplies such as aerial photography film USD 253 000. This amounted to a total of about USD 8. million.

The training program was divided into four sub programs:

- observational tours in the USA for senior staff to attend international conferences and visit users of digital mapping and GIS technology throughout the USA,
- technical seminars in Egypt, which were conducted to acquaint senior and middle managers with advances in the technology and its application to ESA's mission,
- Middle management training in the USA conducted for the purpose of exposing middle managers to the use of modern surveying and mapping technology in practical production environments,
- Engineering and technologist training and upgrading, on the job. This included 4 800 enrollments.

There were additionally a series of workshops to transfer the strategic issues into a realistic but ambitious Strategic Plan and a comprehensive but implementable re organization plan.

What have been the results?

The production facilities and the technical skills of the ESA have been improved significantly. Equivalent improvements in ESA's managerial skills will take at least five to ten more years of intensive and deliberate effort to accomplish. ESA now routinely produces surveys and maps of a respectable quality that are of use to the Ministry of Public works and Water Resources for example in irrigation systems planning, design, operations, management and maintenance. Furthermore, ESA's new digital geographic information products are in demand and being used by almost all other agencies within the government. In this sense, the technical modernization was a significant and important success which can also be seen from the accomplishments of he production during the project life time (see table 1)

PRODUCT TYPE	Achievements	
Geodetic network system	1 020 000	Sq. km
Primary Network	100.000	Sq. km
Precise levels	1970	Line km
Topographic maps 1: 50 000	50 000	Sq. km
Ditto 1: 100 000	33 600	Sq. km
Town and village maps 1 : 1 000	135	Sq. km
Topographic maps 1: 2 500	9 020	Sq. km
Crop, soil, canal, drain mapping 1: 10 000	47 516	Sq. km
GIS pilot project	25 000	Feddan
Orthophoto maps 1: 10 000	35 063	Sq. km
Cadastral surveying and mapping 1: 2 500	1 256 862	Feddan
Land information system	79	Villages

Table 1: Achievements in the modernization project.

3. Developing the Strategic Plan.

Egypt has a surface area of about 1 million square km of which 5 % is currently arable land mainly in the Nile Valley. It is the goal of the present government to increase this to 10 % by developing the desert below the Aswan Dam outside of the valley. Until quite recently only 53 % of the agricultural land and 20 % of the urban land have been incorporated in the national land registration system. Considering the growth of the population from 35.6 million in 1973 to 57 million in 1993 and the expansion of for example Cairo from approximately 5 to 15 million in 20 years this is hopelessly inadequate. The proposed agricultural expansion and investment confidence required for economic development demands security in the rights in land and a transparent, less fraudulent and more vigorous real estate market. Without adequate land registration this will not be achievable. Hence, completion of the cadastre is essential and will improve Egypt's information infrastructure relative to its most critical resource- agricultural land.

Like many NMA's in the world ESA has also experienced the concurrent pressure of

1. Needing to significantly improve its responsiveness to new production and service demands caused by the introduction of Information and Communication Technology (ICT) in society as a whole;

2. Responding to the changing international consensus about the role of government with respect to that of the private sector i.e. responding to questions of privatization, regulatory reform, contracting out of work etc

ESA's operating environment has changed significantly in the last fifteen years. Most ministries of government at all levels are working with or are contemplating the introduction of GIS applications. These require reliable and routine access to the fundamental data in appropriate forms ESA is mandated to produce. At the highest levels in government a Cabinet Information Decision Support System is being developed which among others demands increased responsiveness for the data ESA must produce in formats appropriate to these applications. At that level the integration of social and economic data with cadastral information and data about the spatial distribution of natural and man made features is essential. These are examples that also point to the need for a National Geospatial Data Infrastructure (NGDI) raising the question about ESA's role in its development.

Against this background the following vision and associated mission statement were developed which will guide the whole organization to the future.

Our vision: *Our dedicated and professional staff is committed to manufacturing high quality geographic information products and delivering professional surveying and mapping services to government and the private sector end-users at a reasonable cost and with minimal government subsidy*

Our mission: *As a specialized Authority, the National Surveying and Land Information Authority produces, maintains and distributes current and accurate geographic data in support of national needs. These data describe the Egyptian landmass, its cultural features and the ownership of the land. They are delivered in the form of surveys, digital databases, maps, and related products and services.*

It does not take much imagination to see that both vision and mission require a degree of independence in the governance of ESA difficult to realize within the constraints of the regulatory environment of a standard government department. For example it needs to have some freedom in the salary structure to retain highly trained and specialized staff. Also there needs to be some freedom in developing public/ private partnerships to improve productivity and responsiveness. Another issue is that the mission statement implies a business- like approach, with an accounting system that reflects assets and liabilities according to accepted accounting principles. There is also a need for the building of reserves from operations to ensure that the core responsibilities of government with respect to the land registry as well as surveying and mapping can continue in low income years. These matters cannot be dealt with adequately within the normal government accountability environment.

If ESA is not to be accused of unfair competition it must have a transparent costing and pricing system which includes all assets and liabilities just like a corporation would. If

this cannot be done one should expect significant complaints from the private sector about the lack of a level playing field in the value added geo-information business.

Hence the need for raising the level of the stature of the Authority and reconsider its regulatory position and accordingly its corporate governance has been the first of seven spear points in the strategic plan which was developed for achieving our mission. This has not been without result as at the end of 2000 Cabinet decided that from mid 2001 ESA would be an “independent” economic authority. It means that within a set timeframe it will have to be completely self financing.

The second reflects the recognition that legal or regulatory security for ESA is not enough to thrive. Succeeding in today’s competitive environment requires that anything ESA does only has value to the extent that there is a real or potential need for it. Our products and services must have value to our clients, and only under those conditions will ESA be the customer’s choice for the products and services demanded. The consequence is that ESA must completely rethink its traditional ways of marketing, pricing and distribution more along the lines of a commercial organization. To address this issue is the second spearhead of the strategic plan.

Becoming client responsive and more commercially oriented has other consequences. If ESA sells products and services in a commercial environment it will be liable for errors. Therefore it will be necessary to develop and implement a transparent Quality Management System (QMS) which begins with the quality of the staff employed.

The quality of a product or service is defined as “the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs” ISO 8402 (1994). Quality is not an intrinsic characteristic, but it is related to a perception of users’ satisfaction including timeliness and price. Checking the quality of a product or service at the end of the production line must be complemented with the quality management of the whole production process, and this concerns the whole organization. This concept is captured in the term Total Quality Management. “A management approach of an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction. ISO 8402 (1994). Quality Management is a state of mind embedded in all employees. They must feel accountable for the quality of their outputs and not hve this off on some remote quality control and checking unit. Hence equipping the staff with the knowledge, skills and mentality to perform in a “Quality Environment”, and ensuring that they are being properly led in the same spirit is the third spearhead of our Strategic Plan. Considering the comprehensive approach to this subject taken by CERCO, see for example Dassonville (1999) ESA is certainly not alone recognizing the importance of this subject.

ESA is still in a technological transition. It has with international assistance set the first steps on that road quite successfully. However, implementing IT in existing production lines or pilot projects is one necessary thing, the imperative to manage the technology is quite another. Managing the technology means its optimization in the design and implementation of production processes which can deliver core and value added products

of considerable diversity responding to a variety of market segments. Hence the acquisition of new technology in future will take this into consideration and include the new tools for workflow management and business process redesign. The range of technology that must be resident in ESA is formidable, namely from modern gravity and GPS equipment to a variety of data acquisition, archiving, transformation and visualization tools including modern printing presses which can be integrated into the IT environment. Hence our fourth spearhead is focussed on competent technology management to justify and protect the large capital investments required.

It is evident from the above that an organization structured for the production of a limited number of standard surveying and mapping products according to long term and well established specifications and work processes will be quite different from the organization structure needed to realize our mission statement. The organizational structure begins at the top in terms of the tasks and composition of the Board of Directors in relation to the new regulatory status and corporate governance of ESA. It will then be structured in a fashion so as to be responsive to the commercially oriented marketing, data and map sales and distribution. The responsiveness is not merely a requirement of the technical departments but also of the support departments such as finance, personnel management and administration, including continuous training. Hence the fifth spearhead is organization development to achieve excellence.

The sixth spearhead addresses the issue of protecting the large investments which need to be made in staff development, technology, and of course the database and map production. In the first place ESA must have the possibility of offering rewards that help retain specialized staff and the dedication of their managers. As a minimum staff at all levels need to be continuously upgraded to help them retain the tools to do their jobs be it technical, administrative or managerial.

Secondly, included in the staff training must be a significant component dealing with the requirement to maintain the expensive equipment in running order.

Finally, in the commercial environment ESA cannot succeed if it does not retain its exclusive right to profit from the sale or use of the products it manufactures. This is the basis for realistic financial models which balance pricing with costs and which will provide the opportunity to build the reserves necessary to guarantee the government's core responsibilities are being met also in times when the commercial returns are not so high. For example there could be an economic down turn which slows down real estate transactions and thus ESA income, while the core task of safeguarding the land registers will have to continue.

ESA's tasks are daunting to say the least, and far too large to be carried out by it alone. It simply cannot go it alone. In this seventh spearhead the Authority will deliberately look for partnerships in the public and the private sector to help achieve its goals under the new mission. To this effect bridges need to be build to international donors, the Military Survey Department, the technical resources of the larger municipalities, and possibly other ministries. As well ESA will explore the feasibility what role it can play in terms of

facilitating the start up of a competitive private sector in the surveying and mapping community without having to resort to private monopolies.

It is beyond the scope of this paper to go into the details of the strategic plan itself. It consists of 33 different program elements which all have been organized on the basis of a guiding principle (why it was defined), a goal (indicating where ESA wants to be in future), and strategies for attainment. While the mission statement, and the seven spearheads which form the basis of the strategic plan are issues which are possibly of a more shared nature with other National Mapping Agencies, providing details on those program elements would be too specific for the Egyptian situation. Suffice it to say that the details of the plan and its operationalization have been worked out and progress is being made. However, we will briefly say something more about the need to change the culture of the organization through human resources development. This has arguably turned out to be the controlling factor in the pace of progress.

4. Human resources development.

As a result of the app. USD 55 million invested by the Government of Egypt and international donors in the technical modernization of ESA we have up to date equipment, technically competent operational staff members and effective production support in a number of successful pilot area's.

The challenge is to expand the results in the day-to-day operations of the whole organization. This is far more complex than the development of the pilot projects in which staff received considerable very motivating personal attention from local and expatriate specialists. Operationalization of the results must be done by supervisors and managers of ESA who themselves for most part were only marginally involved in the pilot projects. For this type of technology and knowledge transfer to take place supervisors and managers need to be trained in for example the following skills:

- One) Awareness of the processes of knowledge and technology transfer, including the identification of the reasons for resistance to change and what can be done to counter this,
- Two) Management in a technologically integrated production environment,
- Three) Management of responding to product diversity, by means of the tools such as workflow management, business process redesign etc.
- Four) Management through team processes for the development and implementation of Quality Management Systems
- Five) Modern cost accounting processes.

The Strategic Plan (1995) expressed an urgent need for this type of training to ensure that the operationalization of the results of the pilot projects would not be unnecessarily held up. Hence in 1996 a limited start was made with management training under the GTZ funded project. Further consideration of this issue established the need to train initially about 400 managers and supervisors and in that process establish an effective local management training facility relevant to geoinformatics production organizations.

Part of the requirements definition was awareness training at the very top of the managerial structure of ESA which should sensitize senior managers to the kind of

training required and convince them of the need to support the vast training effort in their parts of the organization.

The requirements definition was the basis for the formulation of a project which will be jointly financed from ESA and from the Netherlands international development sources through the services of ITC as the principal contractor. However, a number of other education facilities contribute to the project as well such as: the Maastricht School of Management (MSM), the Regional Information Technology Training Institute, the American University of Cairo and the University of Cairo. In addition we used a number of local management (TQM) consulting companies.

The project foresees broadly speaking the following steps:

- One) Training trainers to staff up the Egyptian geoinformatics management training facility. This will be done through an especially designed training programme consisting of three components:

Preparation for the study in Egypt: English language, course in general management and project planning given by RITI and AUC coordinated by MSM; technology update and familiarization with all aspects of ESA organization and management organized by ESA with ITC support.

Study of general management: general management aspects as related to the ITC course in operations management; organized by MSM,

Study” Operations management” : organized and given at ITC. It is a course of 10 modules each of three weeks. The last two of which deal with educational technology. The other modules are:

-Strengthening the role of ESA in the decision making processes in Egypt

-Awareness of technology from a management perspective

-Development and management of operations and workflow in ESA Cadastral and Mapping Systems

-Development and management of ESA mapping and cadastral information system and information access utilities, in the frame of national geospatial data infrastructure

-Case study

-Requirements and planning of activities for the implementation of ESA Strategic plan

-Training in a professional mapping cadastral organization in Holland and Germany.

- Two) Developing relevant curricula and learning materials at ITC,
Three) Transferring the courses to Egypt and commencing the local training program under guidance of ITC, MSM, RITI, and AUL
Four) Independent operationalization of the training facility

These steps will take place over a five year period and have started early in 1999.

As most of the NMA's in the Arab speaking region are faced with similar large scale training requirements we foresee the possibility of the deployment of this capacity

beyond Egypt. The intent is therefore to follow through with a second project which will establish the training facility as a resource for the Arab speaking region.

The training facility must of course in the first place meet the demands of ESA in its modernization program. Continuing cooperation with the project parties will be necessary to keep teaching materials and curriculae up to date and relevant.

A not insignificant matter will be that of certification of the diploma's of the facility if it operates in an international environment. In this respect discussions are underway with ITC about the possibility to earn credits in the ESA facility for degrees and diploma's of ITC.

5. Lessons learned.

ESA like most NMAs has come to realize that the impact of ICT in society as a whole is generating a different distribution of capacity in the handling of geospatial information which goes far beyond the experience sphere of these organizations. Whereas in the past NMA's introduced new technology to improve internal efficiency of existing production lines, the ICT demands different products and generates different markets which are not satisfied by our conventional standard maps, even if they are in digital form.

At the same time NMA's are confronted with the challenge of privatization, and if not complete privatization, at least a form of regulatory reform which puts them in a competitive and commercial environment for which the majority are not sufficiently equipped particularly in terms of technological and staff capacity, culture and reward systems.

Unless NMAs can become responsive to the needs of the information society in an environment where they have no longer a monopoly on the technology their obsolescence will not be tolerated. Even those who can hide behind a legal mandate will not be allowed to do so indefinitely.

In many cases the perceived non-performance of NMAs is clouding the discussion about the legitimate role of government in the stewardship and custodianship of the facilities and the geographic record of the country which should guarantee governments access to reliable historical and up to date geospatial data they need to govern. However, in the face of poor performance alternative solutions will be offered and be made to look attractive.

For example there will no doubt be corporations in the near future who will own a vertically integrated set of facilities to produce on demand anywhere in the world high-resolution geospatial data and derived products at a price. Will these operate complementary to NMA's, influence their mandate and mission? These are difficult questions but we tend to believe that assurance of continuity in the reliable supply of strategic geospatial data for government to carry out its responsibilities will for some

time to come be a critical argument in favor of maintaining the national institutions that now exist for this, but in our view not at any cost.

NMA's must get their act together and be clear and convincing about the modern interpretation of their traditional mandates and define this as a core mission statement which will be the starting point of the long road of reinventing the institution.

At ESA these first steps have been made as reported in this paper. What have we learned?

- i. The sequence of steps ESA has taken in the late 1980's and early '90's as described in this paper have proven to be useful and practical.
- ii. The identification of the 7 spearheads at the start of the strategic planning process helped focus its planning activities
- iii. Development of the strategic plan took about 18 months of intensive teamwork and numerous consultations with all elements in the organization under the guidance of an external advisor,
- iv. The process required the undivided attention, visible involvement and commitment of the Chairman of ESA,
- v. The credibility and acceptance of the plan depended on some pilot project success stories in the technical modernization, hence the initial USD 15 million investments in technical modernization were crucial to all aspects of continuing the process of the modernization of ESA, not just the technical modernization,
- vi. The issue of management and supervisory training in addition to technical training should probably have been taken more actively in hand at an earlier stage to ensure continuity of operationalization of pilot projects,
- vii. Earlier design and rapid production of a simplified topographic database (unlike digital topographic maps) structured in several useful ways for the GIS community would have facilitated GIS applications and the foundation for the NGDI
- viii. At all stages the Chairman of ESA led intensive communication of the planning activities and reports on the results of the pilot projects to important politicians
and the public,
- ix. The Chairman deliberately found major partners in the process who are significant clients, and thus developed support in the client community for the development,
- x. The CEO of an NMA who takes the leadership in such a large endeavor as modernization of the organization must do so decisively and be prepared to be full-time involved in it. He or she must make organizational arrangements to ensure ongoing operations continue with minimal CEO involvement.
- xi. Ongoing political support at Cabinet level is crucial and must be nurtured. Understanding and acceptance of the long term character of a modernization process needs to be cultivated. But this can only be maintained if success stories relevant to that level can be reported regularly.

- xii. Next to the ongoing support from Cabinet is the necessity to create ongoing and growing support from the staff. This can only be done by personal contacts and sessions between the CEO and staff.

The most important conclusion and lesson is that there was no choice but reshape the interpretation of ESA's standing mandate in light of the pressing demands put upon the organization in the information technology environment. Once embarked on that road there was no turning back. Clarity of purpose made it possible for ESA to do this deliberately and steadily. This is not to say there were no barriers or sometimes even setbacks, but our clear goals, which are shared through large parts of the organization, make it possible to recover from them and proceed decisively. Continuity and complete conviction and commitment at the CEO level was also a major factor to sustaining the efforts of everyone involved in the renewal process.

References

- Dassonville L. (et al) (1999) *Quality management, data quality and users, metadata for geographical information*. CERCO, Laure.Dassonville@ign.fr
- ESA (1995) *The General Survey Authority's Strategic Plan*. Chairman Egyptian Survey Authority, Orman, Giza, U. A. R.
- ISO 8402 (1994) *Quality management and quality assurance- Vocabulary*