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Decision Support Systems and Strategic Public Sector Decision Making in Egypt

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Sherif Kamel¹

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Abstract

This paper focuses on the application of decision support systems (DSS) to strategic public sector decision making for socio-economic development. It describes the experience of the Egyptian public sector in socio-economic decision making and the related emergence of an information-based support organisation for government, the Information and Decision Support Centre (IDSC). The paper describes a set of decision support system cases, and an issue-based management approach in the design and delivery of these systems. Such cases fall within Egypt's comprehensive plan to introduce and rationalise the use of information technology in various key sectors in the economy. The paper also describes the challenges faced and lessons learned from the DSS cases.

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1. Introduction

Decision support systems, since their inception in the 1970s, have been differently defined and conceptualised by vendors, researchers and academic commentators. However, there has been general agreement that decision support systems are computer-based systems that help decision makers confront ill-structured problems through direct interaction with data and analytical models. Some of the classic DSS texts show that the focus of research and application of decision support systems has to a large extent been on individual managers and on organisational decision processes, largely for the private sector.

Thus DSS are mainly represented as providing a set of opportunities directed toward improving the effectiveness and productivity of managers and professionals, boosting the organisation's competitive edge, and rationalising the decision making process within an organisational context. They aim at realising the desire for accurate, timely and relevant information to help individual managers in organisations deal with an increasingly turbulent economic environment and the growing pressures of competition.

Much less emphasis has been given to the application of DSS in three particular areas: their use with groups (although group decision support systems nevertheless represent a significant domain of research and application); their use in the public sector; and their use to support socio-economic development. These three areas form the focus of this paper, which therefore exposes a relatively hidden DSS domain by demonstrating the use of decision support systems by the government of Egypt in rationalising its decision making processes, and in better allocating scarce resources for socio-economic development. Moreover, the paper demonstrates an issue-based management approach which tries to overcome the challenges faced by decision support systems designers, developers and implementers who are focused on the strategic decision making level.

2. Historical Background

In many ways Egypt is a typical developing country. It faces the common problems of developing countries such as heavy foreign debt, a balance of payments deficit, a high illiteracy rate, poor technological infrastructure, lack of financial resources, and high unemployment. It has been striving to implement a nation-wide strategy to support the realisation of its targeted socio-economic development programme to deal with these problems.

In the mid 1980s, the Egyptian government adopted a far-reaching supply-push strategy for the introduction, implementation and institutionalisation of large information and decision support systems intended to improve strategic decision making at the Cabinet level with respect to socio-economic development. The strategy had to be tailor-made to the decision making needs of the Egyptian Cabinet, which addresses a variety of socio-economic development issues. These issues include public sector reform, administrative reform, debt management, and privatisation.

Before decision support systems were implemented, the following characteristics were identified within Cabinet decision making:

- it was data rich but information poor,
- information systems and management specialists were isolated from the decision makers, and
- computer systems were not viewed as tools that could support decision making.

Moreover, the focus of improvements was more on technical issues than on decision outcomes. Despite these undoubted obstacles, a project was initiated to support Cabinet-level decision making through state-of-the-art information technology (IT) tools and techniques.

3. The Information and Decision Support Centre (IDSC)

In 1985, the Cabinet of Egypt established the Information and Decision Support Centre (IDSC) whose mission was and is to provide information and decision support services to the Cabinet for socio-economic development. The objectives of IDSC include:

- developing information and decision support systems for the Cabinet and top policy makers in Egypt;
- supporting the establishment of decision support systems/centres in different ministries and making more efficient and effective use of available information resources;
- initiating, encouraging and supporting informatics projects that could accelerate managerial and technological development of Egyptian ministries, sectors and governorates; and
- participating in international co-operation activities in the areas of information and decision support.

IDSC's work is divided into three levels:

- The first level represents the Cabinet base where information and decision support systems are developed to support strategic policy and decision making processes.
- The second level represents the national nodes, where IDSC links the Cabinet with existing information sources within ministries, national organisations and agencies, and academic institutions and research centres.
- The third level represents the international nodes where IDSC extends its activities by accessing major databases world-wide through information technology and telecommunications facilities.

The operational environment which IDSC must support necessitated a special organisational structure. Managerial and technical human resources having the knowledge, experience and ability to cope with such a dynamic and turbulent

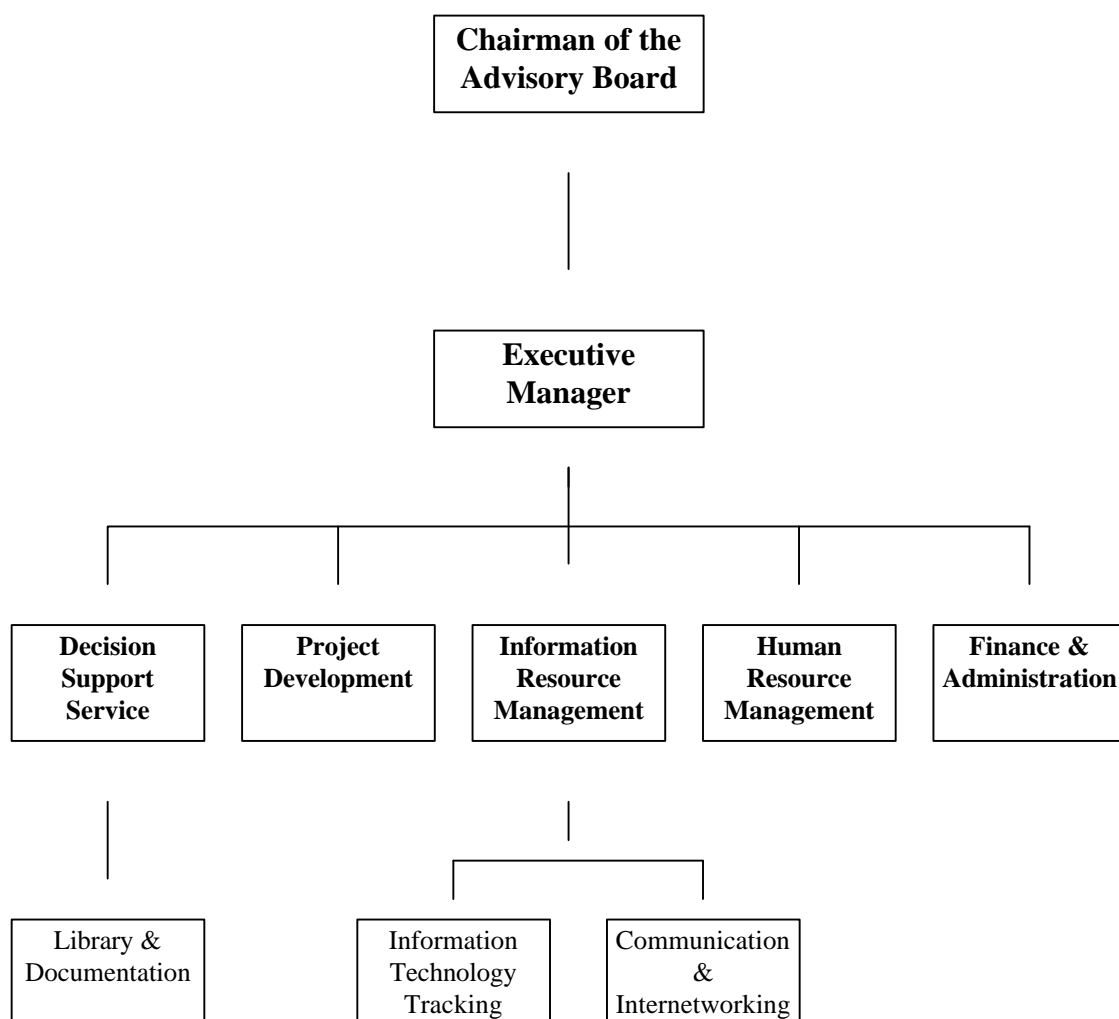
environment also had to be available. The organisational structure, as shown in figure 1, includes:

- Crisis management, priority assessment, and quality control teams which prioritise strategic issues in the Cabinet agenda and assure the production and delivery of high quality information and decision support services.
- A decision support services department, which deals with information and decision support requests from various ministries, governorates and local organisations. Its role is the identification of user needs, issue formulation, definition of information and decision support requirements, and identification of possible alternative solutions to these issues.
- A project development department, which responds to the needs of the different ministries and governorates. The department staff are project account executives whose role is to develop, implement and monitor various projects.
- An information resource management department, which represents the technical staff of the organisation. Its role is to respond to different user needs with respect to systems design, development, installation and maintenance.
- An information technology tracking department, which continuously tracks and diffuses state-of-the-art information technology internally within IDSC and externally within different ministries and governorates through different projects.
- A human resource development department, which deals with the training of IDSC staff as well as the staff of various organisations with which IDSC has joint projects. The training includes a set of programmes and courses in management, information systems and computer applications. The main objective of these training programmes is to diffuse IT knowledge and skills, thereby increasing the effective use of new technology.
- A finance and administration department, which deals with financial, administrative, and legislative issues regarding both internal and external operations. It is also responsible for the development of steps and procedures to be adopted during the implementation of different informatics projects.
- A communications and internetworking department that is responsible for maintaining and supporting all local and wide area networks in the organisation as well as managing Internet access for various departments.

- An organisational library, which is considered one of the key functions due to the continuous need for IDSC staff to have access to various types of socio-economic studies and documentation as well as reference to technical issues relevant to the activities of IDSC.

In addition, there is the international co-operation department, which deals with IDSC's external interactions with international organisations and which works on formulating joint informatics projects with various countries.

Figure 1. IDSC Organisational Structure



IDSC's activities accommodate four domains:

- For the Egyptian Cabinet, IDSC provides information and decision support, crisis management support, modelling and analysis of various high priority issues and multi-sectoral information and database developments.
- For Egyptian economic sectors, IDSC provides assistance in the development of decision support systems/centres, advice and consultancy in the area of information and decision support services, sectoral database development, and project financing and support.
- For the overall Egyptian economy, IDSC provides assistance in policy formulation and drafting, as well as support for legislative reform and human and technical infrastructure development.
- In international terms, IDSC provides opportunities and facilities for technology transfer into Egypt as well as technology transfer to other developing countries through the establishment of generic DSS models for socio-economic development.

As an organisation IDSC grew from a staff of three in 1985 to over 800 managerial, technical and administrative personnel in 1997. The number of IDSC projects has increased steadily to over 500 in 1997, covering a wide variety of economic, social, managerial and technological domains that are of vital importance to sustainable development. Four decision support systems that were developed by IDSC to improve the decision making process in public sector development planning are described in the next section.

4. Decision Support Cases

a. DSS for Strategic Issues: A Debt Management System With DSS Components

Recent economic rebuilding efforts required Egypt to accumulate a foreign debt of about US\$33bn covered in 5,000 loans. These loans needed to be monitored for debt service payments, term re-negotiations, interest rate levels, and payment management and scheduling. The magnitude of the debt burden led the reform of the debt management programme to become a priority issue at Cabinet level. Hence, IDSC initiated, developed and implemented a debt management system aimed at the rationalisation of debt utilisation, and at debt reduction and rescheduling. The system was developed to provide a management tool to support and facilitate the registration, monitoring, control and analysis of Egypt's debts.

Over a period of 18 months a national comprehensive database, located in the Central Bank of Egypt, was developed by IDSC's technical staff. The database included details of government debts and payments, linked to a debt payments transaction processing system. The database was provided with decision support system capabilities, enabling the implications of different debt management scenarios to be tested.

Throughout the development phase, a number of technical and cultural problems arose which caused delays and frustration. Technical issues related to hardware requirements, software availability, and processing of operations. Cultural issues included the fact that most of the software was developed and interfaced in English which represented a problem for many Egyptian users.

The impacts of the system, using decision support tools and generators, was the successful negotiation of debt rescheduling with 14 countries. Negotiation was smoothly managed through the provision of grounded information support that was made available via the DSS. Moreover, loans have been viewed ever since as part of a

comprehensive, integrated and dynamic portfolio rather than being managed on an isolated case-by-case basis.

b. DSS for Strategic Issues: The Customs Reform Programme DSS

Through one of its reform programmes, the Cabinet was about to impose a new set of customs tariffs, largely for imported goods, which were intended to reduce the burden on low income groups, increase the revenue of the government, and create a homogeneous and consistent tariff structure. Anticipation of the tariff changes caused stagnation in the business sector for four months. As a result, multi-sectoral conflicts arose between six different ministries. Hence, some form of decision support system was needed to resolve the conflict and to support imposition of the new tariffs.

Therefore, a team consisting of Ministry of Finance and IDSC personnel was formed to interact with the different parties, get feedback and generate different scenarios to be assessed. A computerised DSS was developed, as a result of which the various inter-ministerial conflicts were resolved within a four-week period. Moreover, a tariff structure was formulated, based on the various scenarios and alternatives that were generated by the decision support system. The government endorsed the new tariff model which was also accepted by the business sector.

c. Sectoral DSS: A Decision Support System for the Ministry of Electricity

The increasing cost of, and government subsidy to, electricity generation in Egypt were continuously enlarging the country's balance of payments deficit and adding to public sector debt. To help address this issue, IDSC developed a decision support system for the Ministry of Electricity which was intended to:

- assess the impact of tariff changes on different income groups,
- provide statistical data on power and energy generation,

- provide statistical data on the distribution and consumption of electricity, and
- assist decision making about the pricing and management of loans within the electricity sector.

A joint team was formed from IDSC and Ministry of Electricity staff. The Ministry staff collected data from different sources. IDSC staff focused on issue structuring, systems and human resource development and, more importantly, on managing the process of developing and delivering the decision support system.

During the implementation process, drought emerged in the sources of the river Nile causing a dramatic drop in the hydro-electric power generated by the Aswan dam and necessitating the provision of US\$5m to fund the rapid construction of three power generating stations. As a result, the Ministry of Water Resources (MOWR) was drawn into contributing to the project since it became a stakeholder in the decision support system design process.

At this stage, the project team therefore incorporated a third group from the Ministry of Water Resources to cover the issues relating to hydro-electric power. In part, this recognition of MOWR as a key stakeholder in electricity generation, and its inclusion in energy decision making was one of the main outcomes of the DSS design and implementation process. The DSS also led to decisions about a new electricity tariff after assessment of the possible alternatives generated by the decision support model and the evaluation of their impacts on different income groups. The case showed that design and implementation processes are inseparable and evolutionary throughout the entire information systems life-cycle.

d. Information Infrastructure Build-up: Establishment of the Governorates' Decision Support Centres

Once IDSC realised the vital role of information in decision making and in socio-economic development, it adopted a supply-push strategy to improve administrative effectiveness at the governorate level through the use of information and decision

support tools and techniques. Since its inception, this project aimed to rationalise the decision making process of the governors through the use of state-of-the-art IT. The project had to be implemented using a supply-push strategy because Egypt has all the classic problems typical of most developing countries that constrain effective use of information and of IT. The project adopted its strategy through the implementation of two parallel policies: the development of an infrastructure for informatics and decision support systems; and the development of human capabilities in the areas of information, computers and communications.

To fulfill this strategy, IDSC developed a comprehensive information base for the governorates through the establishment, in each governorate, of a governorate information and decision support centre (GIDSC) to introduce and diffuse information technology, and to re-envision the role of the governorates in development planning.

The impact of the project is reflected in the number of information and decision support cases delivered at the GIDSCs, and in the diffusion of information technology knowledge and use at the governorate level. Moreover, the work of the GIDSCs led to the introduction and implementation of a new law for local administration - representing a direct result of the project - which allowed decentralisation of decision making authority and power to the governors. The decision support systems therefore had a direct impact on the structure of decision making at the governorate level.

5. An Issue-based Management Approach

The experience of managing the development, design and implementation of decision support systems such as those described above can be generalised as a set of steps and procedures for future use of decision support systems in similar cases. Table 1 provides a comparative analysis between the conventional approach to DSS development, and the issue-based management approach implemented by IDSC.

Table 1. Conventional versus Issue-Based Approaches to DSS Development

	Conventional Approach	Issue-Based Approach
<i>Focus</i>	<ul style="list-style-type: none"> • the decision maker • single decisions • making decisions • generation of alternatives 	<ul style="list-style-type: none"> • decision making issues • interacting decision issues • focusing attention on decision issues • setting of agendas
<i>Favoured Domains</i>	<ul style="list-style-type: none"> • operational decisions • one-shot decisions • functional applications • department applications 	<ul style="list-style-type: none"> • strategic decisions • recurring decisions • cross-functional applications • organisation applications
<i>Design and Delivery</i>	<ul style="list-style-type: none"> • the individual decision maker • interaction between decisions not incorporated • prototyping design • design approach becomes the system 	<ul style="list-style-type: none"> • group decision making and consensus • integration and consensus drives the process • prototyping design and delivery • delivery approach becomes the system
<i>Executive Information System Readiness</i>	<ul style="list-style-type: none"> • no tracking component • emphasises convergent structuring of data • major transformation required to provide EIS functionality 	<ul style="list-style-type: none"> • incorporates tracking component • balances divergent exploration and convergent structuring of data • easy transition to EIS functionality
<i>Relevant Emerging Technologies</i>	<ul style="list-style-type: none"> • expert systems • artificial intelligence 	<ul style="list-style-type: none"> • idea processing and associative aids • multimedia connectivity platforms • object oriented programming

IDSC adopted a two-phased approach for the implementation and institutionalisation of its issue-based decision support systems projects. The first phase (implementation) is concerned with the realisation of decision support systems, and includes a particular focus on model building. The second phase (institutionalisation) is concerned with embedding the DSS into their organisational contexts, and includes a particular focus on management.

The implementation phase was typically divided into three parts:

- The identification of policy needs and the full mobilisation of human and technical resources to be able to achieve effective response and support.
- The identification of decision areas and information requirements, thus translating the planned policy support into specific issues of concern for the recipient organisation.
- The formulation of projects with specific goals and dedicated human and technical resources for each potential area of policy and/or decision support.

DSS project teams were selected to provide fast response, and a focus on results and action. They were two-tier teams comprising government bureaucrats and professional technocrats able to deal with bureaucracy, and IT professionals competent to handle state-of-the-art information and decision support technologies. These two-tier teams were hybrid teams that represented one of the key success factors in bridging the application gap between systems builders and applications users.

The institutionalisation phase covered IDSC's experience with designing, developing and implementing decision support systems for development planning purposes. This experience suggests that managing institutionalisation is as important as model building and that institutionalisation is a complementary and integrated process that accompanies systems development, design and implementation. It comprises six components:

- *Adaptation* deals with various modifications needed to fit the contextual and cultural characteristics of the application environment. Therefore (and notwithstanding the debt management example given above), IDSC made optimum use of available Arabised software in addition to designing and developing Arabised tools and utilities to support and facilitate the use of Arabic-interface software.
- *Diffusion* deals with spreading the use of decision support systems to various organisational levels. IDSC's approach was to develop the information technology infrastructure across all organisational levels through the promoted diffusion of computers.

- *Adoption* deals with the personalised use of information technology tools and techniques by decision makers as well as their support staff. Decision support systems were customised and adjusted to user needs and intermediary support staff were used to support decision makers.
- *Monitoring and tracking* deals with monitoring critical issues, assumptions, priorities, and information and decision requirements, and with tracking changes in the technology and its potential input to the decision making process.
- *Value assessment* deals with reviewing the contribution of decision support systems to public sector strategic decision making in Egypt. It covered tangible and intangible benefits such as: improved decision making at the Cabinet and governorate levels; more efficient use of available resources; improved debt management; and technological infrastructure development.
- *Evaluation* deals with the appraisal, analysis and validation of the value-added benefits of decision support systems developed for socio-economic development planning.

The use of decision support systems in development planning led to the identification of a number of challenges related to strategic public sector decision making, decision support systems, and the implementation and institutionalisation of rational management approaches.

In strategic public sector decision making, the challenges included:

- the efficient and effective use of scarce resources;
- the factors determining implementation of socio-economic development planning;
- the ill-structured nature of strategic decision making processes;
- the turbulent and dynamic environment within which decisions have to be made;
- the crisis management mode of operation for many strategic decisions in the public sector;
- the fact that strategic decision making is usually a group effort rather than an individual one;
- the need for conflict resolution in strategic decision making, given the major issues and stakeholders involved; and

- the formulation, development and implementation of policy reform programmes.

In decision support systems development, the challenges included:

- managing the development of multiple information and decision support systems;
- the institutionalisation of such systems within their application contexts;
- the development of usable decision support systems interfaces; and
- the availability of decision support systems tools and generators relevant to different sectors and applications.

In the practical implementation and institutionalisation of DSS-supported management rationality, IDSC faced a number of barriers caused by:

- resistance to change;
- lack of timely, adequate information about user needs;
- lack of user involvement;
- user language problems;
- lack of top management support;
- lack of continuous communication from users;
- difficulty of problem definition;
- difficulty of responding to user needs;
- inadequacy of model evaluation; and
- poor documentation.

6. Lessons Learned

Based on the implementation of over 500 projects targeted at the development and diffusion of decision support systems in Egypt for development planning, the following set of lessons learned can be summarised. These are likely to be wholly or partially generalisable to the implementation of decision support systems in similar public sector environments:

- Structuring of socio-economic and decision-related issues is an integral part of the design and implementation of decision support systems dealing with national development planning.
- Providing decision support systems requires much time and effort in building and integrating databases from multiple data sources and sectors.
- Developing a decision support system to address one socio-economic issue might affect other issues which should be put into consideration during the design phase to save time and effort and avoid duplication of activities.
- Notwithstanding the previous two points, providing decision support systems for development planning is often both urgent and critical. Therefore, decision support systems design should allow for a crisis management mode of operation. Response to crisis requests entails the preparation of crisis teams with managerial and technical support capable of operating in such situations.
- An effective decision support system depends on the availability and accessibility of timely, relevant and accurate information.
- Successful implementation of decision support systems is a necessary but not sufficient condition for successful institutionalisation of DSS. Both implementation and institutionalisation processes should be well integrated.
- While successful implementation requires top management support, successful institutionalisation requires even broader organisational support.
- Evaluation and assessment of decision support systems is a vital process that should accompany all phases of implementation and institutionalisation in order to provide a real-time response to changes occurring in the environment. Evaluation is definitely not a post-implementation activity.
- Continuous multi-level training of human resources is a critical factor in the successful adoption, adaptation, and diffusion of decision support systems within organisations.

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