

## GIS IN ITALIAN URBAN PLANNING

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**ABSTRACT.** *The paper presents the findings of research into the implementation and use of Geographic Information Systems (GIS) in Italian local authority planning departments. The first part provides contextual information and available data on the diffusion of GIS in Italian local government. This is followed by a discussion of two detailed case-studies undertaken in cities already having 10 years experience in GIS development and use. Based on the findings of these case-studies, and on the earlier evidence presented, the paper suggests that the view of GIS as a “tool” for more rational decision-making, and increased efficiency and effectiveness, may be particularly inappropriate in countries in which these values do not receive high priority. Instead, GIS appears to be a malleable resource able to serve different agendas, through both its technical and symbolic use. In this context, the view of computing as a “package” appears to be useful in explaining some of the characteristics of the cases investigated. Three sets of factors are confirmed as having an important influence on the implementation and use of GIS: the organizational context, people, and environmental stability. In addition, the paper argues that a fourth element, cultural values, plays an important part in shaping the implementation and use of GIS in a given context, and that its significance may be crucial in understanding the experiences of GIS in different countries even when technical solutions are similar.*

### INTRODUCTION

Geographical Information Systems (GIS) have received increasing attention in the last decade, particularly in local government. Several factors have contributed to this phenomenon, including sharp reductions in the cost of hardware (Rhind, 1989), recognition of the geographical nature of most information held by local government (Somers, 1987), and the increasing availability of a wide-range of off-the-shelf software packages (Parker, 1989). The growing number of conferences and journals dedicated to GIS, testify to the considerable potential of this technology, and report increasing diffusion in different organizations and countries. In spite of this potential, a number of problem-areas remain in the take-up of GIS. These were identified by the Chorley Commission as relating to the availability of data in the required format, further technical developments for handling spatial data, cost of adoption and estimation of benefits, lack of awareness, and human and organizational issues (Department of the

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Environment, 1987). Technical progress and increased use of GIS are likely to have a strong influence in ameliorating some of these problems; however, the extent to which they will have a similar influence on human and organizational issues remains doubtful. Already in 1976, after reviewing some of the most advanced GIS experiences at that stage, Tomlinson concluded: "There are just as many problems, and possibly more, on the management side of implementing an information system as there are on the technical side" (Tomlinson, 1976, p. 20). A decade later, and in spite of considerable advances in information technology, the Chorley Commission stressed that "...the major difficulties in successfully using Geographic Information Systems are as much human and organizational as they are technical or due to lack of data of the right sort" (Department of the Environment, 1987, p. 53).

The mounting concern over these issues does not yet reflect in the literature on GIS, which is dominated by technical research, and by uncritical accounts of applications. The available literature on human and organizational issues is not only limited in extent, but also biased towards the implementation of GIS, rather than the effects of its use on the host organization. In addition, it presents conflicting views, broadly divided into two camps: the largest, includes Management and Information Technology (IT) Consultants and those researchers viewing GIS as a "tool" for better decision making, promising greater efficiency and effectiveness to the organization (e.g., Coulson & Bromley, 1990; Ricketson, 1990). Common "cookbook" strategies (Perkins, 1990) to tackle organizational difficulties in GIS implementation include: a corporate approach, commitment of senior managers, a champion, reorganization of existing procedures, thorough cost/benefit analysis, realistic allocation of resources, close control of development and implementation, and the management of expectations at all stages of the process (e.g., Mahoney, 1990; Pearce, 1990; Gault & Peutherer, 1989; Buxton, 1990). The other opposing camp includes those researchers who dispute the appropriateness of this rationalist view of computing, and point instead to the political nature of information (Peters, 1984; Klosterman, 1987), and to the crucial role of contextual and individual factors in shaping the "computer package," which includes both hardware and software but also "...sets of beliefs about what computing is good for and how it may be used efficaciously" (Kling, 1980, p. 79).<sup>1</sup> For the effective utilization of a GIS, it is suggested that three necessary and sufficient conditions have to be met: extensive and clearly defined information management strategy, personal commitment of individuals at all levels of the organization, and environmental stability (Campbell, 1990; Masser & Campbell, 1991).

In addition to the limitations and contrasts identified in the literature, current research and prescriptions are dominated by the experiences of GIS made in North America and Great Britain. This is to be expected in view of the historical development of this technology and the distribution of its adoption, which in Europe is heavily skewed towards Northern countries (Craglia, 1992b). However, it raises questions on the extent to which the research findings and proposed strategies are applicable to contexts not sharing the same values. Does the diffusion of the same GIS packages across countries and cultures mean that the technology is an homogenizing factor? Or should social and cultural values be incorporated into the design, implementation and use of GIS (Chrisman, 1987; Kishor, 1990; Kishor & Niemann, 1990)?

To answer some of these questions, this paper presents the findings of research into the implementation and use of GIS in Italian local authority planning departments. The discussion is divided into three parts: the first outlines some of the contextual factors affecting the development of GIS in Italy. They include administrative structure, planning trends, mapping responsibilities, and diffusion of IT and GIS in local government. The second part presents the findings of two detailed case-studies, while the third part draws some conclusions and suggests areas for further research.

## ITALIAN CONTEXT

### *System of Government*

Italy has only been a unitary State since 1861, and a Constitutional Republic since 1946. The administrative layers, all of which have an elected Council, include 20 Regions, 95 Provinces and over 8,000 Municipalities, 87% of which have less than 10,000 population. Until the late 1970s, the structure of government was highly centralized. Municipalities acted as peripheral offices of the State for the provision of local services and the maintenance of basic information files: the Electoral Roll and the Register of Resident Population (Anagrafe). Since the late 1970s, devolution to the Regions has given these bodies legislative powers and responsibilities which include planning and the provision of local infrastructure. Municipalities remained as decentralized offices of both the State and of the Regions. A radical reform in 1990 (No. 142) overhauled the system by taking a bottom-up approach, and by recognizing the Municipalities as autonomous basic entities of local government. The intermediate layer of Provinces was also given new powers in the areas of land-use planning and environmental monitoring, and a coordinating role in matters of IT in local government. This reform may have profound effects on the organization of local government and its information needs. However, its full impact is unlikely to emerge for some time. To date, Municipalities have a strong departmental orientation. The main forum of coordination are the political arenas of the Council and the Junta, while technical coordination is left to informal, voluntary arrangements among departmental heads.

### *Planning Trends*

The cornerstone of the Italian planning system has traditionally been the Municipal Master Plan, requiring approval from Rome until the 1970s, and from the Regions since. These plans have tended to be rigid, detailed, and long-term, reflecting a blue-print approach to planning. City-wide plan preparation has been generally trusted to appointed consultants (Crosta, 1988), while local planning departments prepare detailed implementation plans. Monitoring and enforcement have never featured prominently in this system, as witnessed by the extent of unauthorized development, which one estimate put at 3 million buildings in 1983 (Urbanistica Informazioni, No. 71, 1983). Information needs of planning departments have therefore been largely ad-hoc and attended to by manual systems. Devolution, special legislation, and dissatisfaction with the system have created a number of conflicting trends: (a) in some Regions, recent legislation moves towards a process-planning approach (e.g., Emilia-Romagna, Law 23/1980) by permitting regular updates to the Plan to be approved by the Municipality itself, as long as major changes are not envisaged; (b) special legislation and deregulation have increased the flexibility of the planning system. However, they are also allowing Municipalities to side-step plans and emphasize "development by projects," particularly in those instances in which large corporations and institutions are interested in redeveloping inner city sites (Campos Venuti, 1988; Dente et al., 1990); (c) some recent plans, in acknowledging the end of quantitative growth have also rejected traditional comprehensive approaches and suggested instead the use of qualitative, morphological analysis as the main tool for plan preparation (Secchi, 1989).

The extent to which these trends will affect the information needs of local planning departments is difficult to assess at this stage. However, the case-studies presented in the second part suggest that the adoption of information technology in Planning departments is likely to depend on the orientation of the local authority and the characteristics of the individuals involved.

### Mapping

Mapping in Italy is a responsibility fragmented among different institutions, at central and local levels, and undertaken by both the private and public sector. The main supplier of small scale maps has traditionally been the Military Geographic Institute (IGM). Lack of finance and personnel severely affected this organization, which was reported in 1986 has having only 200 staff, compared to the over 6,000 staff of the Ordnance Survey in Britain to cover a land area of a similar size to Italy's. As a result, by 1986 only 4% of the maps 1:25,000 were updated to 1970, and 5% of the 1:50,000 to 1980, leaving the vast majority of maps some 20–30 years out of date (Sapio, 1986). Since 1975, the Regions have been contracting private firms to prepare maps (1:5,000–1:10,000) for their territory, and by 1986 some 80% of the country had been covered although not in a digital format (Benedetto, 1986).

At the urban level, the traditional supplier of large scale maps (1:2,000) has been the Cadastral Administration of the Ministry of Finance. However, during the rapid urban growth in the 1960s and 1970s, these maps became rapidly outdated in several Municipalities, and it was necessary to contract private firms in order to get new city maps. A serious constraint in the development of GIS at the local level is that Municipalities have to rely largely on their own resources to acquire digital mapping. Another, is due to the low status of Geography in the Italian university system. A measure of this problem emerges from a comparison of graduate outputs in Italian and British universities in 1987. Although total population and number of graduates are similar in the two countries, in Italy only 5 people graduated in Geography, against the over 2,000 in Britain (ISTAT, 1989; UGC, 1988).

### IT in Local Government

Despite being the fifth largest industrialized nation (Economist, 1990), and the fourth largest European market for IT (Censis, 1990), Italy still lags considerably behind its OECD partners in all measures of IT diffusion (Table 1).

Of the overall expenditure on computing in Italy, local government accounted for less than 6% of total expenditure in 1987, which partly explains the limited diffusion of computing at this level (Censis, 1990). As shown in Table 2, Italian local government is around 10–15 years behind some of its partners in terms of computer availability. Within the country, considerable

**TABLE 1. EDP Expenditure (1990 US \$) and Installed Workstations in Selected OECD Countries, 1987**

	US	France	Germany	UK	Italy
<b>Per Capita EDP Expenditure</b>	389	297	345	261	174
<b>Expenditure EDP/GDP</b>	2.1%	1.9%	1.9%	2.3%	1.4%
<b>Expenditure EDP/Employee</b>	863	785	811	616	434
<b>Workstations (PCs + Terminals) per 100 Employees</b>	35.6	12.9	12.6	12.0	7.0
<b>Source: Censis, 1990</b>					

TABLE 2. Percentage of Municipalities Using Computing in Six OECD Countries

COUNTRY	MUNICIPALITIES	PERCENTAGE	YEAR OF SURVEY
Denmark	276	90%	1975
Sweden	464	72%	1973
U.K.	521	67%	1978
Japan	3,274	64%	1975
U.S.	2,794 <sup>(1)</sup>	51%	1975
Italy	4,400 <sup>(2)</sup>	3%	1976
		56%	1986

1) Above 10,000 population (2) Above 2,000 population  
Source: King and Kraemer, 1985; Honeywell, 1987

North-South disparities are also to be noted, with over 60% of authorities having access to computing in the North, but less than 40% having similar facilities in the South (ANCI, 1989).

In explaining the wide gap between Italy and its partners, an important issue adding to the limited investments is the small size of local authorities in Italy, averaging less than 7,000 population, which limits their availability of human and financial resources as well as their overall need for computing. The importance of this factor is confirmed by data suggesting that larger authorities in Italy are much more in line with international averages. For example, Honeywell (1987) reported that over 90% of communes in the class 40,000–200,000 had access to computing facilities in 1986. These findings underline the importance of population size on the diffusion of computing in local government.

In relation to the application of IT in local government, all available evidence points to similar patterns regardless of population size (ANCI, 1988; Limone, 1989; Honeywell, 1987). The most widely automated files are Population, Finance, and Personnel, while the least automated departments are the technical ones, Planning, Development Control, Housing, Maintenance, in which the use of computers ranged in 1986–1987 from 7% in small municipalities (Limone, 1989) to just over 50% in large metropolitan areas (ANCI, 1988).

The limited use of computing in Italian planning departments has its roots in the dominance of legal/administrative functions in local government over technical ones, and in the prevailing legal culture which emphasises the respect of procedures over the achievement of objectives (De Cugis, 1987). Therefore, computing tends to automate the administrative bureaucratic procedures rather than technical operations. Moreover, the social sciences, with their emphasis on analytical/quantitative methods, have a lesser status in the Italian university system, while planning departments are generally staffed by architects who have an artistic/qualitative training, and by and large, a negative orientation towards computing (Ranzani, 1986). As a matter of comparison, already in 1984 some 85% of all British local authority planning departments had access to computing facilities and used them widely (Bardon, 1985).

### **GIS Diffusion in Italy**

In spite of the relatively limited diffusion of IT in local government, GIS is attracting considerable interest in Italy, both in Municipalities and in other levels of the public administration. A recent European survey (Green, 1990) suggests that Italy is the third largest GIS market in Europe, behind Germany and the UK. Its share of the total European expenditure in GIS was forecast to increase from 11% in 1989 to 13% in 1991. As a comprehensive survey of GIS users in Italy has not yet been undertaken, Tables 3 and 4 piece together information

TABLE 3. Examples of Italian Organizations Implementing GIS, June 1991

LEVEL	ORGANIZATION	GIS SOFTWARE
<b>NATIONAL</b>	IGM (Mapping Agency) Cadastral Administration Geological Survey Ministry Cultural Assets Ministry of Interior Hydrographic Military Inst. Air Force	Intergraph TIGRIS + Syscan Syscan/Digital Arc/Info/Digital Arc/Info Siemens-Sicad Syscan Intergraph
<b>UTILITIES</b>	ENEA (Energy Agency) ITALGAS SNAM (Gas & Oil Engineering) SIP (Telephones) ENEL (Electricity) ANAS (Road Agency)	Intergraph Synercom Synercom GEPIN/Digital GEPIN/Digital Alice SIT
<b>REGIONAL</b>	Piedmont Lombardy Veneto Emilia Romagna Umbria	SITA (in House) + Arc/Info Arc/Info Apic Arc/Info Siemens-Sicad/ItalCad

from a variety of sources to provide a preliminary picture of GIS diffusion in the country. Although further research is needed to complete these Tables, some considerations emerge from their analysis:

1. At the *national level*, the two organizations which could make a substantial impact on the diffusion of GIS in Italy are the IGM and the Cadastral Administration. Both have already acquired GIS technology and are in the process of converting their maps and records to digital format. However, as reported earlier, the financial and staffing difficulties of the IGM, and the backlog in the updating of records in the Cadastral Administration, are likely to delay the operations of these organizations for a considerable time. In addition to these organizations, the Table indicates that several other governmental agencies and ministries have adopted GIS, as well as the main national utility companies. However, to date there appears to be a considerable fragmentation of initiatives, with lack of coordination and agreed standards.
2. At the *regional level*, the Table shows that 5 out of 20 regions are in the process of developing a GIS. Their distribution shows a clear North-South divide, indicating the imbalance in the diffusion of computing in local government in general. All four larger Northern regions have adopted GIS, compared to only one (Umbria) in Central Italy and none in the South. All together the four regions in the North represent some 30% of Italy's land area and some 37% of its population. The lack of GIS applications in Central-Southern Italy may not only be due to socio-economic imbalances, but also to a more limited commitment towards physical planning and monitoring of development. For example, it has been estimated that between 1961 and 1979, one quarter of all dwellings built in Rome were illegal, while in Calabria, one of the Southern regions, this rate reached three quarters of all residential dwellings built between 1971 and 1981 (Urbanistica Informazioni, No.71, 1983).

Among the regions with a GIS there are however substantial differences in terms of the rate of progress made, standards and approaches adopted, and type of application to which

TABLE 4. Examples of GIS Implementation at Urban Level, June 1991

LEVEL	ORGANIZATION	START YEAR	GIS SOFTWARE
URBAN	Modena	1980	IBM GPG+Geodis
	Padua	1980	Siemens-Sicad
	Cremona	1985	Intergraph/Microstation
	Perugia	1988	Siemens-ItalCad
	Trento	1988	IBM-GPG Geodis II
	Sesto S.Giovanni	1988	IBM GPG Geomanager
	Benevento	1988	IBM GPG Geomanager
	Lucca	1988	Siemens-Sicad
	Lumezzane	1989	Prime-System 9
	Bergamo	1990	IBM-Geodis II
UTILITIES	Several Municipal Companies including: Rome (2), Milan (3), Turin, Bologna, Reggio Emilia, Rovereto, Padua, Verona, Brescia, Bressanone, Bergamo, Modena		4 Siemens-Sicad 2 Arc/Info 1 Synercom 1 Digital/GBG 1 EZS I-Comgraph 2 Geodis, 4 Not Known

priority is given. In addition, existing evidence suggests that there is limited interaction between the systems developed at this level and the ones being implemented by Provinces and Municipalities.

3. At the *provincial level*, it would seem that little progress has been made, with only a few confirmed cases of implementation (Padua, Pisa, Modena, and Bergamo) among the 95 Provinces. However, it is only since the reform of local government in 1990 that Provinces have been given a clear mandate as intermediaries between Regions and Municipalities, with new responsibilities in the fields of environmental control, planning, and IT coordination as discussed earlier. It is therefore likely that substantial progress in the diffusion of GIS will occur at this level, even though the limited availability of digital mapping is likely to slow-down the pace of implementation.
4. At the *urban level*, a distinction must be made between the GIS efforts of municipalities and those of their local utility companies, as there is often little coordination between them. Research focusing on municipalities (Craglia, 1992a) has identified ten cities that have made substantial progress in implementing a GIS, of which all but two (Benevento and Perugia) are located in Northern Italy. They are shown in Table 4, while other cities at earlier stages of development are not included.

The cities shown in the Table were the subject of a telephone survey in June 1991, followed by field visits to the five with more developed systems.<sup>2</sup> It is interesting to note that none of the large cities in the country appears in this list. One explanation put forward during the field work was that in larger cities the fragmentation of authority is paralysing the decision-making process in connection to the large investments required to implement a GIS. Smaller cities, on the contrary, require smaller investments, and can take advantage of the closer face-to-face contact among decision-makers to by-pass to a certain extent the rigidity of the administrative structure of local government. Organizational issues, therefore, are at the root of this pattern of adoption.

While software at Regional level appears to converge on Arc/Info, the solutions adopted by Municipalities show a strong correlation to their traditional computing suppliers (primarily IBM and Siemens). This would suggest that in the choice of GIS software, continuity and familiarity with the existing environments took precedence over technical issues such as performance or facility of use. The individual nature of the choices made also reflect the degree of

isolation and the lack of coordination existing. It is, in fact, not uncommon to find Regional, Provincial, and Municipal authorities adopting different GIS solutions for the same area, and these in turn to differ from the one adopted by the Cadastral Administration or the utility companies. An initiative to define common GIS standards was launched in 1989 by the Association of Italian Municipalities (ANCI-SITUS Project), but at this early stage of GIS diffusion the overall picture remains highly fragmented.

A sector of growing applications is that of the utilities. Unlike the UK, utility companies in Italy are local to each major municipality and serve both the main urban area and the surrounding small municipalities. Their status is of semi-independent companies owned by the local municipality to which they turn their profits. Table 4 shows that at least 15 among these companies were in the process of implementing a GIS. This number refers only to the companies for which documented evidence of implementation was found, and may therefore considerably underestimate the extent of involvement of this sector. In spite of this limitation the following considerations emerge:

1. Their distribution confirms once more the North-South imbalances in the diffusion of computing and of GIS. With the exception of the two companies in Rome, all other agencies are located in Northern Italy.
2. Half of the agencies shown belong to the large cities with over 250,000 inhabitants (Rome, Milan, Turin, Bologna, Verona). The comparison of this finding with the distribution of GIS in municipalities would confirm that the lack of GIS diffusion among the largest cities may be more closely related to organizational issues than to technical ones, or to cost. Given that the utility companies are so interested in GIS development as to initiate their own projects, sharing the costs with the Municipality who owns them would make good financial sense.
3. However, coordination between the municipalities and their utility companies does not appear widespread. This is shown by comparing the list of municipalities with GIS with that of the utilities. Evidence from the field-work suggest that in only in three cases (Padua, Modena and Bergamo) there is effective coordination in the development of GIS. In two cases (Benevento and Trento) there is an agreement to share information at a later date, but in most other cases GIS developments appear to be unrelated.

Some of the factors contributing to this fragmentation of initiatives and standards have already been identified: decentralized administration, division of mapping responsibilities, diversity in planning approaches, and low status of Geography in the university system. Others emerge from the analysis of detailed case-studies of GIS implementation and use. As Table 4 indicates, the municipalities of Padua and Modena have by far the longest experience in GIS implementation and use in Italian local government. For this reason they were investigated through detailed case-studies, the main findings of which are summarized below. (For a fuller discussion of these case-studies and of GIS in Italian local government see Craglia, 1992a).

## TWO CASE-STUDIES

Padua and Modena are two middle-sized cities (approximately 200,000 population) located in Northern Italy. The former is some 20 miles West of Venice and has traditionally been ruled by coalition governments lead by the Christian Democratic party, while Modena is approximately mid-way between Milan and Florence and has a history of Communist administrations since 1946. Despite these considerable political differences, both cities stand out in the Italian context for their commitment to efficient administration, and for the extent of their use of computing.



During the 1980s, both Padua and Modena experienced a decline of their resident population due to low birth rates (a feature common to the whole of Northern Italy). Accordingly, the key planning issues in both cities focus on the existing built-up environment rather than new areas for expansion. In Padua, an important issue related to the need for a careful balance between preservation of its historical city centre and encouraging economic activities in this area to reverse population losses. In Modena, the major issues related to the identification of new uses for the older industrial areas, which had been abandoned following changes in markets and production technologies. Both cities also shared the need to enhance the quality of life in their peripheral residential districts, which had been hastily built during the economic boom of the 1950s and 1960s.

To respond to some of these issues, these two cities have recently prepared and adopted new urban plans: in Padua a conservation plan for the historical city centre, and in Modena a new Structure Plan for the whole city. Both plans made use of GIS technology during their preparation and adapted it to suit the different planning objectives pursued and methodologies followed. In Padua the planning process started from the recognition that the centuries-old city centre had undergone many changes during its lifetime, and yet managed to preserve its valuable character and texture. The need was therefore to understand the essential features of this environment and allow changes in harmony with it. A GIS project was established based on a digital map in 1:1000 scale covering the 600 hectares of the walled city centre, and identifying each of its 7,000 buildings. Morphological and historical studies were commissioned to external consultants to establish for each building a number of variables including the period of construction, the type of changes occurred, and the existing architectural and historical values. The task of the GIS was to sieve through all the variable associated to each building and assist planners into developing five composite planning categories, each with its specific planning regulation. The plan thus prepared enables the Municipality to evaluate planning applications based on the distinctive merit of each building.

Similarly to Padua, one of the advantages of developing a GIS in Modena was the possibility of sharpening the focus of the planning regulations by substantially reducing the areas of the planning units. Previous blanket regulations covering large portions of the city had proved ineffective in controlling development, and the need was felt to develop much more detailed approaches, to the stage where each parcel could eventually have individual regulations. An additional objective was to strengthen the monitoring and reviewing functions in order to move from a blue-print to a process-planning approach. For this purpose a new Structure Plan was prepared on a digitized map of the city blocks in 1:5000 scale, while detailed Operational Plans, to be reviewed yearly, are under preparations on new digital maps at 1:2000 scale. The GIS was able to link to the digital base map the large number of automated files already available in the Municipality, after these had undergone a lengthy process of restructuring to make them compatible. These files included detailed information on 250,000 customers of water, gas, and electricity; 180,000 residents; 7,000 dwelling units; and 12,000 economic establishments. The cross-referencing of this information allowed the identification of vacant units, existing densities of population and its socio-economic characteristics, and catchment population of existing public facilities and services. These analyses showed, for each of 370 basic planning units, whether they were above or below a set level of service, and allowed for each unit to develop specific planning regulations. In addition a traffic model was developed within the Planning department to evaluate the impact of the different planning proposals.

These practical applications put Padua and Modena several years ahead of any other Italian municipality in the use of GIS, suggesting them as worthy of detailed investigation. The case-studies were conducted between June and October 1990. In each authority, a 3-week field-work allowed the collection of numerous written documents, and the recording of some 50 hours of semi-structured interviews with 18 users and affected non-users of the GIS. These included key

politicians, the managers of seven different departments in each Municipality, and the managers of the municipal utility companies (water, gas, electricity, refuse collection).<sup>3</sup>

Further details of these GIS applications are available in the Proceedings of the 13th UDMS Conference held in Lisbon in 1989 (Righi & Stancari, 1989; Rumor & Gonzato, 1989). What may be of greater relevance to the discussion is to identify some of the similarities and differences between the two experiences, and to refer them to the wider context of international GIS practice.

Both developments were initiated in the early 1980s. The possibility of purchasing off-the-shelf GIS packages was investigated, but at that stage they were found to be too expensive and lacking logistic support. In addition, it was feared that they might disrupt existing computing arrangements. These considerations led instead to the purchase of newly marketed graphic software from the regular computing suppliers (IBM and Siemens) of these Municipalities, and to extensive in-house customization and development. The decision to develop a GIS had the approval of the respective Mayors, but did not go through the corporate decision-making process often associated with these expensive initiatives (e.g., see Pearce, 1990). Development was kept on the contrary low-key and incremental and was financed through the departmental budgets of the Data Centres and Planning departments. This approach was made possible by relying on existing staff and by having the major expenditure (for digital mapping) approved by the Council as accessory to the preparation of the new urban plans. A partnership with external agencies (local cadastral administration and utility company) also assisted in reducing initial investment for mapping but does not appear to have been crucial to the adoption of the systems.

The development of a GIS for strategic planning appears to run somewhat contrary to international patterns in which operational applications (mapping, cadastral, highway and grounds maintenance) receive first priority. Given that neither authority formulated a "corporate" strategy for the adoption of the GIS, the type of application developed appears to have been functional to the key actors involved. The Data Centre Managers saw GIS as an opportunity to "colonize" the Planning department, which had thus far emerged unaffected by the computerization drive in both Municipalities. Further, the development of the GIS could benefit from "grafting" onto high-profile projects like the preparation of new urban plans, by sharing resources and support. For the Planning managers of both cities, GIS offered the possibility of developing building-by-building planning regulation, thus overcoming some of the limitations of previous plans which covered large built-up areas with blanket regulations. In Modena, the GIS also assisted in siting public facilities and in evaluating the traffic impact of some of the planning proposals. In addition to these valuable technical outputs, the use of GIS appears to have promoted the status of the departments involved, and to have facilitated the acceptance of the plans at various levels by providing a high-tech gloss.

The lack of prior computing experience in the Planning departments caused a number of problems with staff, both at professional and technical levels, including in some instances, total rejection. The negative orientation of architect/planners towards computing, and the hostility of softwares entirely command-driven, and in a foreign language, compounded the problem. Two different approaches were taken in the case-studies: In Padua, the development was spearheaded by the Computing Manager who established a GIS Project inside the Planning department, with two architect/planners acting as liaison between the Data Centre and the planners. This arrangement was very successful in developing the GIS and its planning application, less so in spreading its direct use among planners. In Modena, the early involvement of the Data Centre faded with changes in management. Therefore, the GIS was entirely developed inside the Planning department by its Manager and an experienced programmer. Considerable problems due to software deficiencies, required extensive alterations and have so far constrained access to the system to the two developers. However, by-products of the project (linking of data

bases) are extensively used by other departments, while the purchase of friendlier software should facilitate direct use by other planners.

In both cases however, technical issues inhibiting the direct use of GIS by planners remain downstream to the deeper issues of the relationships between plan preparation, implementation, and monitoring, and of the planners' information needs. It would appear that these issues, and their implications for the use of GIS, have not received full attention, and/or have been constrained by existing legislation and organizational structures.

The development and use of the GIS, and of computing in general, has not been based on an explicit strategy but has followed the strong departmental structure of the Municipalities, and has diffused along lines of "least resistance" based upon the orientation of the individual managers. Although this finding, per se, may not appear unusual, the life-tenure system of Italian government and the lack of mobility of personnel may lead to instances in which only the retirement of a senior manager allows a breakthrough in his department. Problems of diffusion also appear to find consistent trouble-spots: In both cities the key department for planning implementation (issuing building licences) has not participated effectively in either the development of the GIS, or in the preparation of the new plans. Although personalities may have also played a part, it was suggested that these departments often resist the use of computing, which is seen as an unwelcome, controlling filter between technical officers and the public.

Both in Padua and Modena, the development of GIS has not only proved useful during plan preparation, but has also substantially increased the revenues of the Municipality by uncovering tax evasions. In spite of these successes, GIS continues to receive little attention from the political decision-makers, suggesting that economic and organizational efficiency is not one of their priorities. This finding is consistent with the Italian political culture of using public resources and office for political and personal patronage (Economist, 1990). At the municipal level, projects concerned with infrastructure, social facilities, and leisure provide greater political mileage because they are more "visible" to the voter than efficiency measures like tax control. The latter is also an extremely thorny political issue throughout the country, as tax evasion is so widespread that recent estimates put it at one quarter of all income tax and one third of Value added tax (VAT) (Economist, 1990). Although the two cities investigated appear to be relatively well run, it was suggested that local politicians cannot be unaffected by this national political culture regardless of their party affiliation.

The lack of interest generated by GIS at the political level, and the strong departmental orientation of the administration, advised in both cases not to formulate an explicit information management strategy, and to keep instead a low profile. This approach appears to have facilitated the development of the GIS by reducing potential conflicts with other departmental managers and the politicians. However, it may hinder further developments necessitating organizational change or reallocation of resources.

In spite of the numerous technical problems, by far the major constraints relate to human and organizational issues. In particular, competition for computer staff by the private sector, national legislation restricting recruitment in local government to reduce public expenditure, and low salaries for skilled staff are the major problems, in addition to the lack of commitment by top administrators. In this context, only the dedication of a handful of managers and professionals made the development of these GIS possible.

## CONCLUSION

The findings of these case-studies have been confirmed through a robust feedback process and have found additional support by researching the other Italian municipalities in the process of implementing a GIS (Craglia, 1992a). On this basis, some general conclusions may be drawn.

1. The often-held view of GIS as a tool for more rational decision-making, and greater efficiency and effectiveness, appears to be least appropriate in national contexts in which these values do not have the greatest of priorities. Instead, GIS appears to be a malleable resource able to serve different agendas through both technical and symbolic functions. In the case-studies investigated, GIS provided: at *departmental level*, technical aid to planning problems and increased status; at *inter-departmental level*, a vehicle for power enhancement, but also an opportunity to increase coordination, while at *political level*, where "common knowledge" is more valuable than "technical knowledge" (Mazza, 1988), the use of GIS as signal and symbol (Feldman & March, 1981) appeared more prominent.
2. In seeking to explain the implementation and use of GIS in complex social and political environments, such as local authorities, the appropriateness of the "package" view of computing is confirmed. In particular, the GIS "package" was shown to be influenced by three sets of factors:
  - i. *Organizational Context*: including political and administrative features of the Municipalities, relative wealth of their cities, central government legislation, and availability of the technology. These elements were important in shaping the way GIS was developed and its applications. However, they only acted as background to the other factors;
  - ii. *People*: appeared to be the most crucial in the development of the GIS investigated. Only the commitment and dedication of a few managers with the status to fight the necessary battles, and the presence of an even smaller number of single-minded, skillful professionals determined the success and longevity of these projects. Their long-term commitment represents the third factor;
  - iii. *Environmental Stability*: it is doubtful whether much progress would have been made if any of these key actors had moved. The life-tenure system of local government and the attachment to city of birth appear to favour Italy in comparison to other national contexts characterized by higher mobility of personnel. However, the difficulties experienced by both Data Centres in recruiting and retaining staff testify to the importance of this factor even in Italy.
3. These findings confirm earlier research by Campbell (1990) in the context of British local authorities. However, the comparison suggests that while the three sets of factors identified are essential in explaining the development and use of GIS in a given national context, differences in *Cultural Values* are important explanatory factors in a cross-national comparison. These values exert their influence at various levels by shaping the institutional context, the allocation of resources for Universities and research, the orientation of the political system, and the individual attitudes towards technology and computing (also influenced by awareness and experience).

The appreciation of these cultural differences is crucial in sharing experiences of GIS use, and in the context of technology transfer. As standard GIS softwares are adopted by an increasing number of countries, there is a greater need to beware of advocating and applying standard implementation approaches. The "cook-book" strategies advocated by some of the literature on GIS presume a division of responsibilities and roles between political parties and officers in the public administration, and a consensus on the goals of efficient and effective service provision which may be inappropriate in some contexts such as Italy's. In this respect, the case-studies have underlined that the adoption of "corporate approaches" to GIS implementation and "user-centred" strategies may find considerable obstacles due to the strong departmental orientation of Italian local government and the lack of information awareness, as well as computing aware-

ness, in some of the user departments. While in the long-run the effective utilization of GIS in Italian local authorities will depend on cultural, professional and organizational change, in the short-term GIS is likely to be adopted by individual organizations with a positive orientation towards territorial management, and with a few managers and staff committed to the project. The diffusion of their experiences, and of best international practice, may substantially contribute in creating greater awareness of the potential of this technology, and foster long-term change. However, the research has sought to emphasize that present trends focusing primarily on technical issues and on uncritical descriptions of GIS applications, may be of little value to this process of change. Instead, greater attention is needed to the human and organizational issues emerging during, and as a result of, the implementation and use of GIS, and to the underlying cultural contexts in which they take place. Only in this case will effective sharing of experience occur and benefits be realized.

## NOTES

1. See also Campbell, 1990; Danziger, Dutton, Kling, & Kraemer, 1982; Danziger & Kraemer, 1986; King & Kraemer, 1985.
2. Perugia, Lucca, Sesto S. G., in addition to Padua and Modena which were the subject of detailed case-studies.
3. The author acknowledges with gratitude the warm welcome received in both Municipalities, and in particular the valuable support given by Mr. Righi in Modena, and Mr. Rumor in Padua, without whom the study would have not been possible. The following discussion reflects exclusively the views of the author, and should not be taken in any way as representing those of the authorities involved.

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