Implementation Factors for An Economic Development Geographic Information System

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THE REASONS TO DEVELOP AN ECONOMIC DEVELOPMENT GEOGRAPHIC INFORMATION SYSTEM

The economic development process is known as a highly innovative field in which change is a constant. The reason for this volatile nature is simple - a competitive advantage can result in the location of a multi-million dollar facility. With high stakes there is a resultant pressure for extensive capabilities.

The history of the economic development process reveals major innovations which provided high capabilities and thus a competitive pressure. One of the earliest incentives for prospects was the provision of property that had been especially set aside for manufacturing use, such as an industrial park. The next innovation was the provision of speculative infrastructure facilities that would support a location. The most common examples being water service, sewer service, roads and elevated water tanks. An innovation developed in recent years has been the provision of speculative industrial buildings that can be quickly completed to the specifications of a prospect.

The evolution of these innovations has centered upon the ability of a community to assure a prospect of a profitable location that could be acquired quickly. Presently these innovations allow business prospects to locate within a matter of weeks in almost turn-key facilities.

The question facing local and state development agencies is "What will the next economic development innovation be and how can I be the first to have it?" A growing consensus among economic development professions is that Geographic Information Systems are that new innovation. The reasons behind this position are highlighted below.

Beginning in the 1970s, Geographic Information Systems (GIS) have promised to marry map information to attribute information. For example, a GIS can not only display the location of an industrial site, but can also allow the user to highlight attributes of that site. A common example would show all sites with an industrial zoning classification larger than 10 acres and which are within 1,000 feet of water and sewer service.

Recent advances in technology include the ability to input map data automatically, to transfer map data between different software packages, improved printing and plotting ability, and increased capacity in data handling. Related technological improvements are enhanced satellite imagery, video display capabilities, and the development of digital census files.

For a local chamber of commerce, a viable Geographic Information System can be purchased for a cost of under $10,000. This cost is extremely attractive given the ability of the chamber of commerce to acquire data from local, state, and national sources.

The location of a new facility now requires greater ecological and market information than ever before. Ecological information is required due to stricter environmental regulations and the liabilities associated with hazardous waste clean up. The need for enhanced market information has resulted from the splintering of the American marketplace and the data collection processes that have been generated to provide information on these submarkets. Such information is now being assembled on a ZIP+4 basis and being made available for marketing purposes.

Following a national trend, the Georgia General Assembly has recently enacted a Quality Coordinated Planning process to organize development within the state. This bottom-up process requires all communities in the state to plan for their growth, including economic development goals. The development of these goals requires a complete analysis of the existing and the desired economic structure.

Geographic Information Systems are being developed throughout Georgia to support this process. Within the Central Savannah River Area, this GIS is being designed to support the site selection

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process and allow use by chambers of commerce. Another use of these systems is to support the capital planning process for industrial sites in order to accommodate the needs of targeted industries.

SYSTEM CONFIGURATION OF THE CSRA EDGIS

In 1988, the Central Savannah River Area Regional Development Center (CSRARDC) began to design a Geographic Information System capable of supporting the economic development process. This system is operational today and is known as the CSRA EDGIS - the Central Savannah River Area Economic Development Geographic Information System.

The guiding principle behind the development of the CSRA EDGIS has been cultivating data exchange capability. Within the economic development process are a multitude of parties - business prospects, state agencies, regional development agencies, local government and local businesses to name a few. The role of the CSRA EDGIS is to facilitate the distribution of information between these participants in order to locate a new facility.

To adhere to this data exchange principle, the CSRA EDGIS is a multiple platform-multiple software system. AutoCAD is operated on an IBM-compatible platform to provide access to CAD generated information. MetaMAP, an Automated Mapping/Facilities Management (AM/FM) software package is operated on an IBM-compatible platform to provide access to AM/FM systems operated by local governments. Finally, Arc/INFO is operated on a SUN 386i platform to provide access to GIS systems operating throughout Georgia and the nation.

Ancillary hardware includes digitizers, plotters, laser printers, modems, diskette drives, cartridge machines and nine track tape readers. Ancillary software includes database management , spreadsheet, word processing and desktop publishing capabilities.

The design of this system will support data exchange through a variety of means. This capability is important in order to accommodate the information needs of prospects. The expected presentation routine will be the use of Arc/Info to develop detailed site maps, which are then plotted. Database management, spreadsheet and word-processing software will then be used to develop a descriptive report on the site. Finally, an AutoCAD compatible file of the site will be provided for use by the prospect.

INVOLVED PARTIES

In developing an Economic Development Geographic Information System, the needs and resources of all parties in the process are important. In the case of the CSRA EDGIS, the primary participants are the state and local level economic developers. Both of these groups have unique needs and requirements.

On the state level, the CSRARDC requested assistance from the Atlanta Gas Light Company, Georgia Department of Community Affairs, the Georgia Department of Industry, Trade and Tourism, the Georgia Department of Natural Resources, the Georgia Power Company, the Municipal Electric Authority of Georgia, and the Oglethorpe Power Corporation. Except for the Department of Natural Resources, all statewide agencies are members of the Georgia Economic Development Roundtable, an informal group that represents the Georgia statewide developers.

The relationship with these statewide developers has evolved into an advisory council for Geographic Information System activities. The group has assembled on an as-needed basis to discuss new developments and to suggest actions. The group has also assisted in research relating to the development of a standard statewide economic development database. The details of this effort are noted later in this article.

At the local level, the CSRARDC works with the CSRA Unified Development Council. This group is comprised of local development organizations within the region. Members of the CSRA Unified Development Council include area Chambers of Commerce and Industrial Development Authorities, the Georgia Tech Research Institute, the Advanced Technology Development Center, the CSRA Employment and Training Consortium, the various Technical Institutes of the region, and the CSRA Regional Development Center.

Within the Unified Development Council, the chambers of commerce and industrial development authorities interact directly with business prospects. As the direct contact, these developers have unique data needs. Of primary importance are presentation materials and assistance in data collection. They also have unique data requirements. The predominant need is the ability to access a myriad of information, from national data to site specific figures, all in the same presentation and often "on the fly."

DEVELOPMENT OF A DISTRIBUTED NETWORK

The promise of Geographic Information Systems is that the technology can bridge the gap between the information needs of business prospects and the information available from statewide and local development officials. It is based upon this pledge that the CSRA EDGIS is being built. Taking advantage of GIS technology, the structure of the EDGIS is that of a distributed network for economic development officials.

A distributed network for economic development purposes will require close working relationships between both local and statewide development officials. However, "close" in the GIS field is much more involved than that which normally exists. A distributed network requires extensive efforts to coordinate hardware designs, software configurations, the definitions of data, digitizing standards and a myriad of additional details. In Georgia there are three primary efforts underway to develop the "close" relationships needed for GIS, as well as the details upon which these relationships are based.

The Georgia State Mapping Advisory Board is charged with the research recommendations for land records modernization and land information system implementation. Additional responsibilities include: providing financial incentives for pilot projects in this area, encouraging cost savings through coordinated data acquisition, sponsoring education programs, developing technical specification and standards, and contracting for technical work.

The State Mapping Advisory Board has made twenty-eight recommendations during its first year of existence. Those recommendations which impact upon economic development programs the most are the establishment of mapping standards, implementation of a

monument densification plan, creation of a data dictionary, development of a GIS data exchange network, establishment of training programs for policy level officials, and guidelines concerning the means by which land records should be maintained. The Department of Community Affairs is providing staffing assistance to the Board in its efforts.

Closely linked to the efforts of the State Mapping Advisory Board are those efforts associated with the Georgia Quality Coordinated Planning Program. This program requires comprehensive plans to include economic development efforts for each Georgia county and municipality which desires independent plans. Development of Geographic Information Systems are expected to increase dramatically across the state of Georgia in response to the data manipulation requirements of these comprehensive planning efforts.

The major planning categories in Georgia are Community Facilities, Housing, Population, Natural and Historic Resources, Land Use and Economic Development. All categories are required for the development of a plan to support economic development, but the economic development category is the most directly related to the site location process.

The third effort underway in Georgia are the activities of the Data Standards Work Team. This group is responsible for researching the technical aspects of the development of a statewide planning network. A portion of the team's responsibilities is to establish procedures by which a statewide Geographic Information System Network may be developed.

The final report of this group addresses six major topics. They suggested core data items to be covered by the database. They recommended the formation of a statewide estimates and forecasts program. The team created an outline of a statewide computer network to exchange data among all entities involved in the planning process. They provided guidance on a variety of technical issues including appropriate hardware, software, and telecommunications for operating the network. They made recommendations on policy questions related to the management of the database and the network and they discussed implementation concerns and scheduling. To assure that its system was being designed soundly, the CSRA Regional Development Center is participating in several of these planning efforts. Specifically, the Executive Director is a member of the state Mapping Advisory Board and the Director of Information and Technology Transfer is a member of the Data Needs Work Group.

INDUSTRIAL PARK GEOGRAPHIC INFORMATION SYSTEM RESEARCH

In the spring of 1988, the CSRA Regional Development Center applied for an Innovation Grant from the Georgia Department of Community Affairs. This application was for matching funds for the development of an Industrial Park Geographic Information System and was the first such effort of its kind in the state. The grant was funded and the project began in August 1988.

The project was to develop a Geographic Information System for eleven industrial parks located in the Central Savannah River Area. A partner in the project was the Georgia Power Company. Georgia Power maintains site plans for some of these sites, either in paper form or in AutoCAD. The partnership was essential in order to complete the project on schedule and to insure that the needs of state and local development official were considered.

The targeted industrial sites displayed a variety of characteristics. Ownership was by public and private groups. Size ranged from just under 100 acres to over 500 acres. Both urban and rural locations were represented. But most importantly, the availability of accurate data ranged from easily accessible to almost nonexistent.

Since this project utilized AutoCAD as the implementation software, there were no direct links between the map information and the industrial park attribute information. However, data for the industrial parks was collected and organized using a database management software package. The collection and organization of this data proved to be rather complex.

Map data was organized into twenty-two layers. These layers were comprised of line information, text information and symbology. Line information layers are the actual lines on the site maps. Text information layers contained text that identified street names, building names and so forth. The symbology layers contained AutoCAD "blocks" which include attribute information. Layers were created for structures, industrial park boundaries, easements, geodetic control points, flood plains, airport approach paths, natural gas lines, hydrology, parcels, power lines, rights-of-way, road edges, railroads, sewer lines, soil types, telephone lines, topography, vegetative cover, and water lines.

A standard naming convention was established to categorize the many files and layers involved. The naming standard for files included the map type (industrial park = IP), Federal Information Processing Standards County Code (McDuffie County = 189) and Drawing ID (West Thomson Industrial Park = WT). The naming standard for map layers included layer name (Hydrology = HYD), FIPS County Code (McDuffie County = 189) and layer type (Lines = L). It was discovered in a later project that naming conventions effectively allow the automation of the processing and analysis procedures.

The development of a standard industrial site database was also begun during this project. To do so required several meetings with statewide developers. First a database with all existing data elements was assembled. Then this database was edited to establish one database which all agencies could utilize.

Problems encountered during the project were many. One difficulty was the need to establish a consistent coordinate system for the site maps. State law in Georgia requires the use of the 1983 Georgia State Plane coordinate system, so this system was utilized. Therefore, AutoCAD maps developed without any reference to a real world coordinate system could not be used.

Another problem was the quality of local map data, especially parcel information. Parcel maps could only with great difficulty be edge matched because of photographic inconsistencies. As for infrastructure, line locations were often acquired from experienced public works staff using trees, rocks and streams as references.

The speed of data entry was also a problem. Data entry was slow as a result of the learning curve effect as well as data accuracy problems. Also, all map layers were being input before a map was transferred to Arc/Info, when only the lines layers were needed.

There were several findings of the project. One is that the development of AutoCAD industrial site maps can provide chambers of commerce with superior site presentation materials. Typical options now offered by the CSRARDC include color, blue line or black line site maps either rolled, foam core mounted or laminated.

Another finding is that digitizing in AutoCAD provides an excellent map line source for Arc/Info files. Conversion of maps between the two programs has not resulted in any discernible errors. This is significant because, in the opinion of the CSRARDC, digitizing in AutoCAD is easier than in Arc/Info and AutoCAD is used by many engineering and architectural firms within the region.

A third finding is that production of AutoCAD site maps facilitates data exchange with statewide development agencies. Collaboration between the Georgia Power Company and the CSRARDC has resulted in a significant decrease in map production turnaround times.

Some of the findings are actually problems. One problem was the process of converting digital files between software packages. The only available means to convert AutoCAD DXF files to Arc/Info format is to use the Arc/Info DXFARC command. This command is only available in Arc/Info Version 5.0. As the CSRARDC can only operate Version 4.0 on its SUN 386i Workstation, conversion was requested from the Georgia Department of Natural Resources.

Another problem was the coordination of software. The research begun by the CSRARDC included AutoCAD Version 9.0 and Arc/Info 4.0. A new Automated Mapping/Facilities Management software package named MetaMAP was also scheduled for use. At the time of the delivery of this paper, AutoCAD has been upgraded to Version 10.0, no upgrade is available for Arc/Info and MetaMAP has yet to be delivered in its final form. For the Department of Community Affairs which funded the research, the result was that system design criteria were established for Georgia Regional Development Systems. Also, data accuracy levels for site specific information were identified and means of improvement recommended. Finally, the beginnings of interagency coordination were established.

COMMERCIAL AREA GEOGRAPHIC INFORMATION SYSTEM RESEARCH

Following the Industrial Park Geographic Information System research effort was a project undertaken in cooperation with the Economic Development Administration. This research project was undertaken to determine if the data needs for commercial area development were different than those for industrial sites. The target areas in this project were an urban area (Evans, Georgia), an urbanizing area (Thomson, Georgia) and a rural area (Lincolnton, Georgia).

At the beginning of the project the same map layers and database were established as for industrial sites. Throughout the data entry portion of the project, changes were made as required. An interesting note is that changes to the map layers and database were generated through local review of the database structure.

The problems of the Commercial Areas Geographic Information System Research project were quite similar to those of the industrial park project. For map related information, edge matching parcels was quite difficult. This problem is due to the inaccuracies generated in the aerial photographs typically taken in Georgia (neither rectified nor processed as orthophotographs).

Another problem encountered was the collection of attribute information. As with industrial park sites, information exists but is not accessible in digital form. In fact, much data was processed in digital form for the first time during this project.

The findings of the Commercial Area Geographic Information System Research Project are similar to those of the Industrial Park project. Information is available, however, its accuracy is often questionable. Another finding of interest is the existence of a larger number of potential users of commercial area GIS products. These users exist because of the greater variety of uses of commercial areas than industrial areas. From the results of this research, the CSRARDC expects to serve an entirely different audience than with the industrial park portion of the EDGIS. Commercial development is accessible to a much wider and less experienced developer. In fact, the CSRARDC expects the commercial development portion of the EDGIS to support the location decision of very small business owners as well as entrepreneurs.

For the Economic Development Administration, results of this research have been determination of system design issues, needed levels of data accuracy, and necessary presentation formats of data. While the CSRARDC has a sophisticated Geographic Information System, local government and development organizations may require less complex systems. Also, there appears to be two levels of data accuracy needs emerging - a market level of accuracy and a site level. Presentation formats are also an issue because of the expense in producing large color plots and multiple map copies.

DATA EXCHANGE RESEARCH

The establishment of a distributed Economic Development Geographic Information System rests upon the ability to quickly and accurately exchange land related data. While the Industrial Park and Commercial Area Geographic Information System Research Projects examined data collection and entry issues, they did not examine in detail data exchange. The CSRARDC therefore volunteered to participate in a data exchange project with the Georgia Department of Community Affairs and the Georgia Department of Natural Resources.

This project examined the ability to transfer land information from the United States Geological Survey to the Department of Natural Resources to the CSRARDC and onward to local government. The data would then be corrected as needed and any local data added. The locally reviewed data would then be returned upward through the network to the United States Geological Survey.

The research addressed two primary issues. The first of these was system compatibility issues. Systems involved operated Arc/Info (versions 4.0 and 5.0) and AutoCAD software. Hardware included Prime computers, Sun Workstations and no system on the McDuffie-Thomson local level.

The second and most difficult problem encountered was data exchange

media. The DNR Prime computer system utilized nine-track computer tape and the CSRARDC Sun Workstation utilized a 60 Megabyte tape cartridge. In order to exchange data, off-site conversion assistance was needed. Organizations involved in this effort were Prime Computer and the Georgia Power Company.

An examination of modem use for data transfer was also undertaken. Results of the examination showed that existing computer modems were not feasible for data transfer. The exchange of an eight megabyte file containing one topography coverage (out of over two hundred total coverages) took over two hours to transmit. Therefore, telephone costs precluded the use of this method of data exchange for this project.

Another issue addressed in this project was that of data manipulation. An early problem encountered was that of transferring data from Arc/Info Version 5.0 to Version 4.0. Version 5.0 supports double or single precision coordinates and Version 4.0 supports only single precision coordinates. After one week of effort, the discovery was made that Version 4.0 could not read Version 5.0 double precision data. This issue has not been addressed in any software manuals and has created problems in data exchange on more than one occasion.

Another issue involved is the map projections and coordinate systems utilized. Incompatible map projections and coordinate systems mean that data will not match. If this happens to the uninformed user, the temptation may exist to change the map arbitrarily to make the data match. More than likely this will only make accurate data inaccurate.

An issue faced in this research project was to change Universal Transverse Mercator files originally digitized using the Georgia West coordinate system into files using the Georgia State Plane Coordinate System. Once the pedigree of the files was established, Arc/Info commands were used to complete the coordinate system transformation.

There were several data issues faced in this project, with the most important being the establishment of a database dictionary. A database dictionary contains the definitions of each data field associated with a Geographic Information System. In this case, two dictionaries were needed: one for data provided by the Department of Natural Resources and the second for data provided by the CSRARDC.

During the development of the data dictionaries, it was discovered that precise definitions are needed to assure that the data can be easily understood. An example is the need to define the various codes that are used to describe soil types. The CSRA EDGIS data dictionary format is divided into four separate dictionaries to facilitate use by lay people.

The four sections of the database dictionary are a dictionary of layers, a dictionary of databases, a data fields dictionary and a data coding dictionary. The dictionary of layers identifies the various map layers by the name present in the CSRA EDGIS and gives a brief description of what is included in the layer. The dictionary of databases lists the databases of information associated with each layer. The data fields dictionary lists the name of each database field, its structure, a narrative description of the data in that field, and the codes that can be used in that field. The coding dictionary provides the definitions of any codes used in any databases, by field.

While the maintenance of the database dictionaries is a very time consuming task, it is imperative in order to assure that the data maintained in the Geographic Information System can be analyzed correctly. It also insures that the data can be easily understood and exchanged with other participants in the developing network. For the Department of Natural Resources and the Department of Community Affairs, which funded the project, the primary research result was identification of the conversion process for Regional Development Center use of state level digital data. With conversion routines established, it becomes feasible to distribute state level data to the eighteen Georgia Regional Development Centers. The data can then be used in the economic development process.

ROUTING AND SCHEDULING RESEARCH

The CSRA Regional Development Center has initiated an effort to include routing and scheduling capabilities in the CSRA EDGIS. This effort is based upon two expected benefits - provision of services to local governments and services that can be provided to new and expanding businesses to assist them in site selection. For local governments these services will come in the form of routing and scheduling plans for their vehicles. For new and expanding businesses the assistance will include routing and scheduling plans as well as the development of gravity models for analyzing customer and labor drawing capacity.

The development of this capacity is requiring the CSRARDC to examine several system design issues. The first among these is the amount of data storage needed for the effort. Storage capacity of the CSRA EDGIS is being doubled to 640 MBytes. Another issue is the development of appropriate software to perform the needed analyses. Arc/Info Network is being considered in conjunction with specially designed software.

Another issue being faced in this project is the data needed for the development of the routing and scheduling capacity and gravity models. This data is expected to come from two sources Census TIGER maps and local organizations.

TIGER stands for Topologically Integrated Geographic Encoding and Referencing system. It has been designed by the Bureau of the Census for use with the 1990 Decennial Census, but will also have public and private sector uses through the year 2000. Specifically for this project, TIGER maps will be used to provide a topologically correct base map.

A topologically correct base map establishes road segments that have a defined beginning and end. Therefore, the road segment also has a right side and a left side. It is with these attributes that routing and scheduling systems can be established so that directions can be utilized.

Local data that will be included in this project is divided into two types - address information and impedance factors. Address information is necessary to accurately locate a feature on the road network. The address system being developed in the CSRA is a distance based system in which a building address is based upon its distance from an intersection. Increments of addresses have been established every twenty feet, with even and odd final digits specifying the right or left side of the road. In other words, a topologically correct address system.

The other type of information pro-

vided by the local level is that describing impedance factors. Impedance factors are those items that affect the flow of traffic. Examples include the speed limit, the type of road, bridge clearance heights and one-way streets. The number of impedance factors that can be included in a routing and scheduling system are almost limitless, so this project will prioritize the factors and include the most important immediately.

To develop the gravity modeling capability, local information on demographics will also be developed. This information will include population levels, available workers and level of education. It is expected that this information will be attained from state government sources or private sector data companies.

This project will also research means by which the routing and scheduling capabilities of the CSRA EDGIS may be accessed. At this time, there are five different access methods being prepared for research. These include in-house real-time access of the system, terminal real-time access of the system, distribution of routes and schedules using DXF files, distribution of routes and schedules in text form using non-graphic computers, and distribution of the routes and schedules in printed form. The printed form of distribution will include maps and narrative text.

The expected result of this research project for the Department of Community Affairs and the Georgia Office of Energy Resources is the basic system design for regional routing and scheduling capability. This system design will include required hardware and software as well as the data dictionary for required data. The research should also expand the interagency coordination developed within the state.

DEVELOPMENT FACTORS

The research conducted by the Central Savannah River Area Regional Development Center in the development of the CSRA Economic Development Geographic Information System has proven to be quite useful on the local and state levels in Georgia. This is true not only for those organizations developing Geographic Information Systems, but also for the economic development community. The results of the research can be placed into eight categories of factors that affect the development of a GIS.

The first factor is the availability of TIGER and Census data for use in the EDGIS. Development of data for a Geographic Information System is very expensive, in both actual funds and personnel time. The ability to utilize TIGER files and Census information can speed development time by several orders of magnitude and provide similar cost savings. However, with Census data unavailable until 1992, the system design of an EDGIS must be undertaken very carefully.

Another development factor for an EDGIS is the accuracy of data required by the users of the system. This issue was researched in a thesis for the Economic Development Institute entitled "Information Sources for an Industrial Park Geographic Information System". The results of this research indicated that industrial site consultants required accuracies to within one foot of true location by the end of the site selection process. Local development organizations seldom have the ability to provide this accuracy. There are means by which local organizations can attain the needed accuracy, but all are expensive.

The third EDGIS development factor is the availability of staff expertise to operate the system. In the projects undertaken to date, the staff of the CSRARDC has achieved experience through both formal training and hands-on operation. However, the projects undertaken to date have specifically been research projects with time dedicated to learning new skills.

When an Economic Development Geographic Information System is established in a state or local development organization, competitive pressures will require immediate operation of the system. This pressure will require a highly experienced staff that is capable of maintaining the production capacity and analysis capability of the EDGIS.

Related to the need for staff experience is the need for economic developer training. Neither state nor local development officials have experience in operating or planning Geographic Information Systems. As a result, both groups must be trained in the operation of an EDGIS. The difficulty of providing this training is that it must be scheduled so as not to interfere unduly with daily job requirements.

Another EDGIS development factor discovered during the research projects was the issue of data sources. There are many different sources of land related information: the private sector, the federal government, state governments and local governments. Each collects map data and attribute data. However, the types and accuracies of the data vary widely.

Throughout the four research projects undertaken by the CSRARDC, road data from the United States Geological Survey has not overlaid upon road data from local aerial photographs. While this "inaccuracy" issue may seem important, it may in reality be a non-issue. The federal level data is very useful for analyses at the state or regional level. Local level analyses can best be supported by local level data.

The sixth development factor is establishing a system design that supports automated data processing and manipulation procedures. Through the four research projects undertaken, the CSRARDC has generated several hundred map coverages. Managing these files is impossible without a strict naming convention.

Yet another benefit of a strict naming convention is the ability to automate the file processing ability of the EDGIS. By making use of the identifier sections of a file name (type of coverage, county and specific site), the EDGIS can process coverages in a background mode. Examples of this ability would be to import, clean, build, clip and export road coverages for the Central Savannah River Area.

Another EDGIS development factor is the presence of a database design. An Economic Development Geographic Information System rests upon both map data and attribute data. For one item of map data there may exist multiple attributes. For example, a road segment may have attributes related to type of pavement, road maintenance organization, road category and road width. Research has shown that it is much more effective to plan for the inclusion of attribute data than to adjust the EDGIS to accommodate new data.

The eighth and final development factor identified during the EDGIS research is the need for quality assurance and map accuracy. Quality assurance for the distribute network in which the CSRA EDGIS is being developed re-

quires that map and attribute data be reviewed by both statewide and local development organizations for its usability in the site selection process. Map accuracy is related to map quality and is achieved through adherence to federal national map standards.

CONCLUSIONS

The research conducted by the CSRA Regional Development Center shows that an Economic Development Geographic Information System can be developed for use in the site selection process. As the site selection process involves many organizations, an EDGIS must be designed to function as a distributed network. There are a myriad of technical details associated with development of the EDGIS, however the major stumbling blocks are met during the system design phase of the process.

Including all the participants in the site selection process is essential in order to develop á workable data dictionary. Once the data dictionary has been designed, it becomes feasible to pursue federal and private data sources. These sources will enable the EDGIS to provide benefits almost immediately.

For the long term, the development of accurate local information is essential for a working EDGIS. All site decisions are made at the local level and the availability of accurate local information provides a distinct competitive advantage. This local information will require thoughtful insight into the future needs of job creating undertakings and could include site specific data on historic properties, parcel level planning activities, or segment by segment data for infrastructure.

The presentation of the data is the means by which the benefits of the competitive advantage are consummated. The presentation modes examined and used by the CSRARDC have included both printed media as well as interactive access to the Economic Development Geographic Information System. Both may be necessary, depending upon the needs of the prospect.

Printed materials are required in order to allow the prospect to describe the attributes of a specific site. Available through an EDGIS are printed multicolor maps, database reports linked to specific, labeled elements and digital files that enable manipulation of site information.

However, it is the development of interactive access to the EDGIS by nontechnicians that will result in the greatest competitive advantage. Through the use of user oriented menu systems, a prospect can query a thoughtfully designed attribute database at the speed or in the manner that they wish. Such a design also allows the dispersal of the EDGIS network to a much larger portion of the development community, and a consequential multiplication of the possible benefits.

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NASDA Research Forum Papers

The National Association of State Development Agencies (NASDA) was formed in 1946 to provide a forum for directors of state economic development agencies to exchange information, compare programs and establish an organization base from which to approach the Federal government concerning issues of mutual interest. Member agencies generally are state commerce departments or other state government agencies with economic development responsibilities, as well as other non-state organizations interested in economic development.

NASDA is comprised of a number of divisions, among them the Research Division. The Research Division members are state economic development research directors interested in joining together to explore and improve economic development research and analytical techniques, and to voice their input to the federal data establishment.

In May of 1990 the Research Division, in conjunction with the University of Oklahoma, held the first Research Forum (a training program for economic development research professionals). An important component of the Forum was an invitation to the economic development research community to prepare and present research papers on applied economic development research.

The Research Division solicited paper "abstracts" and established a review panel comprised of state economic development research directors. After careful review the Division selected five papers as winners, and invited the authors to present their papers at the Research Forum in May.

This article, "Implementation Factors for the Development of a Geographic Information System", was extremely well received and complemented the Research Forum class session which focused on this very timely topic. The NASDA Research Division hopes you find this paper useful and interesting. Miles Friedman, Executive Director, and Bryant Monroe, Director, Domestic Business Development can be reached at 202/624-5411.