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INFORMATION AND REGIONAL DEVELOPMENT: IMPLICATIONS FOR A COMPUTERIZED INFORMATION SYSTEM

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Introduction

Advances in computer technology have had wide-ranging repercussions throughout society. Such devices as electronic mail systems, facsimile machines, voice-mail machines, and videotex services enable decision makers to have crucial information at their fingertips in a fraction of the time that such information took to acquire previously. One implication of this information revolution has been a growing recognition by businesses, policy makers, and economists of the important role information plays in production activity. Information management and distribution is becoming an increasingly vital activity in private and public organizations ranging from corporations to state governments.

The management of information by state governments with respect to proposed or implemented computerized information systems designed to directly or indirectly promote state economic growth and development motivates this research. The primary objective is to provide a general understanding of the role information plays in regional economic growth and specific policy implications for the development of a computerized information system.

The Nature of Information

The creation of knowledge and the generation of technological change unquestionably have contributed to higher standards of living in the United States and the rest of the world. Solow (1957) reports that 85 percent of the economic growth in the United States from 1909 to 1949 is due to technological change, and there is every reason to believe these results are equally applicable to the present. The creation of knowledge by universities, private industries, and governments improves our understanding of the world and makes it easier and more efficient to satisfy society's wants and needs. Technological developments in agriculture and subsequent improvements in productivity were

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necessary conditions for the development of our modern industrialized society (Rostow, 1962). When improved knowledge of agricultural production made it possible for a single farmer to feed more than himself, labor became available to work in factories and other productive activities that generated the higher standards of living we now enjoy.

It is not merely the creation of knowledge that is important to economic development, however, it is the dissemination of knowledge—information.¹ The technological change identified by Solow is the combined process of the creation of knowledge and the dissemination of appropriate knowledge throughout the economy.

Information Resources

The early works of von Hayek (1945) and Stigler (1961) enable us to recognize that information is a valuable commodity, subject to the range of economic forces affecting all types of commodities. Information is a scarce good that involves real economic costs in both production and exchange. The fundamental characteristics of information that make it a scarce, economic good also generate the concentration of exchange activity undertaken by markets. As Stigler (1961, p. 216) indicates: "The costs of search are so great under these conditions that there is powerful inducement to localize transactions as a device for identifying potential buyers and sellers." The existence of a market-oriented economy can be attributed, at least in part, to the scarcity of information.

Moreover, the exchange of information commodities themselves, including books, newspapers, and education, indicates that information is a valuable commodity for which individuals are willing to sacrifice other goods and services to obtain. There is also a growing awareness that information is a valuable resource used in the production of other goods and services. Information, knowledge, or technology historically were considered only in how they augmented the productivity of labor, capital, and land resources. Explicit consideration of information undoubtedly has been inhibited by its intangible nature. As the earlier reference to Solow's study attributing 85 percent of economic growth to technology indicates, however, information is not an incidental factor in

¹ In this context, three terms need to be distinguished—knowledge, technology, and information. Knowledge is the sum total of available facts known about the world, information is the dissemination or communication of the knowledge, and technology is the embodiment of knowledge into the production process. The creation of knowledge is a necessary condition for this process, but will not promote development until it is embodied in the production process. Information, the communication of knowledge, is a necessary link between knowledge creation and the technological embodiment of knowledge that ultimately promotes economic development.

the production process, but a critical resource contributing significantly to economic development.

Information Diffusion

The distinction between information and knowledge is critical to this discussion. Whereas *knowledge* is the creation of new ideas, *information* is the dissemination of those ideas. In the context of economic development, knowledge is unproductive until it becomes information spatially diffused throughout society.

The general process of spatial diffusion, of which information diffusion is an important subset, underlies the theoretical analysis of regional economic growth. The process of innovation diffusion is the primary focus for the growth pole theory discussed by Perroux (1955), Hansen (1967), and Lasuen (1969). Proponents of this theory argue that regional growth is tantamount to the dispersion of technological innovations throughout a regional economy. Given that innovations and technology are the embodiments of knowledge, however, the discussions in this body of literature are equally applicable to information diffusion. Meir, in a study of the spatial diffusion of automobile technology between 1933 and 1966, states a well-established proposition for the diffusion of innovations: "Regional development is considered both as a prerequisite for, and an outcome of, a growth-inducing innovation diffusion process" (1981, p. 111). Substituting the word information for innovation would generate a statement indicating the importance of information diffusion to the process of economic development.²

Appropriate Information

Studies investigating the problems of less developed countries during the 1960s and 1970s indicate the importance of providing appropriate technology. In contrast to the direct transfer of technology used by developed countries, it became clear that the technology best able to promote development in less developed countries was technology particularly suited to the countries' resources, existing economic structures, and cultures. The same conclusions apply to the more general role of information in economic development. To promote economic development effectively, information needs to be appropriate for the given situation in the society.

² The importance of information diffusion is seen by examining the agricultural extension process in this country. Establishment of land grant universities in the 1800s, with missions to disseminate agricultural information throughout the country, played an important part in the tremendous increases in productivity in the ag sector in the last 100 years.

Appropriate information is becoming increasingly critical in the development process, given the tremendous advances in communication and information transmission technology that have occurred and are likely to continue. Explosive exponential growth in information availability makes it exceedingly difficult to assimilate the information that is most relevant to an existing circumstance. Although accessibility to a wide range of information is important, the effectiveness of an information system is based on a trade between accessibility and appropriateness. The promotion of economic development entails the widespread dispersal of information, but the information needs to be accessible in a manner that is most appropriate for potential users.

Three Sources of Regional Growth

The three primary sources of regional growth are external relocation, internal expansion, and internal start-up. The openness of regional economies implies that economic activity can be promoted by increasing the quantity or quality of resources either internally or externally. For example, regional labor supplies can be increased internally through population growth or increased externally through migration. Analogously, the physical stock of capital can be increased through internally or externally supplied funds. The latter example is particularly important in the context of regional growth promotion policies which can be directed toward the relocation of external activity into the region or encouraging the growth of internal activity.

External Relocation

The promotion of economic growth through the relocation of external activity to the region has considerable theoretical justification. Neoclassical studies of regional growth by Borts (1960), Borts and Stein (1964), Vinod (1973), and Smith (1974, 1975) indicate the importance of factor movements, especially capital, in the promotion of a region's economic growth. The relocation of capital goods improves the economy-wide allocation of resources and also stimulates economic growth of the receiving region. This proposition long has been followed by practicing economic development specialists at the state and community levels.

The neoclassical theory implies that the promotion of regional growth through the relocation of external activity must consider the relative prices and the comparative advantage of one region over another. The neoclassical theory indicates that the national allocation of resources is more efficient if factor movements occur from high price to low price regions. These factor movements generally will occur through competitive market forces, but are subject to available information on relative factor prices. Given that information is costly and not perfectly

available to everyone, a clear role for an information system begins to surface.

Resource allocation can be more efficient (and regional growth will be promoted) if comparative regional information is available. Such information would include not only factor prices, but all types of economic and noneconomic information affecting production activity. This is not a novel conclusion; many regional economies have emphasized external relocation. The types of information needed for relocation decisions and the attraction of external activity have been discussed and identified extensively. Most communities, counties, and states throughout the country have community profiles designed to identify their comparative advantages. A computer information database and network can improve such profiles by providing appropriate information, updating it, and making it more accessible to interested parties.

Efforts undertaken to improve the accessibility of information will enhance the overall efficiency of economic activity. This is especially important when one considers that economic markets exist as a means of overcoming the costly nature of information search. More accessible information lowers the costs of search and contributes to a more efficient allocation. Support for this contention can be found in the management literature concerning interorganizational information systems (IOS). An IOS is simply an information system in which resources are shared across two or more organizations. Barrett and Konsynski (1982, p. 94) point out that "initial incentives for the development of an IOS are economic and involve three potential benefits for the participating organizations: cost reductions, productivity improvements, and product/market strategy." They cite the dramatic savings that have been achieved in the grocery industry as a result of IOS implementation as a cost reduction example. They also find IOS participation enhances productivity, through "... improved effectiveness in resource allocation decisions and efficiency in resources utilization" (1982, p. 95). In support, Suomi (1988) and Johnston and Vitale (1988) both cite lower costs as a way that an IOS can bring competitive advantage to an organization. These studies and the spectacular IOS successes of American Hospital Supply's ASAP and United Airlines' Apollo reservation system suggest that an information network can put potential relocators together with potential relocation sights more effectively and inexpensively. In the context of a market, this should improve the market for relocation.

An information system relates to relocation in two basic ways. First, it can make information readily available to any potential relocating activity. A computerized information network has the capability of providing decision makers with greater accessibility to data, a greater variety of data, and a more timely update of data than currently exists.

Second, an information system can provide information indicating where a region is not competitive with other regions, which can be used to assist a region in rectifying its deficiencies and enable it to direct its energies toward relocating activities for which it is best suited.

Internal Expansion

Export base studies by Hildebrand and Mace (1950), North (1955), and Sasaki (1963) suggest a major role for export-oriented activity in the promotion of regional growth. The internal expansion of activity through increased exports generates a multiplicative effect on regional employment and income. Export base analysis argues that regional growth is attributable to external demand for internally produced output. The importance of external demand leads North to state: "It is evident that this growth [of a region] is closely tied to the success of its exports and may take place either as a result of improved position of existing exports relative to competing areas or as a result of the development of new exports" (1955, p. 251).

The export base theory indicates that the multiplicative local/base relationship is initiated through increases in external demand, implying an important role for efforts to promote external demand. External demand is promoted by states through tourism advertising, liaison offices in other countries, and various government lobbying efforts. The role for information in this process is clear. Export demand promotion involves making potential buyers aware of internal production, which requires making information readily available to potential buyers. As indicated by North, regions that produce similar products compete with each other for demand much as do individual firms. And like advertising undertaken by competing firms, regions collect and disseminate information that can help sell regional production to external buyers. A region must know not only its strengths, but also its potential weaknesses.

Leven (1985) notes a critical regional development policy perspective derived from the export base approach. Seeking to promote internal expansion through external demand implies that the lack of development in a region is due to external factors beyond local control and, presumably, responsibility. Leven suggests that an internal orientation would be more effective, albeit implying that the lack of development is due to local problems that can be controlled but also require explicit recognition. The key difference is that external orientation promotes the positive aspects of a region, while internal orientation emphasizes the negative aspects.

Internal expansion faces two sets of potentially limiting constraints, the lack of external demand and limited resource availability. If the lack of external demand is constraining internal expansion, then the

same general types of activities associated with selling the region for external relocation are applicable. Whether a region is selling itself to external relocators or selling its goods to external buyers, information plays an important economy-wide role in more efficiently allocating resources and stimulating regional activity. Internal expansion also can be enhanced by providing regional business with information about external demand, including information about potential buyers (such as names and addresses of purchasing agents, stores, or other businesses in major cities throughout the country) or information about transportation (such as costs, available routes, time schedules, etc.).

Constraints on the supply side imply a different role for information. Internal expansion can have sufficient external demand, but be constrained by lack of access to resource supplies. While this is applicable to any of the factors of production, it often surfaces relative to financial capital. A business may be unable to expand due to limited local credit markets and the lack of information concerning alternative sources of credit even though sufficient external demand exists. A clear role exists for a system that can provide relatively small, but growing firms with credit information, including names and locations of regional or national lending institutions.

Although limited financial capital is a constraining factor that needs to be addressed in an information system, any transportable resource can be a constraint; appropriate information needs to be made available. Once again, the costs of information search by individual firms can limit the identification of available or less expensive sources of raw materials or intermediate input goods. An information system can lower production costs and relieve resource constraints by making price, location, and other information concerning resources readily available to local firms.

Internal Start-up

The start-up of new activity within a region is the third basic source of regional growth. The role innovations play in economic growth is crucial to this presentation. The discussion of growth pole theory by Perroux (1955) primarily concerns the role innovations play in the growth process. Perroux argues that growth poles are established by the creation of technological innovations and act to diffuse the innovations throughout the economy. Perroux views the creation and diffusion of innovations as the primary driving forcing in promoting a higher level of development. This not only supports Solow's findings, but is consistent with other authors.

For example, North's discussion of the export base theory also identifies a central role for technological innovation in the development process. He argues that: "The concerted effort to improve the technol-

ogy of production has been equally important. Agricultural experiment stations, state universities, and other local research groups become service adjuncts to export industries and conduct research in technological improvements in agriculture, mining, or whatever manufacturing comprises the region's export base" (1955, p. 248). In North's view, development is initiated and stimulated further as regions seek technological innovations that improve their export base activity.

Malecki (1983) presents an extensive survey of technology and regional development literature, concluding that: "The role played by technology in regional development appears to be far greater and more complex than that suggested by models of regional growth and development. Technology and innovations are not 'black boxes' that spread throughout regions, nations, or the world. Instead, they are the result of explicit decisions of firms concerning the types of products and processes their business will include" (1983, p. 112).

Malecki indicates that technological innovation is something that can be controlled by business, government, and policy makers: "In conclusion, this review has attempted to point out that technology, its control, and its shortages do much to form the economic landscape of regions and nations, and the economic condition of the entire nations in the international system" (1983, p. 112). Intraregional control of technological innovation, together with recognition of the critical role technological innovation plays in promoting development, implies that regional growth and development can be stimulated through internal activity.

The relationship between innovations and regional development, with particular emphasis on internally stimulated activity, also has been studied by Meyer-Krahmer (1985), who investigates innovation behavior and research and development expenditures of firms in the Federal Republic of Germany. He concludes that a relationship exists between innovation activity and regional development, offering three recommendations for regional policy: 1) to enhance the innovation potential of a region by encouraging firms to undertake innovations; 2) to improve regional conditions for innovation; and 3) to motivate innovating firms to increase their activities by removing various innovation limiting bottlenecks. An important feature of his study is the shift in policy emphasis from attracting external activity to promoting internal activity through innovation stimulation.

Coffey and Polese (1984) make a strong argument favoring the promotion of internal development. A major premise of their argument is: "A region's potential for development rests upon the stock of entrepreneurship and the accumulated knowledge embodied in its population" (p. 3). Using entrepreneurship and its implications for innovations, they develop a model of internal, or local, development containing four distinct stages: "1) emergence of local entrepreneurship and local

firms ... ; 2) growth of local firms and their expansion beyond the region ... ; 3) emergence of a local control structure ... ; and 4) establishment of a strong locally controlled economic sector ... ” (p. 7). Pursuing the first stage of this process then sets in motion regional economic development for some period to come as the other stages are achieved.

To illustrate the advantages of their approach they discuss the possible results from an externally oriented development policy. “In an extreme case of a region which is characterized by a process of non-local development, the initial impetus to growth will be provided entirely by external investors and entrepreneurs. Further, the investments made will be very largely concentrated in those sectors which are based upon the natural advantages of the region, especially its primary resources; thus, the region would possess few or no man-made advantages. The few firms controlled by local entrepreneurs which succeeded in penetrating extraregional markets would, along the way, have been purchased by external interests. The region would suffer a continuous net outmigration of potential entrepreneurs and of other human resources, finding itself, at the end of the process, with a structure doubly dependent in terms of the control of its economy and the composition of its imports” (Coffey and Polese, 1984, p. 9). They conclude that: “Economic base theory, in its various forms, leads us to underestimate endogenous development factors and to emphasize the evolution of external demand” (p.10).

Moelle (1983) voices similar recommendations in his analysis of technological change in Europe. In the context of innovation diffusion he argues that: “... their diffusion tends to be unequal across space, notably because of geographical barriers.” Then adding: “Highly developed regions with good access to information will be among early adopters, followed by the regions in the next layer of the urban hierarchy, with the peripheral, backward areas bringing up the rear” (1983, p. 29). His policy recommendations are particularly relevant to this study: “A policy intended to stimulate the spread of new ideas would have to make them easily accessible to all regional actors” (p. 30). And then: “To raise the innovation potential of a region, a set of measures is needed, aimed at improving: access to inventions and innovations; access to finance and investment; and receptivity to change and competitive position” (p. 33).

Information is both a limiting and a promoting factor for technological innovation. The lack of information can constrain the innovation diffusion process, and the availability of information can promote innovations synergistically. The agricultural sector presents an example of this process. Implementation of new production techniques by farmers is not possible until this knowledge is communicated to them as information. The communication of two separate, and seemingly unrelated,

bits of information can generate a synthesis leading to the creation of a new technological innovation.

The development and introduction of new products, production techniques, or other innovations can stimulate regional growth. Entering the first of the four stages identified by Coffey and Polese allows a region to obtain and retain a larger share of the development benefits generated by innovations. New products and innovations that are diffused throughout society also generate society-wide benefits. The question is who benefits first and most. As Meyer-Krahmer finds for regional development in Germany, areas with more innovation activity are likely to have the higher levels of development.

This approach implies, as suggested by Meyer-Krahmer, that regional development can be promoted by encouraging and inducing internal entrepreneurial activity and innovations. Information plays a critical role in this inducement through all stages of the innovation process. Starting with basic scientific research needed to generate knowledge and inventions, providing potential entrepreneurs and existing business with information concerning potential innovations, generating information that will facilitate the implementation of the innovation for either the start-up of a new business or the expansion of an existing business, and making information available that will allow the innovation-generated business to continue expanding and growing into the latter stages identified by Coffey and Polese are all critical roles played by information.

Unlike policy makers and information users typically concerned with external demand or relocation, those making use of information aimed at the internal orientation development promotion may be much less aware of the specific information that is most useful. While a development planner trying to encourage the relocation of a branch plant into the community might know what information is needed to sell the community, an entrepreneur trying to begin a new company may be unaware of the alternative types of data needed to produce and market the product effectively. An information system can provide not only the appropriate information, but can indirectly provide the guidance.

The close relationship between innovations and information implies an information system is ideal for promoting entrepreneurial activity. The provision of information concerning patents, inventions, scientific discoveries, and techniques or products in other regions can lay the foundation for innovations. Although the entrepreneurial process, due to its random and somewhat creative nature, can not be strictly controlled, it can be encouraged. This is the argument made by Meyer-Krahmer (1985) when he calls for "an innovation-oriented regional policy" generally aimed at enhancing the innovation potential of a region. Moelle (1983) echoes this sentiment, suggesting that a regional devel-

opment policy needs to be a regional innovation policy. He even recommends: "Local entrepreneurs need to be made aware of the needs for innovation. They need to be acquainted with the techniques of innovation and production, and the possibilities of local co-operation for research and innovation" (p. 36).

One critical factor in the entrepreneurial start-up process is the risk associated with implementing a new and untested production process, product, service, etc. All production activity is risky, even for established firms; however, the uncertainty surrounding a new, untested venture compounds the normal risks of production. Information can play a pivotal role in eliminating some of this uncertainty, and reducing the risks of a start-up activity. A new activity has a better chance to survive and expand if it has accessibility to information concerning potential markets, transportation costs, and resource supplies. The risks of start-up activity can be reduced further with information relating to basic business operations, including management, marketing, and accounting. This can be accomplished by providing the names of business consultants, information about business extension courses, and titles of related reference materials. The key is that an information system, as noted in the parallel IOS literature (Barrett and Konsynski, 1982; Suomi, 1988; and Johnston and Vitale, 1988), can reduce the information search costs that are a critical constraint to new activity.

Financial capital, a critical resource constraint previously discussed under internal expansion, bears repeating here. The availability of financial capital is probably the most important initial resource constraint for start-up activity. New and potentially profitable start-up activities may fail before they have a chance to escape the introductory stages of their development due to the lack of financial capital. Information on credit availability, financial markets, interest rates, venture capital sources, etc., can help alleviate this constraint.

Implications for a Regional Development Information System

The theoretical discussion of the relationship between information and regional growth contained in the previous section has important implications for the structure of a state-wide information system. Each of the three primary sources of regional growth—external relocation, internal expansion, and internal start-up—generate important differences in the potential users of, the accessibility of, and the types of data contained in a development-promoting information system.

Potential Users

A wide range of potential users is likely to surface for a state-wide information system, with diversity in backgrounds and levels of exper-

tise the norm. Potential users most concerned with external relocation, including community development specialists, chambers of commerce, public utilities, and various state and local government officials, are likely to have a relatively high level of knowledge in terms of specific data needed, although such users may be lacking in computer expertise. Potential users concerned with internal expansion are most likely to include existing small to medium size businesses that are likely to have a moderate level of business expertise. Unlike development specialists, however, they are not likely to know all of the information they need to expand their operations. While users for external relocation generally know the questions to ask the system and probably already know many of the answers, users for internal expansion know only some of the questions and few, if any, answers. In contrast, potential users falling under the internal start-up category are likely to know none of the questions, let alone the answers. An information system needs to handle all levels of users.

Accessibility

The importance of information diffusion in the promotion of economic development implies a system that is easily accessible to potential users. A key conclusion obtained from the discussion in the preceding section is that the dissemination of information helps promote economy-wide efficiency and helps stimulate the creation of ideas and innovations that underlie the overall progression of regional economic development. The attraction of external relocating activity into a region implies that the system needs only relatively limited accessibility within the region, being available to key users who undertake the role of promoting the region to outside concerns. In contrast, the promotion of growth through internal start-up necessitates widespread accessibility due to the unknown nature of potential entrepreneurs. Pursuing regional development through internal expansion implies that the system's accessibility needs to fall somewhere between these two extremes. Although the system needs to be relatively accessible throughout the region, potential users are likely to be a smaller, more narrowly defined group than simply potential entrepreneurs, but the group is more widely defined than development specialists.

Data Needs

The three alternative methods of promoting regional growth also imply differences in the types of data included in an information system. A critical feature of the type of data included in the system is based on the earlier discussion that information needs to be targeted appropriately to promote regional development effectively. Each of the potential users implied by the alternative methods is likely to require different

types of data. While there also will be a large degree of overlap, this discussion will concentrate on the differences in data needs. The type of information needed to promote regional growth through the relocation of external activity includes a wide range of comparative data, including community, county, and state data. A variety of socioeconomic activity that is deemed important to relocating activity would need to be incorporated in the available data. Standard economic data, such as wage rates, per capita incomes, unemployment rates, taxes, and electricity rates, are obviously important to a relocating firm. Other noneconomic data, including population demographics, educational characteristics, cultural activities, and weather conditions, also are extremely important. These data are readily available through government publications and would be relatively inexpensive to provide and update.

Given that internal expansion often is constrained through either the lack of external demand or resource supplies, the most important information concerns potential markets and the availability of raw materials, intermediate goods, and other resources. On the demand side, nation-wide community, urban area, and county socioeconomic data recommended for external relocation also would be extremely valuable in determining potential markets for regional production. On the side of resource supplies, an extensive catalogue of raw materials, intermediate goods, and transportable inputs could alleviate resource constraints limiting internal expansion. These data are not as readily available and would be more expensive to provide and update.

The types of information most important in promoting regional growth through start-up activity can be separated into two categories: identifying innovations and facilitating start-up. For the first category, an information system can play a valuable role in stimulating the synthesis of innovations. This entails information on new inventions, patents, research activities at universities, and scientific breakthroughs. While it may not be feasible to establish and constantly update this type of database, it is possible to provide the information that can direct interested parties to appropriate sources, names, telephone numbers, reference sources, etc. These are the most expensive data needed for an information system.

A second, more likely role played by an information system is facilitating the start-up of new activity, given that an entrepreneur already has identified the innovation. The information needed in this case would include basic business operating information such as marketing, management, and accounting, most likely in the form of sources where prospective entrepreneurs can go for more detailed information. The system also needs to include data relating to resource supplies and potential markets that would relieve any constraints limiting the start-up of firm. For many start-up firms the biggest initial constraint is the avail-

ability of financial capital. While information concerning other types of resources and intermediate goods, including costs, availability, and transportation, needs to be included, particular attention should be paid to financial data. The most important data would be credit availability and sources, interest rates, venture capital sources, and other financial data. These data would tend to be readily available from secondary publications and would not be extremely costly to provide and update.

General System Recommendations

The analysis of information and regional development contained in this and the preceding section generates the following recommendations for an information system that is intended to promote regional economic development.

Comprehensive Comparative Data

An information system needs to contain a comprehensive set of comparative socioeconomic data for different regional levels throughout the nation, including state, county, and community levels. This would facilitate identification of the state's comparative advantage and highlight potential weakness that can be corrected. The types of data included in the system must go beyond traditional economic data, but also should include other cultural, sociological, and political aspects of society.

State-wide Accessibility

An information system needs to be widely accessible throughout the state and to external users. A computerized system accessible through standard telephone hook-ups would contribute to the ease of access. It is also important that potential users be aware of the system's existence and be knowledgeable about the system's operation. This implies the need for advertising, promotion, and/or extension courses in addition to a system that is user friendly to a wide range of expertise levels.

Multiple-User Friendliness

An information system must be able to accommodate users with different backgrounds, objectives, computer expertise, and knowledge of the development process. It must be able to provide clear, concise, and up-to-date information for users who know exactly what they want and do not want to be burdened with a cumbersome system that assumes they know nothing. The system also must be able to guide novice users through the maze of data, provide answers to unasked questions, and act as an expert to users who know nothing.

Specific System Recommendations

The preceding general recommendations for a state-wide information system can be facilitated by considering the following set of specific recommendations.

Financial and Transportation Data

An information system, while containing an extensive array of socioeconomic data, needs to pay particular attention to information that can be used to stimulate internal start-up or expansion activity within the state. Two items that surface as being especially important are financial and transportation data. Both often are overlooked in traditional discussions of development-related information, but both are critically important to the internal promotion of regional growth through either the start-up of new activity or the expansion of existing activity.

Nonquantitative Information

An important dimension of an information system, in addition to providing hard, quantitative socioeconomic data, is to provide non-quantitative information such as directories of names, addresses, and telephone numbers of government officials or consultants; citations for books and other reference materials; and times and locations of forthcoming meetings, extension courses, and conferences. The information system should provide one-stop shopping for users interested in obtaining information related to economic development.

Interstate Computer Links to Other Information Systems

One way to enable easy accessibility to comparative data throughout the U.S. is with linkages to other computerized on-line data and information systems. Because several states throughout the country have developed, or are developing, information systems, establishing computerized tie-ins with other state systems would make it easier to access vast amounts of information that might exceed the storage capacity of any single system. This also would help promote the more detailed county and community level comparisons throughout the country to the extent that other systems contained similar county and community level data.

Computer Links to National Information Systems

In addition to other state information systems, data accessibility can be enhanced through linkages with national on-line computer information systems. While a great deal of the basic in-house database will be obtained from federal information sources such as the Department of Commerce or private sources, such as Data Resources, Inc., a standardized method of accessing data from other information systems is

recommended. For example, the promotion of internal start-up activities may involve the infrequent search of a specialized system containing patent information. The infrequency of this search would make it impractical to store the information as part of the in-house database, but the potential benefits from such data make it important to develop a standard access procedure.

State-wide Nodes

State-wide accessibility of the system can be promoted through the establishment of at least one operational node in each county and possibly in every community in the state. These nodes should consist of the hardware needed to access the system (including computer, telephone modem, etc.) and an individual trained in the use of the system who can instruct others in the system's operation. Given that the system needs to be relatively user-friendly, the training and time requirements for the individual would be minimal. This nodal setup can be considered as a series of seeds that are planted in the counties and/or communities to spread the system throughout the area. From a practical standpoint, individuals targeted as the nodal seeds should be those most likely to use the system on a continuing basis and most likely to benefit from the system. Three groups that immediately come to mind are community development specialists, chambers of commerce, and bankers. Each group has a clear interest in promoting local development and is thus likely to be receptive to an information system with this objective. These individuals ideally can act as a source of expert advice for other users.

Agricultural Extension Efforts

Accessibility of an information system can be enhanced from a practical standpoint by building on the agricultural extension approach to information dissemination. The existence of a county agent, acting as the focal point for any questions or concerns on the part of farmers, helped disseminate valuable information that promoted tremendous increases in agricultural productivity occurring over the past century. A similar approach can be undertaken for an information system, although aimed at increased productivity of all economic activity rather than just the agricultural sector. Although the computerized network with telephone access would eliminate the need for potential users to make a trip to the local county information office, the existence of an information node in each county could facilitate the effectiveness of the system.

State-wide Promotion

Given that initial seed users of the system cannot be expected to actively spread information about the system to all potential users, an

extensive state-wide advertising and promotional campaign is recommended. This could include direct mailing of brochures, which are designed to inform individuals of the system's existence, to potential users. Brochures should specify where to go, what to do, and whom to contact for more information. In addition, extension courses, short courses, or hands-on presentations need to be offered in every county and/or community throughout the state. These would be designed to promote interest in the system and illustrate its full capabilities. This should be a continuing process, albeit with less intensity after the system is established.

Conclusion

This discussion has identified several critical ways that information and an information system can be used to promote regional economic development. By generally reducing the costs of information search and making information readily available to a wide assortment of interested parties both within and outside a region, an information system can improve the overall efficiency of resource allocation. This will benefit the national economy, but also can benefit the regional economy by both informing others of its comparative advantage and highlighting problems within the region that can be corrected. The relocation of external activity can be encouraged and external demand for regional production can be promoted.

An information system may be even better suited to the promotion of internal activity. Increasing information accessibility can establish a regional environment that is conducive to innovation activity. Moreover, an information system can promote the expansion of internal activity by reducing demand and supply constraints that often limit a growing firm.

From technological change to innovation diffusion, information dissemination is a key factor in the progression of regional economic development. It is difficult, if not impossible, to conceive of higher levels of economic development without greater accessibility to information. Recent advances in computer technology and information processing make the creation of a computerized information system a logical mechanism to promote economic development into the next century.

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