CRITICAL SUCCESSFUL FACTORS ANALYSIS FOR NATIONAL DATA INFRASTRUCTURE IMPLEMENTATION

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Abstract

Information is an expensive resource, and for this reason appropriate information and the resources to fully utilize this information may not always be readily available, particularly in the developing country. Many national, regional, and international programs and projects are working to improve access to available spatial data, promote its reuse, and ensure that additional investment in spatial information collection and management results in an ever growing, readily available and useable pool of spatial information. In regions characterized by an availability of geographic information, in combination with the power of Geographic Information Systems (GIS), decision support tools, data bases, and the World Wide Web and their associated interoperability, the way better-resourced communities address critical issues of social, environmental, and economic importance is changing rapidly. The available computing infrastructure, available legal arrangements and full understandings of countries systems, legal and economical position for a given country could be the key for organizing, hosting and handling national spatial data on the national level. Furthermore technology has reached a point were every body can share information on real time. The study will describes different spatial data experiences in sharing and visualizing spatial data using different frameworks such as spatial data infrastructures, centric databases and distributed spatial data.

The main problem is many professionals feel that ready made solutions could solve the problem regardless the nature, habits and the culture of the countries. Developed countries have huge computing infrastructures which make data handling and sharing through local and global networks easy and mandatory for every user. However, developing and undeveloped countries could have a lack in the computing infrastructure. A good running computer networks could be a major problem of having efficient system to share and handle geospatial data. Therefore a good understanding for the property and the criteria of a given national geospatial data is important to have an effective national geospatial framework in a given country. Enterprise GIS implementations are costly, and yet this seems to be the direction adopted by organizations tackling the initiative for the first time and often for the second or third time. Why do organizations take this approach? How is success measured? Are there techniques that can ensure success of enterprise GIS implementations? In discussing strategies for successful enterprise GIS implementation, it should remain evident that each organization is ultimately unique, having its own culture, business practices, methodologies, and processes. An adopted system that works for one organization will not necessarily be adequate or appropriate for another organization. The nature of the organization, and the people that work within it, will shape the way technology is accepted and used by the corporation or organization. Consideration must be given to the complex, "political" nature of the organization. It cannot be assumed that individuals will behave professionally, or rationally, rather than according to personal agendas (Haley, 2007).

Keywords: Geospatial data, Framework, Organization, Geographical Information System, Enterprise GIS, Critical success factors

1. Introduction

Appropriate information and the resources for maximum utilization may not always be readily available as information is an expensive resource, particularly in countries that are still undergoing the process of development. Many programs and projects at the national, regional, and international levels are working towards improving access to available spatial data, promoting its re-use, and ensuring that additional investment in spatial information collection and management results in a pool of spatial information that is continuously growing, readily available and useable. It is easily noticeable that there is a rapid and vast change in the way better-resourced communities address critical issues of social, environmental, and economic importance in regions characterized by an availability of geographic information, in combination with the power of Geographic Information Systems (GIS), decision-support tools, databases, and the World Wide Web (Internet) and their associated interoperability (FGDC, 2005).

In our present days, the process of decision-making at all levels of government and in private industry is affected by the increasing role of Geographic Information Systems (GIS) that facilitate spatial analysis. In turn, GIS analysis depends on many factors such as the availability, quality, and compatibility of digital geographic data. Development of these data is normally the highest cost-factor in the use of technology to address today's problems. Billions of dollars are invested annually in producing geospatial data, but many of these data collection activities are redundant as data already exist. Sometimes the reason could be that these data are hard to find, frequently undocumented, or in incompatible formats (FGDC, 2005).

However, even in the new era of networking computers, the social norms of the past continue to forbid users from finding and thus using critical geographic information. This could lead to either the abandoning of proposed projects or to unnecessary and usually expensive recapture of existing geographic information. The discovery, acquiring, exploitation and sharing of geographic information vital to the decision process would easily be possible for local communities, nations and regional decision-makers only through common conventions and technical agreements (GSDI, 2004) such as National and international Data infrastructures.

Furthermore Rapid development and advanced technology have created a need for geographic spatial databases to help in aiding growth and development all over the world. Tens of billions of dollars in the industrial world have been spent in creation of systems. Systems were developed and designed in order to serve specific needs and communities such as urban planning, land records and businesses, etc. The Mapping Science Committee of the National Academy of Science reported spending to be $ 4.4 billion (Groot and Mclaughlin, 2000). There are many countries trying to develop there own National spatial data infrastructure (NSDI) to remove duplication and redundancy of their geospatial data.

Fauziah Abu Hanifah, *et al*., (2007) has stated in the critical reviewing of the Malaysian NSDI the following "Many countries are developing NSDIs to improve access and sharing of spatial data. The current NSDI provide mainly the ability to access and retrieve spatial data. The development of these NSDI models have not met user needs as expected. Hence, the concept of an NSDI needs to progress so that it allows more than just the ability to access geospatial information. It needs to be enhanced so that it is possible to share data, business goals, strategies, processes, operations and value added products and services in order to support a spatially enabled government", (Fauziah Abu Hanifah, *et al*., 2007). This applies for many countries who are trying to implement the NSDI concept on their local and national levels.

In context, many poor countries needs the NSDI to develop and monitor their growth therefore it is often said that Africa is poorly mapped, that is, there is a paucity of geospatial information. Without proper geospatial information, it is not possible to use GIS for the purpose of analyzing development needs and planning projects or monitoring the impact of development on projects. This can serve as a clear example

of the nature and the status of the geospatial data in one of the five continentals. The study illustrates the reasons why there are poor data for Africa. The paper also defines the two reasons behind the case, viz., the low standard of living in Africa and the lack of governmental support. Clearly, this example stresses the importance of knowing the nature of a given place before trying to fit or an implement NSDI. The Geospatial African project had wasted time and effort before realizing that there were problems of communication, data availability and data access. Furthermore, one of the biggest drawbacks in the African project was the educational level and the expertise. Thus, the following statements were given: "to be effective, there must be a critical mass of expertise in GIS. The local academic institutions often are unable to provide the required technological skills" (Clarke, 2008).

There are different standards of living and economical situation for different countries this drive us to very important question 'how countries can improve there NSDIs? And then money can be saved as will as time on the implementations of their newly built NSDIs'. The following sections will discuss the need for NSDI to serve geospatial data in the Middle East and United Arab Emirates. The objective of the study is to determine critical success factors that affect the success and the progress of NSDIs implementation.

2. Literature Review

Strategic planning is a critical element for articulating a shared vision, and for building the partnerships that are necessary for disparate organizations to work together on common goals. The key is to identify geospatial needs that are shared by many stakeholder groups. For instance, it is easy to envision that statewide ortho-imagery acquired on a routine basis would be useful to almost all stakeholder groups. Effective strategic planning is essential for moving collaborative programs forward and gaining the required support for investments in SSDI (NSGIC, 2006).

One great contributor to the strategic planning for in the managements part is learning more about critical success factors analysis which we will apply this analysis in this paper to get their we need to do literature review that helps in defining the critical success factors that effect the implementation of NSDI based on other experts published works.

2.1 Success Factors defined by FGDC.

The National states Geographic Information Council (NSGIC) produced a table to compile a set of success factors and pitfalls in one place, as a handy reference for discussion and consensus-building as part of the planning process. The following critical successful factors were placed in the table and they are as follows:

- Make sure the strategic goals are accepted and agreed upon: goals and objectives should be clear for everybody so money and community support can be gained.

- Make sure the strategic goals are feasible to implement and consistent with expectations: challenging goal can be perfect idea, as long as it is achievable. Success tends to “breed” further success while early failures can cause the participants to lose interest in the planning process.

- Incentives that will stimulate a commitment to strategic goals: What’s the stimulus required for your stakeholders to commit to this effort? When it comes to the Federal Government wanting the NSDI to be implemented, with the states as primary agents, (or the states wanting local government buy-in) what’s the quid pro quo? What other incentives are there apart from Federal grant money linked to

compliance? For example, what can the states themselves do to create incentives for the participants? Look at all possible benefits such as statewide data contracting to get "scale of economy" savings for individual local governments, or statewide data distribution centers that may free up staff time for local participants. Quantify every incentive to ensure that their true values are understood.

- Get top-down support: a full understanding of the benefits of the NSDI should be illustrated for the top government people so support and commitment can be gained.

- Get grassroots support: Win grassroots support through broad participation and open discussion. An enumerated list of clear and tangible benefits is needed for grassroots entities, too. Understand the burdens and new responsibilities that might fall upon grassroots performers, and identify resources to meet their needs.

- Recognize the need for change: If an organization is not configured (or funded) to achieve the desired goal, then change is needed. Change might be needed on multiple fronts, including organizational culture, political environment, procurement processes, and technical practices.

- Define the project boundaries: what the user will get in and out the plans should realistic and can be implemented.

- Choose appropriate milestones and a timeline: deadlines should be met and set car fully.

- Evaluate alternatives along the way: evaluation of progresses should be measured and projects can be changed towards new technologies.

- Consider "unbundling" subprojects at the action-level of the business plan: A good example of unbundling is represented by the "Imagery for the Nation" initiative. As this gains traction, focused business plans to implement the program make sense. Other examples might include cadastral data or any of the "framework layers." Breaking down strategic goals into rational steps so that they can be implemented is the purpose of business planning.

- Be determined to create and maximize value: The easy answer to implementing a SSDI is to say "send more money to the states or locals." While this will help, it could also result in the squandering of scarce resources unless there is a serious intent and effort to truly create value in delivering NSDI or SSDI components. What is the perceived level of contribution to society (public value) associated with implementing the NSDI or SSDI? What is the cost of realignment against the benefit?

- Concentrate resources on key goals: Trying to achieve too much with too little can lead to failure. Seek sustainable funding sources, above and beyond incentives.

- Understand previous efforts: Analyze past successes and failures, but avoid "paralysis from analysis." Also, avoid merely copying past efforts, and promote strategies that use lessons-learned as leverage.

- Creativity and imagination: Creative approaches that synthesize past experiences with new ideas are needed for strategic change. This is especially true when traditional roles and responsibilities need to be changed.

- Promote a process, and not just a destination: Realization of a successful program heavily depends on an inclusive process, where implementation details may vary over time, and not necessarily be fixable at the start of the program.

- Energy and willingness to act: Enthusiasm can be contagious. So can negativity. Most long-term efforts will have ups and downs, but maintaining a suitable level of energy and willingness to act will help overcome the doldrums and lack of progress (NSGIC, 2006).

The NSGIC also defined the pitfalls and backdrops as follow:

- Dissension over goals.
- Unrealistic goals and expectations.
- Lack of motivation to implement an "unfunded mandate".
- Ignore top-down support.
- Ignore grassroots support.
- Ignore the need for change.
- Shoot for infinity.
- Choose a non-specific "whatever" attitude and rely on random chance.
- Ignore alternatives along the way.
- Keep all of the eggs in one basket.
- Be determined to maximize funding.
- Dilute resources across all goals.
- Ignore previous efforts.
- Same-old-same-old there no creativity and adopting new technologies.
- Too fixed on the destination.
- Ho-hum: there is no willingness to act (NSGIC, 2006).

In addition, FGDC (2005) defined the following factors to ensure the success of a project:

When the project starts:

1) A real need must be there and defined so public trust should be gained.

2) Right people should be recruited to work with your stakeholders so good relation can be established. Match managers to management issues and technical staff to technical issues.

3) Be sure that you have executive buy-in for this effort. They may not support even the most logical and compelling conclusions if they don't perceive the need for your solution.

During the process of the project:

1) Communications are critical to any success of the projects.
2) Try to facilitate meeting logistics so they are equitable to all participants. Look for technology solutions such as WebEx ™ or video conferencing that will allow your participants to work from their own office when needed.
3) Manage the personalities and skills of your working group to take advantage of, and recognize their strengths and weaknesses.
4) Develop solutions through a consensus-based process. Don't force untenable compromises or let your working group members begin to view the process as "winning" or "losing."
5) Work to create an environment of mutual respect that fosters participation by all working group members.
6) Write your plans with focus, brevity and clarity. Management will reward you for taking this simple step.
7) Use conservative estimates in all financial areas. Management can recognize efforts to improperly "tweak" the numbers.

After completing the Planning Effort:

After completing strategic or business plans, many managers expect to receive attention and funding for the simple reason that they have a plan in place. Nothing could be farther from the truth. The real work begins after the completion of the planning process and you won't get attention or funding unless you aggressively market and pursue implementation of your plans.

1) After the “group think” is over, evaluate whether or not you created a realistic and workable solution for the problem that you identified in your planning process. You should have done this in the planning process, but if you didn’t, ask the group to take another look and refine the plan.
2) Make sure that you can articulate the compelling reasons why your project must be funded. If you can’t, who will?
3) You must repeatedly ask (within the limits of good taste) for the funding, staff and other resources that are needed to implement your plan and objectives.
4) The right people must always remember what you asked them to do. You have to simplify your message and make sure it is concise and clear.
5) All of your stakeholder groups need to ask for the same thing. If they don’t, you’re destined to fail.
6) You have to deliver a consistent message about solving problems that will be remembered. When elected officials and executives think about how to solve their problems, will they remember your solutions?
7) You need to be "right" and ready to make your case whenever the opportunity arises. Make sure there are no “holes” or inconsistencies in your plan that will reduce your credibility. Always carry your plans and marketing materials and be prepared to give a 15 second to 10 minute summary of the plans.
8) You should be reasonable and ready to make the right compromises. Always anticipate where negotiations on program features, budget or other resources will go, and be prepared with intelligent compromises based on facts (or consensus with your stakeholders) that you have already assembled.
9) Be prepared to take the “other guy's” money when they slip-up. It’s a cutthroat world and like it, or not, you are competing for limited resources. When someone else fails to deliver on a grant or to get their paperwork in on time, be prepared to step in and take their funding to accomplish your goals.
10) Understand your "friends" and your "enemies" in the process. When you take the time to know what motivates the other guy, you will be in a much better position to reach consensus on the tough issues. The key is listening to what they say and understanding their position even when you don’t agree with it.
11) Don’t despair or allow negative attitudes to convince you that something can't be done. Assuming that your planning efforts have created a realistic solution, you should simply ignore negative comments and early failures. Most strategic objectives take years to implement unless you are just plain lucky, or they were born from executive interest and have immediate political support. Be patient.
12) Be “guilty” of making an honest effort and working hard to achieve your goals. There simply are no substitutes.
13) Mange the expectations of your stakeholders. Don’t let them believe that achieving the goals is a simple process. If you do, they will loose interest after early failures and they will not be there to support your efforts when they are most needed" (NSGIC, 2006).

2.2 Qatar GIS

In a paper written by Tosta, (1997) , various factors that effect the geospatial data industry in a certain country are illustrated. In that paper, the writer expressed the need of implementing similar system in the United states of America. This paper describes the successes of the Geospatial data industry managed,

stored and visualized in a certain frame the same system in United States. However, the writer highlighted the main difference between Qatar and the US that makes the implementation of the similar system in the States is too difficult to be done.

The paper defines the following factors made nationwide GIS coordination possible in Qatar: Highest-level political support;

- Political will and authority to mandate and enforce standards;
- Outstanding technical leadership;
- Small and relatively uncomplicated geography;
- Few institutions;
- Adequate funding; and
- Little existing GIS activity (Tosta, 1997).

Haley (2007) defined the following factors for successful GIS:

- Visioning and planning.
- GIS business unit.
- Organizational placement.
- Staffing.
- Mandate.
- Data management.
- Funding strategies.
- User involvement.
- Including committee structure.
- Project teams.
- Pilot projects.
- Prototypes

2.3 GIS Implementation Factors:

Nasirin and Birks (1998) make comparisons between market leaders and followers. The paper describes GIS applications experiences of key UK food retailers. To study the GIS system, the researchers depend on the traditional system development live cycle SDLC. The following factors were found in the system implementation face:

- Forces to GIS implementation Internally and externally: in this analysis the paper defined external and internal factors that effect the applications of GIS in food store in this proposal the discussion will be focused in the global case of the factors not to specific case like wise in the paper. But we can defined the external factors as the environments were is the GIS are applied food store, governments organization and other, the internal factors are the managements of the GIS project.
- Planning and Objective of GIS implementation: the writers define the actual factors that effect the planning and objectives and they are as follows; using of new technology, easy planning, direct process, good control over the data and cutting down the coast.
- Top Management Awareness and Support: a total understanding of the GIS project in organization is very important on success of the project. A communications should be made between GIS mangers and other departments through verse means.
- GIS champions' role: A GIS champion is someone who is completely committed to the idea of implementing the system within the organization. They wholeheartedly pursue the goal of GIS implementation through selling the idea to senior managers, co-workers and anyone who is willing

to listen. It was widely accepted that without a champion, an organization could not successfully implement a GIS.

- The need for Analysis: Good analysis is a must to educate the mangers and the people involved in the project this analysis will help in getting the data used and the conceptual frame work for the project. This will allow for clear definition of the user requirements.
- The Development of Applications and system: This factor includes good creation for the user interface and quires as the user required. The created menus should be in standard form.
- System Procurement: the development of the implementation in house which fit the user requirements so close relation between developers and users could impact success for the project.
- Database Management Systems (DBMS): Defined the data as the most pragmatic issue for success of the GIS. Data integration and multiple plate forms is another hard issue to be resolved.
- Awareness and Involvement of Users: Good communications between GIS project team and the users could lead to success of the project.
- Resistance to Change: Understanding and knowing the resistance to change is significant to successfully implementing GIS.
- Provision of Training: the training should be built to the user as they require and consideration of the following points should be taken; user must understanding the new applications interface, the training could be in or out of the site, the training should be easy and simple to the points.
- Vendor Support: the team should support the user of the application and they have to provide training in regular basses (Nasirin and Birks, 1998).

2.4 Review of Malaysia NSDI

Also, a paper reviewing the current NSDI in Malaysia from critical point of view (Fauziah Abu Hanifah, *et al*., 2007). They described that the Malaysian NSDI was built according to skilled GIS experts and they wanted to highlight the success and drawbacks of the current system. More consideration for user requirement should be taken into account in the light of the new technology to improve data access and retrieval (Fauziah Abu Hanifah, *et al*., 2007).

The following different challenges the writers feel they are essential to be addressed, which may represent a critical success factors:

- A lot of political negotiation.
- Agreements on standards.
- Agreement on costs sharing.
- Agreements on maintenance.
- Data format issues.
- Data quality issues.
- Data content issues and semantics.
- Temporal and spatial coverage.
- Resolution.
- Origination.
- Format.
- Map projections.
- Incompatible.
- Integrating multiple.
- Standards and specifications together.
- Communicating complex standards.
- Designs in appropriate ways for different consumers.

- Developing authoritative online resources for national and international use.
- Difficulty to access the huge volume of multi-source geospatial data.
- Difficulty to integrate the multiple-source data from multiple data providers.
- Lack of knowledge to deal with geospatial data. Because of the diversity of geospatial data.
- Expert knowledge in the data manipulation and information technology is needed to handle such data and not all users have such knowledge.
- NSDI to facilitate spatially enabled government.
- Role of government, private and academic sectors.
- Development of NSDI vision, mission and road map.
- NSDI to facilitate integration of natural and built environment datasets.
- Capacity building (Fauziah Abu Hanifah, *et al*., 2007)

The study of the critical success factors that effect current geospatial data sharing and handling will lead to good understanding of the new generation of frame works with consideration of the property the culture and the nature of the NSDIs.

2.5 Status of NSDI in Nigeria

Nwilo and Osanwuta (2004) argued that for the purpose of having a successful implementation of the National Spatial Data infrastructure, there is a need to have a well-distributed and homogenous control network, a good geodetic reference datum, a well-developed geoid, identification of stakeholders, good telecommunication and well-trained manpower. Nigeria has a good geodetic reference datum and a well-distributed control network. Most of the control network was established by traditional methods.

Additionally, the writers brought to light some issues concerning the status of spatial data infrastructure in Nigeria and they described the problems for applying NSDI in the country. These problems include the following:

1. Poor geodetic coordinate systems coverage.
2. Trained manpower.
3. Internet access
4. Data sharing suffer similar fate.
5. Even information on the waterways that are in abundance has not been managed in such a way that they are easily accessible to interested parties.
6. Finance
7. In the case of communication, it can be said that the telephone density in Nigeria is poor but certainly one of the best in Africa. The recent introduction of digital mobile telephone services and the licensing of the private operators have seriously improved the tele-density in Nigeria.
8. In terms of core-data the writers highlighted the following points:
   - There is a need for coordination between custodians to ensure that components of the region datasets are collected to consistent standards.
   - That the community of users must be adequately consulted to determine specifications and problems.
   - Access to the data is provided in accordance with the policies determined for the countries spatial data infrastructure; and
   - The country's data set conforms to a set of standards that ensure that it can be combined with other components of the country's spatial data infrastructure to create value added products:
     (i) Identification and prioritization;
     (ii) Production and integration; and

(iii) Data maintenance.

- In generating information on fundamental datasets, it is important to map information on the following broad classification namely:
  (i) Data types
  (ii) Data sources
  (iii) Nature of access
  (iv) Orders of data.

9. Development of a Clearing house Network.
10. Development of Metadata.
11. Standards.
12. Promotion and Outreach.
13. Qualified Manpower.
14. Effective telecommunication,
15. A vibrant press.
16. Good road and rail networks (Nwilo and Osanwuta, 2004)

The above can be considered as CSFs. But a careful study should be done before considering those factors. Furthermore this applies for new counters who want to implements NSDIs and they have the same conditions of Nigeria.

2.6 Global Spatial Data Infrastructure

Onsrud (1998) carried out a survey of INSDI in different countries in the world. The survey was conducted with help of FGDC and NIMA. The basic precept of this survey was that information about the status of spatial data infrastructure developments in each nation should be reported by individuals within each nation rather than by outsiders (Onsrud, 1998).

The following issues were surveyed:

- Policy Issues:

- Leadership.
- Availability of digital data.
- Mechanism of accessing data.
- Legal and economic frameworks for access.
- Data collection coordination: who, what and when data collected.
- Pricing of data and services.
- Commercial involvement: privet sector involvement in the NSDI.
- Public domain data sets: please describe those digital spatial data sets for jurisdictions within your nation that are available to anyone without any licensing or intellectual property restrictions imposed on the data sets and the data sets are available at no cost or little cost. How may copies can be acquired of these public domain data sets?
- Public goods aspects of NSDI: Please describe any additional services or goods provided by government in support of the NSDI for which individual users are not charged.
- Privacy: Please describe how the information privacy of individual citizens is protected relative to data that may be accessed through the NSDI (Onsrud, 1998)

- Operational Issues:

- Authority: Do the laws or formal orders of any legislative or executive branches of government explicitly recognize the need to establish or further develop the NSDI?
- Funding: Have funds been specifically budgeted and acquired for NSDI activities?
- Inclusiveness: Please describe the types and extent of participants involved in building the NSDI and their roles.
- Components: Please ensure that all components of NSDI are present.
- Research: Have funds been specifically budgeted and spent on research projects to advance NSDI concepts?
- Linkage to general information technology standards – Which international or national information and communication technology standards has the NSDI adopted?
- Global spatial datasets: Does your NSDI provide access to spatial datasets with global coverage?
- Global or regional infrastructure initiatives: Is your NSDI formally affiliated with or connected to any global or regional spatial data infrastructure initiatives?
- Long term vision or strategic plan: Has a long term vision statement or strategic plan been developed for your country's NSDI?
- Grand challenges: Name one of the most pressing challenges for NSDI development in your nation.
- Further information: If an NSDI website exists where information about NSDI efforts in your nation may be found in the future, please provide the website address (Onsrud, 1998).

The above issues are critical success factors that are important to ensure the success of NSDIs implementations which the writer had sent to nations in form of questions. The surveyed nations have agreed about the following grand challenges, which are:

- Ensuring cooperation of all levels of government in the development and implementation of NSDI policies.
- Creation of a group of people who truly understand what geospatial information is at a fundamental level and how it can be represented, organized, and used . very few people who carry the big picture.
- Ensuring the consistency of data to enable successful integration and adequate quality of the data.
- The formal coordination of data collection and NSDI efforts generally.
- Gaining an understanding of the geo market.
- Legal and economic aspects of NSDI are the priority issues.
- Poor resources or limited resources.
- Further development of access - to everybody, anytime, any place and anywhere.
- Effective communication links.
- NSDI is an on-going process. greatest challenges deal with administrative questions
- Workable incentives must be developed to facilitate and enhance cooperation.
- Maintaining a shared vision over time.
- Getting the attention of even one high-level official who truly understand the key role of spatial information in the rapidly evolving information society in identifying such champions! (Onsrud, 1998).

There are important differences in the infrastructure developments being sought after, particularly with regard to legal, economic, scale, and organizational considerations. Nevertheless, there are some commonalities as well. These commonalities are probably most evident in the areas of metadata, core data, standards, portals and clearinghouse concepts. Local, national and global awareness of spatial data infrastructure concepts and approaches appear to be increasing. Those promoting cooperation and collaboration in the advancement of national spatial data activities may want to concentrate first on these areas in which significant agreement already exists among nations and build upon those commonalities (Onsrud, 1998).

2.7 GIS Implementation Strategies

In their report titled "GIS Modules and Distributed Models of the Watershed", DeBarry and Quimpo (1999) believed that there are three approaches to implement GIS. These approaches are as follows:

- Server center strategy.
- Integrated enterprise GIS.
- Behind-the-scenes tool technique to bring GIS to the organization.

The writers suggested that it is possible to combine the basic approaches. These strategies can be implemented at the government level with long term plan to reduce duplication and to allow wide access to the data. Additionally, it can be at the organizational level where they will be having a key GIS person to support the organization in doing their duties where GIS functions are not in the main stream of the organization. This method is cost effective. The third method concerns the organization implementation of GIS in their application so users do not know anything about the GIS. Everything is running behind the scene. The writers also suggested a hybrid system which depends on the organization need as it could be more effective. With disregard to the type of the system, the following factors were considered as successful factors and they are:

- Champion to promote GIS development within the organization.
- Planning.
- High level management support.
- Completion of user needs assessment.
- Shared project ownership among the users.
- Accurate time and cost estimates for associated costs, including products.
- Clear goals and objectives defined for GIS departments.
- GIS education and training.
- Coordination of GIS development and staff continuity.
- Defined funding plans.
- Solid written contracts with vendors and clients.
- Publicized successes.

The writers found that it is difficult to implement all the above factors. However success depends on how much a given organization will implement of the above factors. There are other factors to be considered which the writers described them as organizational attributes and they are as follow:

- Overall organization functions and goals.
- Sources of data available as input to the GIS system
- GIS hardware, software, databases and products which are currently and planned to be utilized.
- Management approaches which will guide and have guided the GIS program to date.
- Cost of implementation, both historic and planned.
- Benefits of the implementation, both tangible and intangible.
- Procedure to be used in evaluating and comparing the cost and benefits.
- Review generation procedures, internal, external, current and potential.
- Quality assurance and quality control procedures and any applicable data standards.
- End-user interactions and training - consider how the GIS group will communicate with its user.
- Evaluation procedures to be used for reviewing the GIS.
- Legal issue pertaining to data distribution and ownership.

Once again, the writers realized the difficulty of implementing all of the above attributes although cost benefit analysis is crucial to point out benefits and justify cost (DeBarry and Quimpo, 1999).

2.8 Importance of Computing Infrastructure for Data Sharing

Many problems which are unsolvable could affect the model of newly framed geospatial arguments. Many designers tend to implement solutions for problems they are sure that they can take ages to be solved. For example, country x doesn't have good networks between their local and private stockholders. Implementations of the SDI could be delayed until a good network is built next month or in the next twenty years. However, considering such property could lead to saving time and cost of framework building. Therefore, one of the mistakes that could lead to inefficient national geospatial framework is to import a readymade framework that doesn't account for the properties and the local system in a given country.

Although the coverage and format of most data, as being observed, have been mainly focused on the needs of the original collecting agency, still scope exists for these agencies to further develop data in response to the needs of other users including those in the private sector (Hall, 2003).

3. Discussion

There are many NSDIs initiatives in the world. The above illustrations shows there are different critical success factors that effect the implementation of the worlds NSDIs such as the legal issues, education level, standards for the Geospatial data and others. The next questions are how we can identify those critical success factors, to which extent their effect exists and how we can model them. It is evident there are critical success factors that effect the success of the NSDIs in different countries based on the literature review. Therefore countries need to under stand the critical successful factors so a successful story can be written.

Nowadays, there is no doubt that spatial information plays a crucial role in the sustainable development of country. It is one of the backbones of the e-government concept. Similarly it is widely agreed that the most adequate framework for handling these spatial information on a national regional or international level is the SDI concept. The term Spatial Data Infrastructure (SDI) has numerous Definitions across countries, regions and disciplines. These definitions differ as considerably as do the stated objectives of the more than 120 SDI initiatives now underway across the globe, with varying degrees of success (Longhorn, 2004). This concept has been around for almost three decades and some 150 countries are at some stage of its implementations. However it seems that all of these experiences have known a failure in some aspects. As discussed in above and in the literature review in Section 2.

The main problems there are no clear studies that gather, analysis and Prioritize critical success factors for the implementations of NSDI. Good understanding of the critical success factors that affect the success and failure of NSDIs implementations will help in minimizing the chances of failing any implementation of NSDI. No much work has been done in discovery, analysis and classification of the critical success factors that affect the success of implementing NSDI for data sharing and handling at the national level and the international level. Some of the studies such as "Cook book" have not touched all the aspects related to successful implementation of NSDI and it provides just broad guidelines.

There is a correlation between the economical, legal and computing infrastructures for a given country and the implementations of NSDI for geospatial data handling and sharing at the national level. So, measurement of the critical success factors and analysis of the implementations according to the criteria and the property of a given country could lead to effective and efficient geospatial data framework. Therefore a money, time and effort saving could be possible.

The study is very important for all countries that apply and implement NSDIs, which will help them to tone and refine their process on geospatial data sharing and handling at the national and international level for the following reasons:

- Knowing the critical success factors will definitely help in preventing mistakes and losing time in falling in the same mistakes "duplicating works".
- Most of data handling and sharing concepts are imported from other countries that had successful store, so those concepts may not fit to other countries that do not have the same parameters and factors. Knowing the successful factors model will optimize and tone the process in the implementing NSDI in new countries.
- Fixing and creating well-defined critical success factors model will help in choosing the most effective methods and process; hence money, time and effort can be saved or better utilized.
- Some countries may require having different frameworks or modified geospatial data handling methods or techniques to build there own effective national framework based in the critical successful factors. This framework can be enhanced if the above factors are applied properly.
- Good understanding of the critical success factors could lead to integrated geospatial data solutions which fit all considered parameters.
- Spreading awareness of the critical success factors that affect progressing of implementing NSDIs will provide safe and successful NSDIs.
- CFS Identifies the key concerns of senior management in the implementations of the NSDIs.
- CFS will help in the assisting in the development of strategic plans for the implementations of the NSDIs.
- CFS identifies the key focus areas in each stage of The NSDIs implementations life cycle and the major causes of NSDIs failures.
- CFS evaluates the reliability of NSDI.
- CFS identifies business threats and opportunities in implementing NSDIs.
- CFS measures the understanding and the productivity of people (Carali, 2004).

4.2 Summary

To conclude, I would like to make a mention that I don't want to neglect or underestimate the great idea of the SDI concepts, but my intention is to bring forth and cast the light on the problems. Studying critical success factors will confirm the success of future NSDIs and will aid the process of decision-making. If this is achieved, then money, efforts and time will greatly be saved and consequently utilized for the betterment of the people of the organizations.

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