Strengthening the Importance of Geographical Information Systems (GIS) Components in Organisations for a Successful GIS Technology

A key to a successful GIS in organisations

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Summary

Many GIS organisations or organisations with GIS technology tools are faced with problems in implementing GIS technology at their work place. In most cases, GIS fails because the professionals and managers who allocates resources are simply not aware of what drives GIS technology, and as a result they ignore the core components that leads to a successful GIS implementation.

Introduction

The term ‘geographical information systems’ describes a technology. It’s a complex technology, and its successful application requires the linking of a number of technologies most of which have been developed independently of the GIS world.

GIS deals not only with technology, but also with the inputs to and the outputs from that technology, which makes it a field of study.

In order to properly use GIS, we need to understand what is involved in making it work successfully. What is involved is not simply technology but the whole context of its use. In summary, this article brings forward the idea that there are complex ramifications to the use of GIS technology.

When justifying GIS nowadays, experts need to strengthen the importance of the GIS components, namely technology, data, organisations, methods and body of ideas. This is because these are the core base of GIS that match the vision and commitment of the
administrative and technical levels concerned, which should then be balanced against the technological and organisational investment needed in developing the necessary GIS infrastructure.

**Definition of GIS – In summary**

As mentioned by Heywood et al. (1998), definitions of GIS are likely to change quickly as technology and applications develop further. This is proven to be true, in the sense that definitions vary according to the background of the person who is giving it; some people define GIS in their line of duty and vice versa.

As mentioned earlier in my introduction, the term ‘Geographical Information Systems’ describes a technology, while, Geographical Information Science (GIS) is the term used more nowadays, referring to GIS as more than a system which can process much data. They offer functions for collecting, storing, processing, and retrieval of spatial data. Below is an early definition of GIS:

‘A system for capturing, storing, checking, manipulating, analyzing and displaying data which are spatially referenced to the earth’ (Petch 1999)

This is essentially a technocentric definition. It focuses on what the technology does, not why it does it or what the role and context of the technology are. A spatial component makes it Geographical (G). Much data from different sources, different suppliers from different hardware platforms, combined, analyzed together and interpreted make it (new) Information (I). The ability to integrate with different software and make it available online makes it a system (S). The whole of activities and means to provide users with the geographic information needed to carry out tasks and to take decisions in the context of spatial problems is GIS. In summary, GIS should be able to edit the geo-referenced data, spatial data analysis and modeling.

**Components of GIS technology**

The success of a GIS in any organisation can only be successful with the support of technology, data, organisations, methods and body of ideas as GIS components (see figure 1 below); these are discussed in detail below. GIS can be viewed as a software package, the components being the various tools used to enter, manipulate, analyze and output data.

Since GIS cannot operate in isolation from an application area, which has its own traditional ideas and procedures. Brief descriptions of each component are provided below as illustrated in Figure 1 above.
Technology
First among the GIS components is the technology of GIS itself, which consists of the software and hardware. The software part of this technology is initially a set of software process at the core of which is a set of algorithms for accessing, presenting, analyzing and synthesizing data with reference to their spatial and non-spatial attributes. Linked to these programs are others for data management, for extraction from databases, for visualizing data and for undertaking other tasks such as importing and exporting techniques (Petch, 1999). Networks (intranets, the Internet) and distributed systems are a very important part of this technology in GIS.

The hardware part of the technology is centered on the computer platform and has peripheral devices related to input and output. These include conventional read devices such as floppy disks, compact discs (CDs), etc that allow file transfer, as well as network devices, together with output devices such as printers and plotters. In addition there are specific devices widely used in GIS applications for input and output of maps to and from analogue formats, such as scanners. In data collection, GIS technology has sufficient support tools that allow Global Positioning Systems (GIS) to upload and download data.

Data
The second main element of a GIS is data. All information systems are based on data and rules for using data in some form or other. The main components of the data part of the system (figure 1) are inputs, spatial and other forms of databases, data maintenance systems and quality assurance systems (Petch, 1999). This initially means at this level, GIS is now beginning to include not only technological entities but also human systems.

Organizations
The third part of the GIS is the organizations. Any information system can only work in the context of an organization (Petch, 1999). The organization consists of many complex and subtle parts but we will consider it here to consist of a set of business objectives, a set of business processes, management, operators and the general overarching component and people. Particular sub-components of the management, operators and people are those concerned with system design, implementation and monitoring since they have a particularly important role in defining what a GIS is.

Methods
The fourth component of GIS is the set of methods. They are neither hardware, nor software, and certainly not specific to people. They are independent procedures or rules for undertaking the various tasks involved in the design, creation and operation of GIS (Petch, 1999). A method contains the logic for a procedure and the specification for the actions. There are methods for spatial analysis, for data manipulation, for database design, for user needs analysis, for map interpretation and the list goes on and on. Each activity has a method. And the method is what determines the meaning or quality of the outcomes of that action. Method is the key to everything in GIS operations.
Body of ideas

Finally, there is the body of ideas, which lie behind the use of GIS. They include areas of engineering concerned with computing including mathematics and physics that lie behind the computer hardware systems. Behind software systems are bodies of knowledge concerned with geomatics, data processing, databases, spatial analysis, and multimedia and in any applications area there are bodies of theory such as from agriculture, geology, surveying, ecology, sociology, transportation etc. Behind organizational issues are theories of management, systems design, business economics, sociology, psychology, psychophysics and ergonomics. Methods stand on bodies of theory from every conceivable branch of science, sociology, management and commerce (Petch, 1999).

Conclusion

GIS cannot operate in isolations; it requires the technology to run, the data to work with, and the organisation in order to reach the business objectives, mission or vision, the methods in order to have procedures, standards and rules of carrying activities, and body of ideas in order to understand the detailed use of GIS. In combining these components together and of course in GIS technological manner, the output should be a successful GIS with different roles, and should increase efficiency in the organization.

In conclusion, top management, GIS specialists and GIS managers in any organization need to stress the importance of the core components of GIS. This is because these are the tools of realizing, promoting and understanding the need of GIS technology in organizations in order to reach the business objectives.
References

Addison Wesley Longman Ltd

Mundia LC (2007) The Use of GIS in Flexible Land Tenure System (FLTS) at City of Windhoek -
Namibia, MSc Thesis, UNIGIS, Vrije Universiteit- Amsterdam, the Netherlands. Available

Petch JR (1999) UNIGIS Module 1 Course Notes. [online] Vrije Universiteit-Amsterdam, the
Netherlands. Available from:
http://www.feweb.vu.nl/unigisonline/ModulesE15/module1sep/pdf_other/sect1.pdf
[Accessed 27 November 2006]

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Lisho Christoh Mundia holds a MSc in Geographical Information Science (GIS) and other academic
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