DATABASE DESIGN FOR E-GOVERNANCE APPLICATIONS: A FRAMEWORK FOR THE MANAGEMENT INFORMATION SYSTEMS OF THE VIETNAM COMMITTEE FOR ETHNIC MINORITY AFFAIRS (CEMA)

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Abstract

The database system, providing basic information and on-line services, supports the "good governance" concept developed in the last century for sustainable development, challenges and opportunities in the context of integration and globalization. In this paper, the framework for the design of e-Local Governance (e-LG) is discussed that integrates an Information System (IS), a Geographical Information System (GIS), and ATLAS, focusing on ethnic minorities in Vietnam. The design framework is based on various classification categories, i.e. ethnic group, sex, age, education background, and income. The database system is built to enhance the Committee for Ethnic Minorities Affairs (CEMA) capabilities, in the planning and decision making process by providing data, internet-based GIS, internet communication, and some ecological economic models to disseminate analysis results to the ethnic minorities concerned. The unique feature of CEMADATA using GIS is that it helps users not only to improve provision of information and public services, and to encourage ethnic minorities to participate in decision making processes, but also to support the competency-based training for the IT personnel.

Keywords: Database, MIS, GIS, e-Governance, Ethnic minority.

Introduction

In recent years, the rapid development of information technology, multimedia, along other scientific advancements have introduced profound changes in economic, social, political and cultural aspects around the world. The application and development of information technology and multimedia communications has contributed to freeing physical capital, strength, wisdom and spirit of the whole society, promoting economic and social development, while improving the quality of life of every citizen.

National database systems, around the word, have been playing an important role in the process of building e-government. Each country has their own strategic development of e-government, thus database systems selected are different. Thus, review of e-government of a country should be considered in the context of the development strategy of each country. For Vietnam to develop its national database, the Prime Minister issued a Decision (No 714 / QD-TTg, 22.05.2015), specifying that that development of the national database should be the cornerstone of e-government development. Thus far, six national databases have been deployed, namely: the National Database on population (chaired by the Ministry of Public Security); the National Land Use Database (chaired by the Ministry of Natural Resources and Environment); the National Registered Enterprises Database (chaired by the Ministry of Planning and Investment); the National Database of Aggregated Statistics on Population (also chaired by the Ministry of Planning and Investment); the National Database of Finance (chaired by the Ministry of Finance); and the National Insurance Database (hosted by the

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Vietnam Social Security Administration). These databases are the foundation of e-government development in the country, and they will contribute in the management and operations of the respective ministries, departments and agencies (NIPTS, 2003).

According to legal provisions, the Vietnam Committee for Ethnic Minorities Affairs (CEMA), a ministerial-level agency of the Vietnamese Government, is responsible for the state management of public services.[4] The CEMA database system (CEMADATA), as described in the Ethnic Minorities Affairs Strategy 2020, does not currently fulfil the requirements for good governance. Provision of information and on-line services are still at an initial stage, as its content is not fully integrated and appropriately shared. In order for the CEMADATA to fully meet its objectives, it needs to be based on current practices in information technologies, web-based GIS systems and multimedia communications and it needs to fulfil certain requirements before it becomes fully operational, i.e. integrate several components that are related to each other; be able to manage and analyse data; be fully based on database management principles (DBMS); and integrate geographical information systems (GIS)[5] as an important decision making and spatial analysis tool. Once such requirements are fulfilled, measures to further develop e-government may be taken.

This paper introduces a framework for the design of the e-Local Government Integrated Database, which will integrate sectoral databases and the Provinces' database into the national databases aiming to focus on ethnic minorities affairs in Vietnam. To build a web-based CEMADATA system, the following elements should be considered: [i]definition of the rationale and the practical relevance for building the database system for ethnic minorities in Vietnam; [ii] formulation of the design framework in sharing and integrating information for CEMADATA; and [iii] preparation of recommendations on how to develop e-governance through CEMA.

Database systems and E-Governance

E-government refers to the use, by government agencies, of information technologies that have the ability to transform relations with citizens, business, and other government departments. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interaction with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and/or cost reductions.

According to the United Nations E-government Survey, Vietnam is ranked below Singapore, Malaysia, Brunei Darussalam, the Philippines and Thailand. Table 1 presents rankings for ASEAN countries along the E-Government Development Index. It is noted that the e-government rankings between the Philippines and Vietnam have only slight differences. They actually demonstrate that both the Philippines and Vietnam have continuously been making a serious effort to develop e-government. This similarity allows for sharing knowledge and experience in the development of e-government between the two countries.

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[4] CEMA also acts as the State's representative in commercial enterprises where the State is an investor (under the Management Commission).

[5] The main database of the GIS has been built by using such modern technologies as GIS and remote sensing, topographic maps, digital elevation models, Contours, orthogonal photos, satellite images, interpretations from remote sensing images, statistics, measurements, etc. These technologies are then associated with spatial data (XY coordinates) to convert from data into information and from information into knowledge by the spatial analysis functions of GIS (Cường, 2004).

Table 1: E-Government Development Index Rankings of ASEAN Countries

| No	Country	2016		2014		2012	
		Rank	Index	Rank	Index	Rank	Index
1	Singapore	4	0.8828	3	0.9076	10	0.8474
2	Malaysia	60	0.6175	52	0.6115	40	0.6703
3	Brunei Darussalam	83	0.5298	86	0.5042	54	0.6250
4	*Vietnam*	*89*	*0.5143*	*99*	*0.4705*	*83*	*0.5217*
5	Philippines	71	0.5766	95	0.4768	88	0.5130
6	Thailand	77	0.5522	102	0.4631	92	0.5093
7	Indonesia	116	0.4478	106	0.4487	97	0.4949
8	Laos	148	0.3090	152	0.2659	153	0.2935
9	Cambodia	158	0.2593	139	0.2999	155	0.2902
10	Myanmar	169	0.2362	175	0.1869	160	0.2703

Source: E-Government Development Index (2016)

The development of e-government in Vietnam was formally initiated in 2004 and mandated by the Government of Vietnam through Project 112 and Presidential Decree No 449/2013 "On the database system of ethnic policies".

Figure 1: E-government model (Meier, 2012)
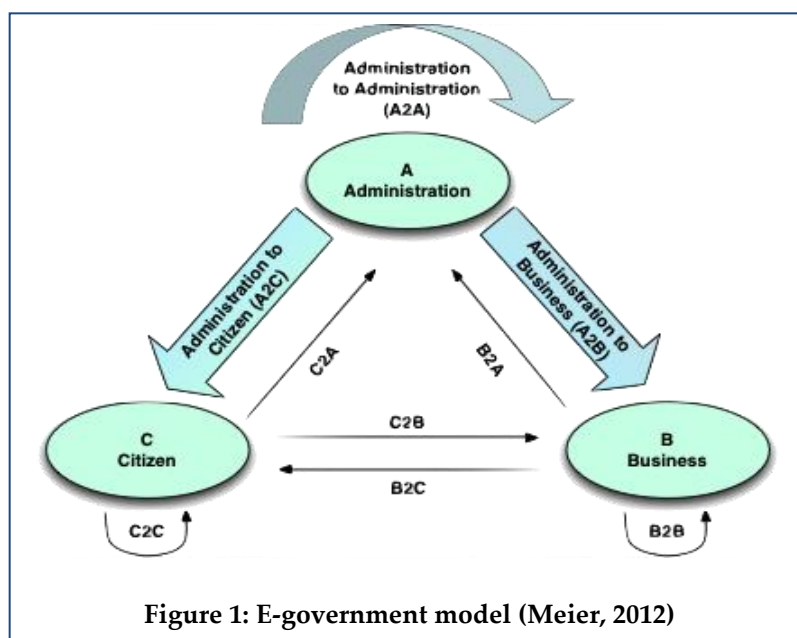
In 2013, the development of e-government in Vietnam reached the phase of "interaction". This is indicated by the fact that all ministries and provincial governments had developed their websites. In addition, ICT infrastructure had been built, which connected Vietnam extensively. Government employees used personal computers connected to the Internet. Despite that, internet access is still limited. However, Vietnam seeks to further develop ICT, by making available hardware and software to be used for the internal activities of government, i.e. e-office, e-budgeting, and on-line public services.

Such investment is very important for the development of an effective local-governance and therefore for CEMA. However, how to invest is even more important in order to attain the best possible efficiency for CEMA to improve organizational operations, enhance the policy making process and provide services and information. This also entails, restructuring CEMA's administrative apparatus, applying new technologies in the reform process in order to establish the foundations for managing this project to ensure the most comprehensive results are achieved.

Figure 2: Factors contributing to Integrated Service Delivery (John, 2004)
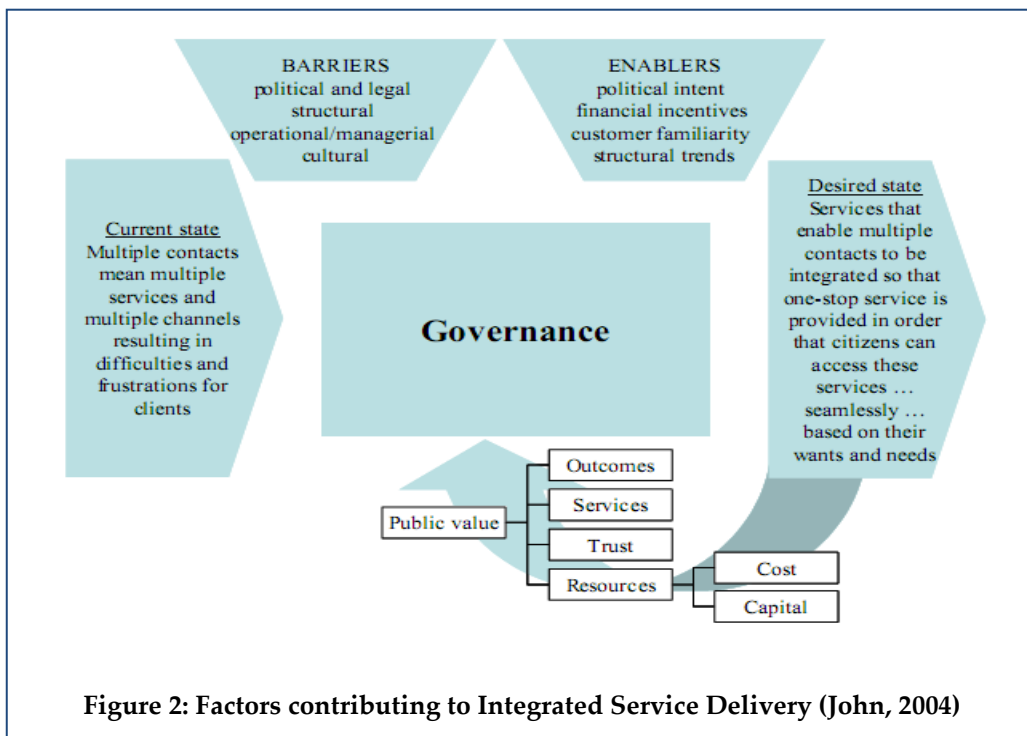
CEMADATA architecture

Every day, businesses collect a multitude of information about people, such as credit card numbers, bank balances, and purchase amounts. This information is stored in databases, along with photographs, fingerprints, videos, and book abstracts, etc. With the proliferation of the Internet and the means to capture data in computerized form, a vast amount of data is available at the click of a mouse button. Organizing these data for ease of retrieval and maintenance is paramount. Thus, managing databases has become a vital task in most organization (Mannino 2007).

A simplified CEMADATA contains data about ethnic group, region, gender, age, habitat, education level, etc. and other sorts of facts such as government reports, project researches, outcomes. Through proper analysis the CEMADATA information may support the search for answers to such issues as what are the most urgent priorities for ethnic minorities, what policies have been prescribed and implemented by the relevant authorities. However, this simplified version of CEMADATA still lacks much information, that is usually stored in fully-fledged database systems. For example, this version does not contain maps and images, which could provide for additional uses.

CEMADATA should also provide long-term memory for a management information system (MIS), which will contain entities and relationships. For example, the CEMADATA version, depicted in Figure 3, contains data about ethnic group, region, and habitat so that the policies and management manners can be generated. Hence, the MIS should have the following functions: ethnic issues, signs / identifications, scenarios building, and management manner.

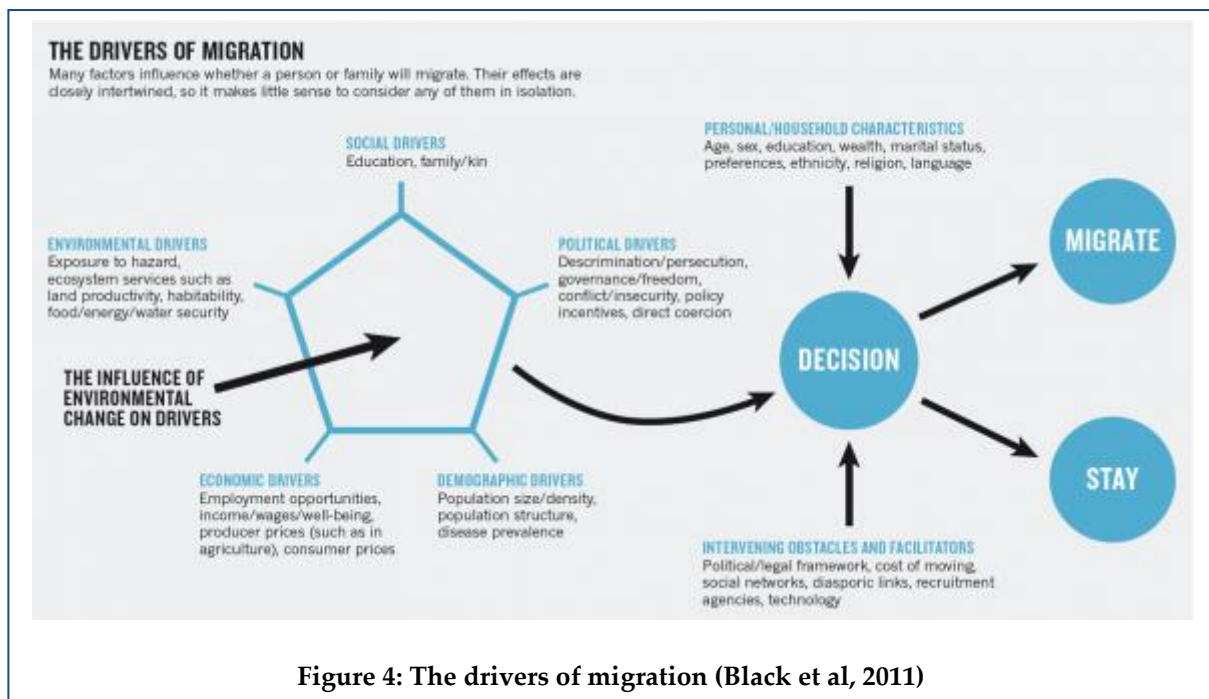**Figure 3: Graphic depiction of a Simplified CEMADATA base**
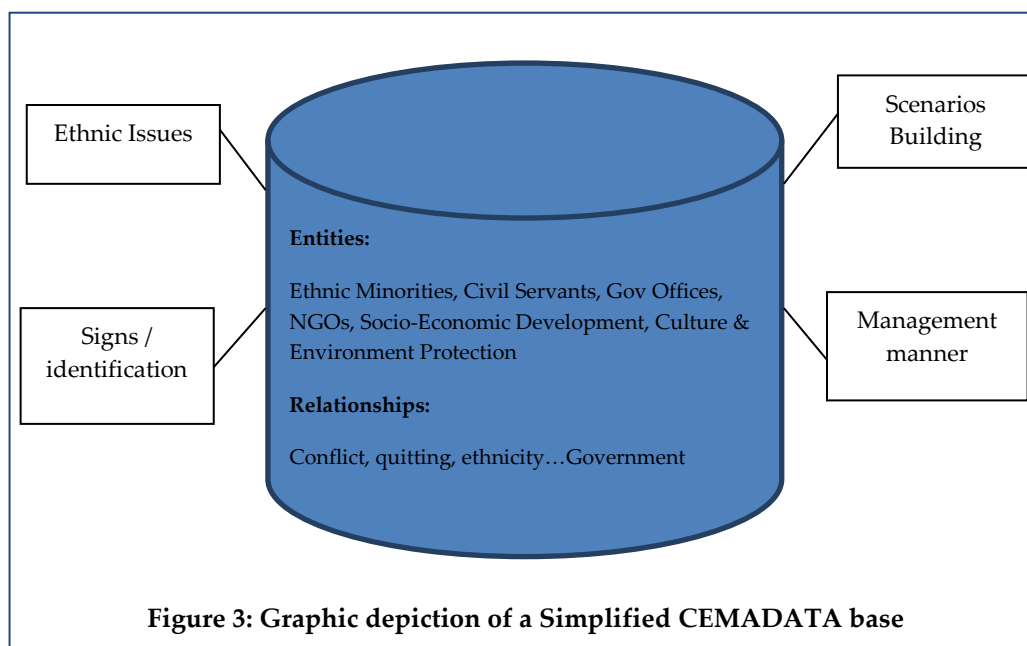
Ethnic issues

The culture of Vietnamese ethnic minorities is rich and extremely unique. This precious heritage should be preserved. The volume of documents, publications and artefacts about ethnic minorities are many and varied. They are stored in museums, documentation centres, galleries and souvenir rooms in many places across the country. Therefore, the state management organisation responsible for traditional culture and indigenous knowledge and practices should preserve and protect such heritage from disasters and other dangers induced by climate change. For example, the holistic and integrated indigenous sloping land management for watershed[6], to sustain uninterrupted rice production and vegetation for livelihood purposes, as well as for biodiversity preservation, for forest generation and for ecological purposes should be preserved.

Signs / Identifications

The CEMADATA should support the authorities to control migration of ethnic groups and their impact on the socio-economic development of the country, and on border security. The CEMADATA should allow, both government officials and community groups, to enrich the database about the past and present conditions of ethnic communities, thus creating a comprehensive information system.

Migration is a result of several converging factors (see Figure 4 for drivers of migration), which may include economic constraints, turbulent political situations, climate change, employment and education opportunities, etc. It may also be a result of the pace of change in social and family traditions, gender roles and age distribution (Nguyen, 2015). Hence, mobility of vulnerable households is often understood as a common and potentially beneficial adaptive response; or as a strategy to cope with and reduce exposure to various hazards.

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[6] These indigenous cultivation methods are described by various ethnic terms: the "nuong" system in the mountainous provinces; the "ruong" system in the Mekong river delta; and the "ray" system in the central provinces.

THE DRIVERS OF MIGRATION
Many factors influence whether a person or family will migrate. Their effects are closely intertwined, so it makes little sense to consider any of them in isolation.

SOCIAL DRIVERS
Education, family/kin

PERSONAL/HOUSEHOLD CHARACTERISTICS
Age, sex, education, wealth, marital status, preferences, ethnicity, religion, language

ENVIRONMENTAL DRIVERS
Exposure to hazard, ecosystem services such as land productivity, habitability, food/energy/water security

POLITICAL DRIVERS
Descrimination/persecution, governance/freedom, conflict/insecurity, policy incentives, direct coercion

THE INFLUENCE OF ENVIRONMENTAL CHANGE ON DRIVERS

DECISION

MIGRATE

STAY

ECONOMIC DRIVERS
Employment opportunities, income/wages/well-being, producer prices (such as in agriculture), consumer prices

DEMOGRAPHIC DRIVERS
Population size/density, population structure, disease prevalence

INTERVENING OBSTACLES AND FACILITATORS
Political/legal framework, cost of moving, social networks, diasporic links, recruitment agencies, technology

Figure 4: The drivers of migration (Black et al, 2011)

Scenarios building

The CEMADATA base should allow users to evaluate alternatives, the MIS should share information and, at the same time, be integrated with the six national databases, and thus be able to retrieve sufficient and adequate information to form various alternative scenarios and design different plans. In this context, internet-based GIS are particularly valuable. For example, the CEMADATA system should provide a database for land use planning and link it with ecological economic models. Linking models of analysis with a web-based GIS system could generate outputs in the form of simplified reports that could become analysis tools for the general public. In this case, users could compare the consequences of different alternatives, rather than solely relying on information provided.

Management manner

Based on the signs / identifications of options, the CEMADATA system should provide a mechanism for government officials, academics and other stakeholders to express their preferences and vote for preferred options. Consequently, the CEMADATA could become a forum for the public to discuss current issues and to be involved in the policy planning and formulation and the decision making process. It would create a virtual community where concerns and other issues are expressed and discussed.

Database environment of a web-based CEMADATA system

Database management

The web-based CEMADATA system should be built by integrating a variety of data. Most CEMA information systems support only a few data types nowadays. They include the census of population and housing (1999), household living standards (2002-2004), national health survey of teenagers and youth (2003), as well as the results of 135 programmes and projects (Be and Nguyen, 2016). However, advances in hardware and software capabilities allow for complex data to be captured, manipulated and analysed digitally. Almost all kinds of complex data, including images, audio, video, maps and three-dimensional graphics may be incorporated into a database system nowadays.

A good example is a soil erosion map, which can be formed by multiplying the respective USLE factors.[7] Then a soil fertility map can be generated by overlaying individuals maps of pH, total N, available P, total K, OM, CEC and trace the elements shown in Figure 5 and the figures presented in Table 2 below.
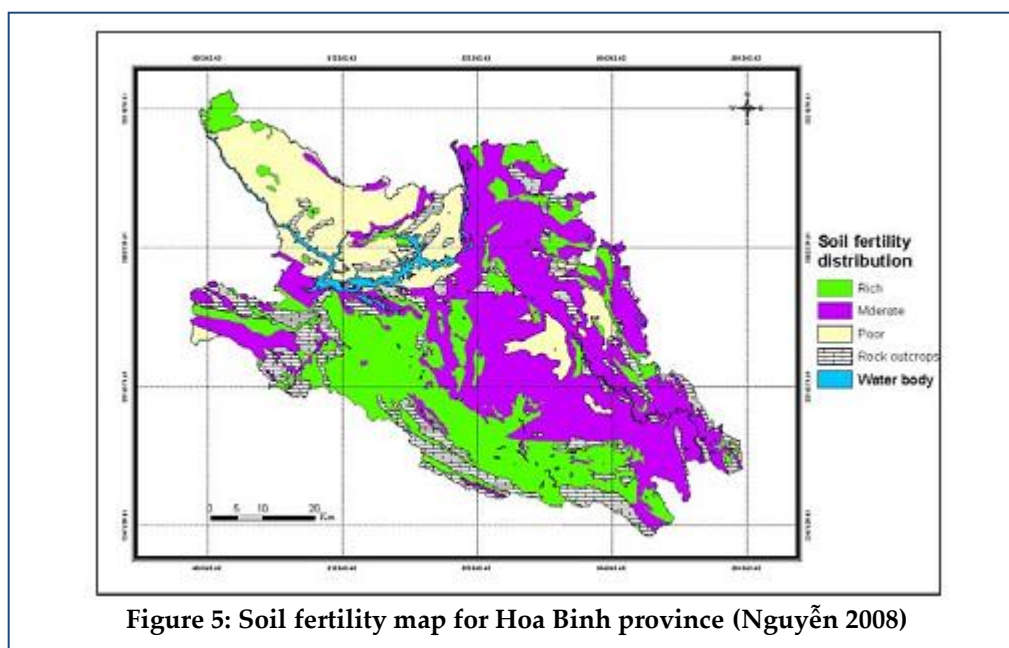

Figure 5: Soil fertility map for Hoa Binh province (Nguyễn 2008)

Table 2: Land suitability for fruit trees in Hoa Binh province (ha)

Kind of tree[8]	S1	S2	S3	N1	N2
Orange	28205	30384	13078	25266	39416
Tea	23951	24365	14074	19967	39572
Paulownia Fortunei	33736	26420	23440	51352	1314
Plum	8804	7373	26367	67853	26119
Sugarcane	35121	13066	20807	30967	36871
Longan	26625	34476	18841	29952	26958
Litchi	28168	28887	22266	22715	35474
Mango	43187	20812	23167	46388	7533

Source: Nguyễn, 2008

Database technology

The web-based CEMADATA system should be integrated and its information shared to support decision making systems that focus on four pillars: [i] Ethnic minority; [ii] Ethnic policy; [iii] Related sciences and technology; and [iv] Internet GIS. Because of different requirements, operational databases are usually separate from the CEMADATA for decision making support systems that need broader integrated processes. Operational databases could be stored, manipulated and analysed in a data warehouse.[9] The transformational

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[7] Like rainfall erosivity (R factor), soil erodibility (K factor), topographical characteristics (S and L factors), cover management (C factor), and conservation practices (P factor).

[8] S = Suitable; N = Not Suitable

[9] Data warehouse, is a term coined by William Inmon in 1990, with reference to a central data repository where data from operational databases and other sources are integrated, cleaned and standardized to support decision making processes.

activities, e.g. cleaning, integrating and standardising are essential for achieving considerable benefits by manipulating and analysing different data sets.

System architecture of a web-based CEMADATA system

The web-based CEMADATA system, with a three–tier data warehouse architecture, meets the necessary function requirements as shown in Figure 6 below. The three–tier architecture comprises the web browser (client tier), web server (server tier), and one or more server application (application tier). The web browser is a user interface to gather user input. It supports JAVA and HTML. All map-based functions are constructed in JAVA applets, whereas other functions are incorporated in HTML. The web server handles users' requests and transfers the requests to an application server.

The application server is used to process user requests. The server application is composed of three components: a map server, one or more analysis model servers, and a database server. The map server is designed for map rendering and spatial analysis, the analysis model server is used to provide what-if analysis functions, and the database server is used to handle data management via DBMS. Data and analysis models can be accessed by all users for retrieval and analysis at the web client.
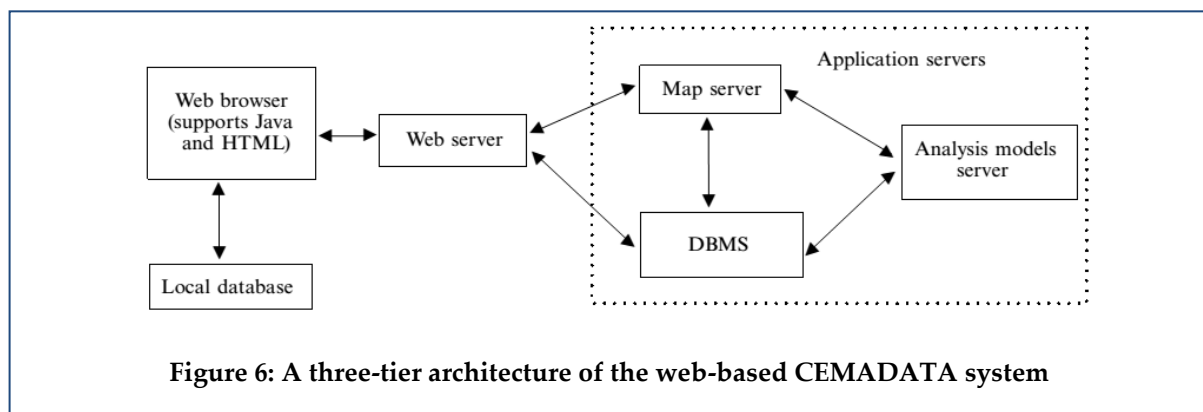

Figure 6: A three-tier architecture of the web-based CEMADATA system

Source: Peng, 2001

The architecture shown in Figure 6 is a client-server arrangement of the web-based CEMADATA system. That is, users make queries at the web browser, and the process is conducted either at the JAVA applet for simple requests or at the application server for complex requests.

System components and design of a web-based CEMADATA system

The framework depicted in Figure 6 can be implemented in a variety of ways. We present some of the methods utilised in in constructing the different components and the design of a web-based CEMADATA system.

Component architecture

Distributed CEMADATAs support national requests that use data stored at more than one autonomous site.[10] In the component architecture, the local database managers can be homogenous or heterogeneous. A distributed CEMADATA with homogenous local CEMADATA is tightly integrated. The distributed database manager can call internal components and access the internal state of local data managers. The tight integration allows the distributed CEMADATAs to efficiently support both distributed queries and

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[10] A site is any locally controlled computer with a unique network address. Sites are often geographically distributed, although the definition supports sites located in close proximity.

transactions. However, the homogeneous requirement precludes integration of existing databases.

A distributed CEMADATA with heterogeneous local data managers is loosely integrated. The distributed database manager acts as middleware to coordinate local data managers. SQL often provides the interface between the distributed data manager and the local data managers. The loose integration supports data sharing among legacy systems and independent organizations. However, the loosely integrated approach may not be able to support transaction processing in a reliable and efficient manner.

Design framework

The design issues are addressed in a number of architectures. For this architecture, the design framework of a web-based CEMADATA describes a three-tier architecture as depicted in Figure 3.

Conclusions

In this paper, the web-based CEMADATA system is presented. The system intends to enhance the capability of the Committee for Ethnic Minority Affairs (**CEMA**) in the planning and decision making process by providing several integrated databases, e.g. [i] Ethnic minority; [ii] Ethnic policy; [iii] Related Sciences and technology; and [iv] Internet-based GIS. The unique feature of the web-based **CEMADATA** system is that it provides users not only with a tool to improve public services and provide information, but also to encourage ethnic minorities to participate in decision making processes.

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