Developing a Land Use Information System for Local Government: The Case of Naga City, Philippines

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by

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I certify that although I may have conferred with others in preparing for this assignment, and drawn upon a range of sources cited in this work, the content of this thesis report is my original work.
Signed …….

Disclaimer

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ABSTRACT

The study aims to improve land use processes in local government with the support of an information system. This objective is realized through the conduct of analysis, design, and prototyping. The study takes Naga City in the Philippines as case for developing the land use information system.

Analysis is done to understand context of land use processes in local government. Understanding context is essential to defining the content of the information system. Analysis starts with literature survey to describe the context of change as reflected in the continuing redefinition of concepts on land use management and information system. The study then takes a critical look at how Naga City local government practices land use planning and monitoring, and applies information technology to support such functions. It reviews local government's policy direction and priorities, and identifies issues and opportunities in land use and database management. Among the issues identified, the following can be highlighted: more data but less analysis in the formulation of land use plan; planning as a one-shot activity; absence of sustainability assessment in processing applications for zoning clearances and certificates; and computerization efforts that resulted in islands of automation.

Based on the analysis, a design solution for the information system is proposed. First, a set of guidelines for developing the system is defined. This is then translated into a System Architecture, which provides the global view of the system. The System Architecture includes the processes of development control and assessment, enforcement and monitoring, planning, local knowledge acquisition, management control, and service delivery and communication channel. These processes are supported by a number of databases, including operational databases, land supply and use, spatial layers, policies and plans. Based on the System Architecture and an analysis of user requirements, the structures and functionalities of the system are developed applying Unified Modeling Language (UML) notation.

Prototyping is intended to demonstrate system features and identify potential problems in implementation. A working data model is developed for the prototype. The prototype is subjected to three tasks based on user requirements, namely: providing immediate access to data, facilitating decision-making, and conducting spatial analysis for land use planning. Based on the results of the prototype, the following problems are identified: absence of a key identifier to link datasets; heterogeneous data models and software applications; untapped location-based datasets; unstructured sustainability and suitability criteria for land use.

In the conclusion, implications of the system for local government are defined, as follows: 1) land use information system can serve as platform to integrate data and facilitate data exchange in local government; 2) it enables decision-making; 3) it is a means to induce community involvement in land use issues; 4) it facilitates and enhances analysis for land use planning; and 5) it is a tool for improving public service.

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ABBREVIATIONS

BSWM	Bureau of Soils and Water Management
CASE Tool	Computer Aided Software Engineering Tool
CBD	Central Business District
CLUP	Comprehensive Land Use Plan
CPDO	City Planning and Development Office
EDP	Electronic Data Processing Unit
ESRI	Environmental Systems Research Institute, Inc.
GIS	Geographic Information System
HLURB	Housing and Land Use Regulatory Board
ICT	Information and Communication Technology
ITC	International Institute for Geo-Information Science and Earth Observation
LAN	Local Area Network
LGUs	Local Government Units
MGB	Mines and Geosciences Bureau
MIS	Management Information System
NAMRIA	National Mapping and Resource Information Authority
NCPC	Naga City People's Council
NEDA	National Economic and Development Authority
NGOs	Non-Government Organizations
NPAAAD	Network of Protected Areas for Agriculture and Agro-industrial Development
PAG-ASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PHIVOLCS	Philippine Volcanology and Seismology
PIN	Property Identification Number
PIP	Performance Improvement Program
PSEP	Public Service Excellence Program
RDBMS	Relational Database Management System
SDW	System Development Workbench
SLARIM	Strengthening Local Authorities in Risk Management
SWOT	Strengths, Weaknesses, Opportunities, Threats
U.P. SURP	School for Urban and Regional Planning, University of the Philippines
UML	Unified Modeling Language
USAID	United States Agency for International Development

1. DEVELOPING AN INFORMATION SYSTEM FOR LAND USE: AN INTRODUCTION

1.1. BACKGROUND

The importance of land as a resource cannot be overemphasized. Land issues have become a concern not only locally or nationally but also globally. They are high in the agenda of international conferences and treatises, such as the Agenda 21 of the Rio Conference in 1992, the Habitat Global Plan of Action in Istanbul in 1996, the New Delhi Declaration on Sustainable Shelter and Urban Development in 1996, the Bathhurst Declaration of the United Nations in October 1999, and the Johannesburg Summit of 2002. These events and agreements have placed land at the center of development issues. They have underscored the fact that land issues are tied to combating poverty, to protecting the environment, to promoting food security, to advancing social equity, to ensuring peace and order, and to spurring economic growth.

Land as a resource is finite and scarce. This situation has reached critical level such that land has become increasing vulnerable to pressures brought about by factors both natural and man-made. These include demographic pressures, natural calamities, rapid urbanization and its attendant problems, such as pollution, congestion, traffic, informal settlements, housing shortage, and poor basic services. All these are acutely felt in developing countries, such as the Philippines, where land is subject to misuse, mismanagement, and bad politics. Thus, the various international treatises have harped on the role of land administration in advancing sustainable development and good governance.

Land administration, following the United Nation's definition (U.N. 1996: 14), has three areas of concern, namely, ownership, value, and use of land. It is "the process of recording and disseminating information" about these concerns. This puts forward the development and maintenance of land records and information infrastructure as important public functions. That is, land information if managed and made available enables decision-making. It can also be harnessed to increase transparency and accountability, and promote citizen participation.

The focus of this study is land use, one of the three land administration concerns. The word "land use" can mean different things to different people. For many, land use is synonymous to a map where the geo-space under study is divided and classified according to dominant use. But for others—like geo-information managers, urban planners and land administrators—land use is more than a map output. It is a complex process that deals with allocating land and determining its use for sustainable development. It is very much a socio-political concern as it is economic and geographic. In the Philippines, land use refers both to the substantive issues of land conversion, land reform,

environmental protection, farm productivity, land valuation, as well as to a map layer of a municipal information system or a fundamental dataset of an planned geo-spatial data infrastructure.

Local government in the Philippines looms large in the discussion of land use issues. With the enactment of the Local Government Code in 1991, the process of land use planning and monitoring falls squarely on the shoulder of local government. Local government is mandated to adopt a Comprehensive Land Use Plan (CLUP). It also performs functions of monitoring and control through the issuance of zoning clearances for building and business permits, and certificates of site zoning classification.

An information system would fit comfortably in local government. Voluminous data on land use are collected, created, and used. An information system could help organize, store, and process these data for easy access, analysis, and dissemination. Furthermore, land use deals with space and time. A considerable part of the activities and decisions of local government deals with spatial information. One estimate shows that more than 80% of the data needed by government, businesses, and private individuals have to do with location of people, places, things, and events (NAMRIA 2000). Thus, an information system that can handle spatial and non-spatial data could be a valuable resource for local government.

By any indication, however, an information system to support planning and monitoring has yet to be realized in most local government units. Many land use data and maps in the country are still in analog format. They have not been organized in a database structure. There are efforts to build databases and to go digital but many were done piecemeal and have resulted in islands of automation within and among organizations.

Going by the number of approved CLUP, a land use information system is not commonplace in local government. Only 10% of the total municipalities and cities in the country have updated plans as of 2001. About 52% have not done any updating, and 38% have no land use plans (Llanto and Ballesteros 2003: 9). An existing CLUP, however, does not automatically mean that the local government has a working information system. The process of formulating a CLUP requires the collection of data from various agencies and the conduct of survey, which could be an opportunity to build a database.

With the CLUP in place, the local legislative body has to pass a zoning ordinance to translate the plan into a legal measure. Local government monitors and ensures compliance with the zoning ordinance through the issuance of clearances and certificates. However, there is much to be desired in monitoring land use. Records on actual land use, if at all existent, are not kept updated. The process of issuing clearances and certificates can be slow and is used mainly to check compliance with zoning, without maximizing the process to monitor land use changes and to consider emerging pattern and possible effects.

1.2. RESEARCH PROBLEM

Central to this research is the question: How could land use processes in local government be improved with the support of an information system? This is the theme that runs throughout the study. It is decomposed into three areas of concern, as follows: 1) How does local government conduct land use planning and monitoring? 2) How should an information system for land use take form in local government? 3) How would the system work when implemented through a prototype?

The first question deals with an analysis of current practice and priorities of land use planning and monitoring in local government. It reviews concepts relating to land use and information system, and examines existing condition of local government.

The second question goes into the core of the information system. It defines a set of guidelines for system development and determines user requirements. These guidelines and requirements are translated into process and data models.

The third question has to do with applying the model in a database and Geographic Information System (GIS) to illustrate some aspects of the information system.

1.3. RESEARCH OBJECTIVES

Given the above research problem, the study has the following research objectives:

1) Analyze land use processes in local government
   - Review available literature related to land use and information system
   - Examine existing conditions and practices of land use planning and monitoring in local government
   - Propose changes to current setup

2) Design an information system for land use planning and monitoring
   - Define guidelines for developing the information system
   - Determine requirements or needs of users
   - Model the structure and functionalities of the system

3) Apply the design through prototyping
   - Demonstrate system functionalities or features
   - Identify potential problems in implementation

1.4. RESEARCH QUESTIONS

1) Questions for objective 1
   - What lessons can be learned from developments in theory and practice that can be applied in examining the case of local government?
   - What are the issues affecting local government in land use planning and monitoring?
   - What improvements can be proposed to existing processes?

2) Questions for objective 2
   - Based on the analysis, what general specifications can be outlined for designing the system?
   - What are the needs of users that the system should be able to provide?
   - What are the components of the system given the guidelines and user needs?
   - What are the roles of these components (functionalities)?
   - How do the different components relate (structure)?

3) Questions for objective 3
   - Using a prototype, how does the system work when implemented in a database and GIS?
   - What problems could arise when the system is developed?

1.5. RESEARCH FRAMEWORK

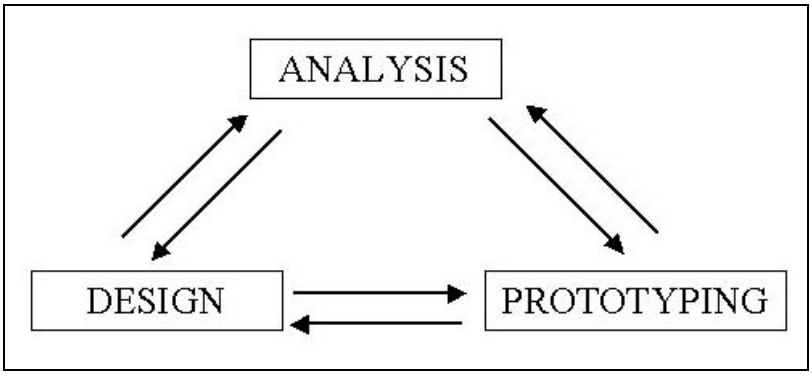

Figure 1-1. Research Framework

As illustrated in Figure 1-1, the study consists of three components: analysis, design, and prototyping. These components correspond to the three research objectives set above. Analysis entails scanning the environment through literature review and examination of local government context. Design involves modeling the information system based on system and user requirements. Prototyping deals with developing a working model.

The forward and feedback arrows between components indicate an iterative process. Analysis deals with land use concerns that would be the subject of Design. It is the basis for defining system requirements and modeling data and processes. Analysis also serves as input to Prototyping to demonstrate and explain system features. Prototyping in turn depends on Analysis to identify potential problems in implementing the system in a local government setting. Design feeds into

Prototyping as data model is implemented to support particular land use processes in local government. The feedback arrow indicates validation and interaction between Design and Prototyping. Prototyping involves translating Design from conceptual into logical level following rules and semantics of computing systems.

1.6. SIGNIFICANCE OF THE STUDY

This study hopes to propose a viable mechanism to help local government deal with issues concerning land use planning and monitoring. It proposes a design solution to a land use information system.

In many of the guidelines prepared to help local government formulate and update their land use plan, the need to collect, organize, and store data has been strongly recommended. This study hopes to put flesh to this recommendation. It envisions an information system that would be useful to local government in managing land use processes. This study provides a road map of sorts on how to develop the system, taking Naga City as case study. Other local government units may learn from the findings and methods, and may adapt them to local circumstances.

The challenge always in any system development is to align information technology with the needs of local government organization. This is an important component of this research where existing condition and requirements of users are documented and are used as backdrop to designing the system. Efforts are made to understand the organization where this information system would actually be situated.

This study goes beyond design. It demonstrates system features by using available computing technology in database and GIS. It is an attempt to show how the system would work and what problems could arise in implementation.

The design integrates process and data, structure and functionalities. Applying the Unified Modeling Language (UML), which is the industry standard on system and software development, the study makes use of a notation that is rich in depicting the functional, static, and dynamic views of system.

1.7. SCOPE AND LIMITATIONS

This study is not about land use or physical planning per se but is about developing an information system to support land use activities in local government. It looks into land use planning and monitoring within the context of information processes and requirements.

As a design type of research, this study does not fall neatly in known research methods of hypothesis testing, evaluation, or forecasting. Developing an information system is not about proving hypothesis, measuring indicators, or establishing patterns. It is concerned about understanding processes and context, about clarifying issues and proposing solutions. In that sense, it is pragmatic, action-oriented, and user-driven. It requires the conduct of fieldwork, contact with users through interviews

and surveys, documentation and observation of activities and procedures to seek answers to questions of what the condition is, why is it so, and how things can be changed for the better.

The design is focused on information system. Developing such a system may entail changes in institutional arrangements and organization processes, which are not directly tackled in this study but could be a topic for further research.

The prototyping is not about checking the internal consistency and technical reliability of the design, which are the concern of software developers and system managers. It is more of building a working model to show system features and anticipating problems in the light of realities in local government. Prototyping is small-scale and is dependent on data that is available to populate the database and GIS.

The study is not about local government in the Philippines in general but more about the condition and experience of Naga City. The study used the data collected and made available during fieldwork in Naga City in September 2003. The one-week fiesta celebration in Naga City during the third week of September cut further the already limited time in the field. Data come both in digital and mostly in analog format. Interviews and survey were dependent on the availability and cooperation of respondents.

1.8. THESIS STRUCTURE

This chapter sets the parameters of the study. A brief background is given to introduce the topic and raise preliminary issues on land use and information system. The Research Problem structures real-world issues into a workable research topic. This is then translated into specific questions and objectives, which set the tone for the content of succeeding chapters. The Research Framework summarizes the 3 major elements of the study. The Significance of the Study discusses the contribution of the work in producing policy-relevant information and hopefully in building knowledge. The Scope and Limitation further defines the research concern and identifies the constraints encountered in conducting the study.

Chapter 2 describes how the research is conducted. It first gives a profile of the study area—which is Naga City, Philippines—specifically the reason for the choice of the area, some geographic facts, its location, the local government unit, and the relevant offices. The Methodologies and Data Collection discusses the various data-gathering activities done in the field. It also describes the data collected and the problems faced during fieldwork.

Chapter 3 synthesizes what available literature has said about information system and land use. It reviews how related concepts have evolved and trends have emerged through time. Information system is defined and its objectives identified as they relate to decision-making, customer satisfaction, business performance, and knowledge work. Land use is seen as both static and dynamic concept. This is then reviewed in the light of land administration and management, information system, and planning and monitoring. A contextual view of land use and information system is presented at the last part of the chapter.

Chapter 4 takes a critical look at the experiences of Naga City. It characterizes the existing situation of Naga City local government and establishes the need for an information system for land use planning and monitoring. Specifically, it examines policy direction and priorities, land use planning, land use monitoring, databases and GIS. In identifying issues and opportunities, the chapter makes use of findings in the literature survey and in the field. This is an attempt to understand the context within which the information system will be developed.

Chapter 5 focuses on the design and development of the information system. Based on the context defined in Chapters 3 and 4, guidelines are established for developing an information system for land use. This set of guidelines outlines the general principles in developing the system. The chapter proposes a System Architecture situating related components and functions. It shows processes and databases on land use in Naga City local government and indicating ways of dissemination and control. The requirements of users are crystallized from the interviews and surveys, which are used in the design of system structure and functionalities, applying the Unified Modeling Language (UML) notation.

Chapter 6 demonstrates system functionalities through a prototype. The UML diagrams developed in the previous chapter are applied in GIS and database system. The prototype is built to show system functionalities based on specifications and user needs. It demonstrates the functionalities of accessing and integrating data, facilitating decision-making and land use planning. Based on the trial run, problems are identified to anticipate those that could arise once the system is implemented.

Chapter 7 is the conclusion. Guided by the analysis, design, and prototype, it defines the implications of the proposed information system for Naga City local government in performing its functions of planning and monitoring land use. It also lists topics for further research.

2. RESEARCH SITE AND METHODOLOGIES

2.1. THE STUDY AREA

2.1.1. Reasons for Area Selection

Naga City, Philippines, became a potential study site when ITC (International Institute for Geo-Information Science and Earth Observation) selected the area for the project called SLARIM (Strengthening Local Authorities in Risk Management). The selection came at an opportune time when the proposal for this study was being drafted. ITC then had already established contacts with the city government and had collected datasets relating to natural disaster and hazards.

Although this study is not about disaster and risk management, the researcher decided to choose the same area for pragmatic reasons. One, cooperation of the city government would be ensured given the ITC-Naga City tie-up. Two, the researcher has local knowledge of the area and has the facility to speak the local dialect. This proved to be valuable especially during the conduct of interviews and survey.

But the choice was also guided by substantive concerns. One important consideration is that the local government must have an existing land use plan and a zoning ordinance passed by its *Sangguniang Panlungsod*, its local legislature. Or possibly, the local government may have just adopted or is in the process of formulating its Comprehensive Land Use Plan (CLUP). Another concern is that the city performs monitoring and regulatory functions on land use, such as through the issuance of zoning clearances and certificates.

Naga City meets the criteria. Its CLUP was developed in-house with the help of an external consultant. This is an update of a land use plan dating back to 1978. Attempt was made to update this in 1994 but the plan did not get approval. Another effort at updating was done in 1999 to 2000. Based on this new CLUP, the *Sangguniang Panlungsod* passed a zoning ordinance on 15 November 2000. After several rounds of consultation and revision, the Housing and Land Use Regulatory Board (HLURB)—the national body tasked to promote land use planning standards—approved Naga City's CLUP and zoning ordinance through Resolution No. 733 on 16 October 2002. With regard to monitoring and regulation, the city government keeps records of zoning clearances and certificates for site zoning classification issued in compliance with the approved CLUP and zoning ordinance.

2.1.2. Basic Geographic Profile

Naga City is located in the province of Camarines Sur, Philippines, which is one of the 6 provinces comprising the administrative region of Bicol or what is known as Region 5 (See Figure 2-1 below). It is 377 kilometers south of Metro Manila, the capital city. Naga City is landlocked and shares boundaries with several municipalities. It is bounded on the north by the municipalities of Canaman and Magarao, on the south by the municipality of Milaor, on the west by the municipality of Camaligan, and on the east by the municipality of Pili and Mt. Isarog, a dormant volcano.

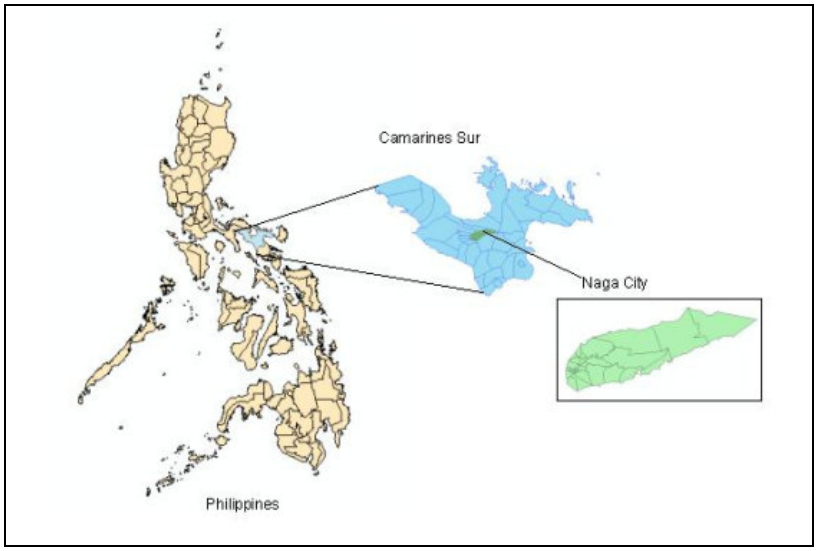

Figure 2-1. Philippine Map with An Inset of Naga City

Naga City has a total land area of 8, 448 hectares. Its terrain slopes upward from west to east, that is, from the city proper to the foot of Mt. Isarog. Almost sixty percent of its land area have slopes from 0-3% (almost level) to 3-8% (nearly level to slightly sloping) (Naga City 2000: 6). In terms of existing land use, 67.55% of the total area are agricultural lands, 14.30% residential, 7.23% forest parks and reserves, 5.97% grassland, 1.92% commercial, and 1.78% institutional (See Figure 2-2) (Naga City 2000: 174).

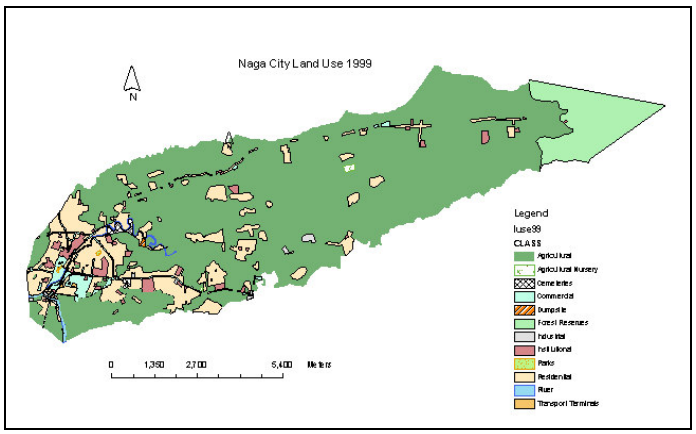

Figure 2-2. Naga City Land Use 1999

The National Statistics Office of the Philippines classified all of Naga City's 27 *barangays*—the smallest administrative and political unit in the Philippines—as 100% urban. These *barangays* have built-up areas and have an average population density of 1,503 people per square kilometers (Naga City 2000: 14). Based on the 2000 census, the population of Naga City stands at 137,810. The number of households totals 26,317.

Situated at the center of Camarines Sur and Bicol, Naga City serves as hub for service, education, commerce, and business for Metro Naga and the region. Metro Naga was formed in 1993 and is composed of 15 contiguous municipalities including Naga City. Naga City boasts of having, among other things, 2 Central Business Districts (CBDs), 40 banks, 37 insurance companies operating in the city center. It is home to 146 educational institutions including pre-school, elementary, secondary, tertiary, and vocational schools. According to the Asian Development Bank, the average family income of Naga City is 42% higher than the national average and 126% higher than the Bicol regional average (Robredo 2002: 19).

In the Regional Physical Framework Plan prepared by the National Economic and Development Authority (NEDA), Naga City is seen as the "conduit of development of the Metro Naga area and the Legaspi-Iriga-Naga-Daet Growth Corridor" (Naga City 2000: 5-6). In the draft Metro Naga Physical Framework Plan, Naga City is identified as a Primary Urban-Sub-Regional Center characterized by the following:

- Performs primarily commercial, marketing and administrative functions serving the entire Metro Naga area;
- Contains the largest market thru which selected agricultural commodities are exported to Manila and nearby areas, and thru which nearly all periodic markets in the area with any external trade linkages exchange their goods;
- Trade linkages with other towns provide an institutional exchange network needed to stimulate agricultural productivity in the rural hinterlands;
- Contain most of the higher level communication, economic, recreational, administrative and marketing functions;
- But Naga performs few secondary (industrial or manufacturing) activities and offer no significant basis for inter-regional trade (MNDC 2002).

2.1.3. Naga City Local Government

The information system developed in this study is intended for Naga City local government. The local government has expressed openness to the idea of setting up an information system for land use and is, in fact, in the lookout for ways to improve its system and operation.

Naga City local government has been widely recognized for innovations in local governance as evidenced by the many awards it received from local and international bodies. These awards include: CyberCity Award for the Asia-Pacific conferred by the United Nations Development Programme; finalist, World Habitat 2002; 1998 Dubai International Award for Best Practices in Improving the Living Environment; Habitat II Top 40 World Best Practices for *Naga Kaantabay sa Kauswagan*;

acclaimed as one of the most improved cities in Asia by Asiaweek Magazine, November 1999 (Philippine Free Press 2003: 16).

A force behind these innovations is the team of offices of the local government housed in Naga City Hall. They perform diverse functions as reflected in the organizational chart in Figure 2-3.

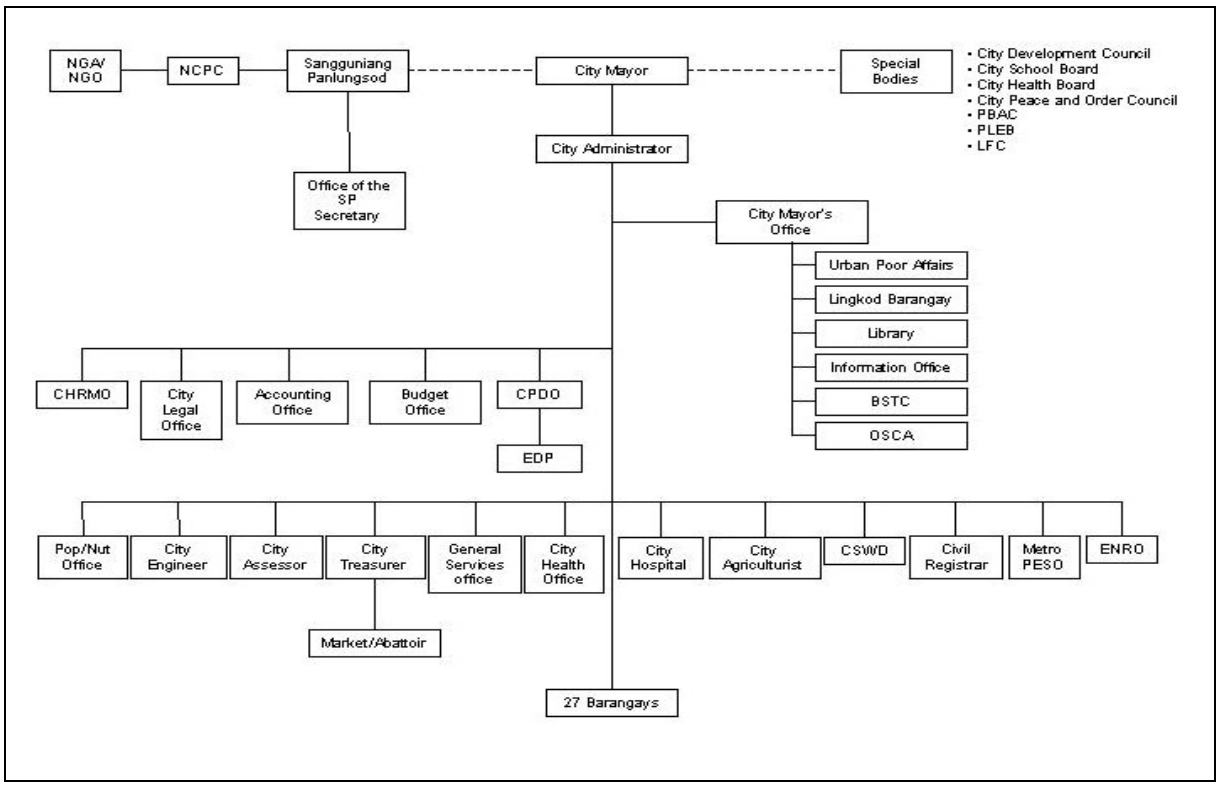

Figure 2-3. Organizational Chart of Naga City Hall (Naga City 2000: 161)

At the helm of the organization is the City Mayor acting as the local chief executive. The twin functions of land use planning and monitoring are lodged in the City Planning and Development Office (CPDO). The Electronic Data Processing Unit (EDP) was actively involved in the formulation of the CLUP by providing mapping services. From this organizational chart, which is based on the approved CLUP of 2000, the EDP falls under the CPDO. Currently, the EDP is under the Office of the City Mayor performing functions related to mapping, information and network computing.

The CPDO has the following mandate:

> The CPDO is research and planning arm of the city government. It is chiefly responsible for formulating integrated development plans and programs, and monitoring and evaluating their implementation by various local government offices.
>
> One of the CPDO's main outputs is a CLUP and Zoning Plan that is updated every 5 years. This is the basis for the office's issuance of locational clearances and certifications of site zoning classification (Naga City website).

The EDP, on the other hand, discharges the following functions:

> This office is in charge of systems development for various city government offices and functions; database and network management; and repair and maintenance of the city's computer hardware. It also evaluates other offices' requests for equipment and accessories.
>
> One of the important services this office has to offer is a local Geographic Information System (GIS) that produces maps used for planning and presentation purposes (Naga City website).

2.2. METHODOLOGIES AND DATA COLLECTION

To support the research framework set in Chapter 1, this study undertakes literature review and fieldwork as methodologies to collect data. Figure 2-4 illustrates how these methodologies fit into the scheme of the study. Using System Development Workbench (SDW) notation, the diagram shows Literature Review and Fieldwork as processes for data collection, which generated data stores or stocks. These data stores are inputs to Analysis, Design, and Appraisal, which structure and process the data to produce relevant findings and recommendations.

The Literature Review was done initially to scan related concepts and trends about the topic. This served as input to formulating the proposal and preparing the fieldwork activities. The review is continuing and has become purposive and more focused as the study deals with each of the research components. Relevant documents found during fieldwork were likewise reviewed and included in the data store.

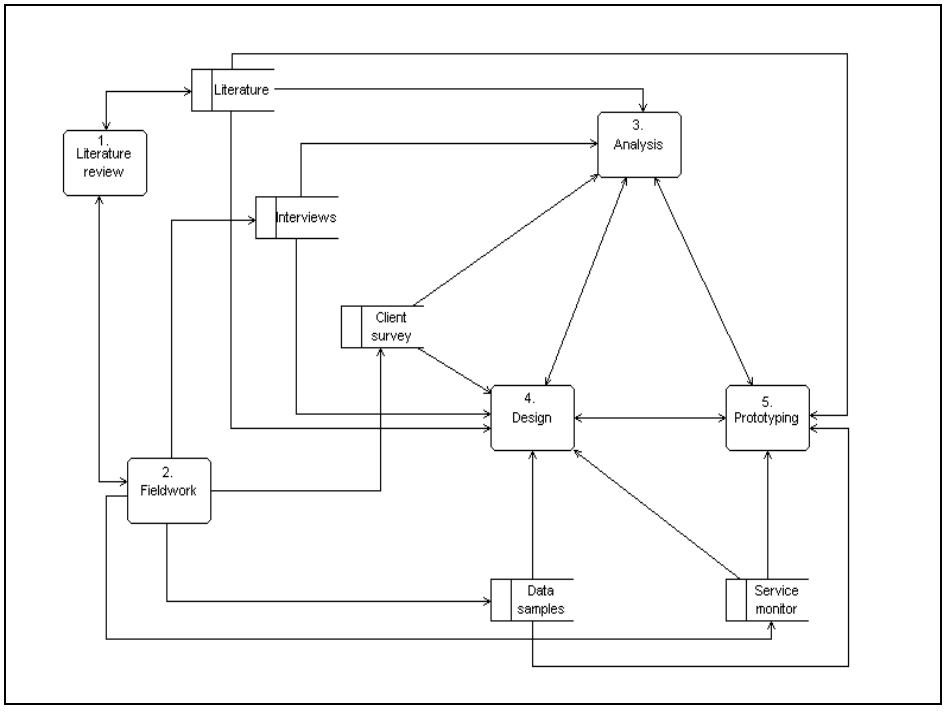

Figure 2-4. Methodologies and Data Collection

The Fieldwork is meant to document processes, to draw out insights from key informants and clients, and to gather data and documents related to land use. Data-gathering activities include document search, conduct of client survey, interviews with key informants, monitoring of land use services, and collection of sample datasets. These are represented as data stores in Figure 2-4. They are described below based on accounts in the field.

2.2.1. Literature

The document search in the field yielded a number of secondary materials, such as the following: national and local policies on land use; Naga City's approved CLUP and zoning ordinance; technical assistance reports on GIS applications involving Naga City; annual reports; planning guidelines; and published studies on land use. Sources for these documents are the Naga City local government, regional offices of the Housing and Land Use Regulatory Board (HLURB) and the National Economic and Development Authority (NEDA) in Legaspi City, the School for Urban and Regional Planning (U.P. SURP) of the University of the Philippines in Diliman, Quezon City. These materials were reviewed and formed part of the data store called literature.

2.2.2. Interviews

The interviews drew out insights and perspectives on the processes, priorities, and plans of the local government which otherwise could not be captured in written documents. They were conducted from 8 September to 3 October 2003. The CPDO staff helped in identifying offices that actively took part in the formulation of CLUP and are involved, in one way or another, in land use planning and monitoring. The interviews covered 14 key informants inside Naga City Hall as listed below. Informal interviews were also conducted with staff of HLURB, office staff inside Naga City Hall, and an urban planner in U.P. SURP.

- Jesse M. Robredo, City Mayor
- Julian Lavadia, Jr., City Councilor and Chair of the Land Use Committee of the *Sangguniang Panlungsod*
- Juan O. Villegas, Jr., Head of CPDO and Zoning Administrator
- Leon B. Palmiano IV, Head of the City Engineer's Office
- Ramon R. Albeus, Head of the City Assessor's Office
- Rodrigo C. Belleza, Head of the City Treasurer's Office
- Benjamin N. Padre, Head of the Electronic Data Processing Unit
- Rolando SL. Campillos, Head of the Urban Poor Affairs Office
- Oscar P. Orozco, Head of the Environment and Natural Resource Office
- Wilfran P. Calleja, Head of the City Agriculturist Office
- Allan Cabague and Tessa Rey, staff of Metro Naga Development Council
- Cecille S. Daplin, staff of CPDO
- Job B. Oliva, staff of CPDO
- Rosemarie I. Ciudadano, staff of CPDO

The interview questionnaires were semi-structured to allow the researcher to raise pre-defined questions and to probe respondents. A set of guide questions was prepared before the fieldwork (see Appendix A). However, a number of questions had to be changed to adapt to the circumstances and differing roles of each respondent in land use planning and monitoring. Thus, guide questionnaires were prepared for each respondent consisting of generic and specific questions. The researcher also formulated separate interview guide and tables (see Appendix B) for CPDO staff to document the process of issuing certificates and clearances. To ascertain correct documentation, validation sessions with CPDO respondents were held.

The interviews were done in the local dialect or vernacular. This helped in eliciting cooperation from the various respondents. The interviews were taped for easy replay and recall when transcribing and translating the responses into English.

2.2.3. Client Survey

A survey was administered to client who were availing themselves of services in CPDO on September 24, 29, 30, October 1, and 3, 2003. The survey questionnaire is composed mostly of closed questions (see Appendix C). The objective is to surface service needs and perceptions of clients. Those surveyed included those making inquiries about CPDO services and Naga City in general, those applying for zoning clearances, and students securing data. 23 clients took part in the survey. Their responses are inputs to Analysis and Design.

In a number of instances, the researcher had to explain the purpose and content of the questionnaire. Sometimes the questionnaire, which was written in English, had to be translated in the vernacular.

2.2.4. Data Samples

The researcher obtained sample datasets both analog and digital for use in Design and Prototyping. Forms for clearances, permits, tax declaration and payment, and the like were collected from different offices in Naga City Hall. These would be indicative of the data created, collected, and used by these offices. Datasets obtained from CPDO include handwritten records of site zoning certificates from 1991 to 2000, zoning clearances issued in 2002 in MSWord, and Naga City's statistical profile also in MSWord. The researcher got actual application forms of zoning clearances and certificates for site zoning classification that are duly accomplished and with the supporting documents to serve as reference in modeling processes.

The Electronic Data Processing (EDP) Unit provided map layers in ArcView, which were used during the formulation of the CLUP. The City Engineer's Office opened its business permit database, which it started organizing and storing 3 years ago using MSAccess as its database engine and Visual Basic for its Graphic User Interface.

The City Treasurer's Office stored data on business permits in a database encoded in FoxPro. The researcher identified relevant fields in the database and requested the EDP head, with access to the

database, to extract data for 2002 and 2003 in MSExcel. The City Assessor's Office, on its part, keeps tax declarations also in FoxPro database and maintains parcel-based tax maps in paper form. It has started digitizing these maps. The researcher got sample datasets of tax declarations for 3 *barangays* and a sample copy of a digitized tax map.

The staff members were reluctant at first to provide sample datasets. But the researchers got the approval of their office heads. Extracting digital data was not easy. The staff members cannot manipulate the database and are limited by what are provided in the user interface, e.g., standard reports. The researcher got help from EDP, which generated the available data needed. Not all offices in Naga City Hall, however, have databases. Other offices have not organized their files or simply refused to open their records.

2.2.5. Service Monitor

The service monitor provided the researcher an opportunity to observe at close range how services at CPDO are actually delivered. The issuance of zoning clearances, certificates for site zoning classification, and the provision of data are considered frontline services of CPDO. Through the service monitor, the researcher was able to follow the procedures of these services. The observations and insights gathered are inputs to Design and Prototyping.

Procedures on how CPDO conducts its frontline services were documented through interviews. They are validated through observations of actual application processing and data provision. The service monitor was conducted for 4 days from September 29-30 to October 1 and 3, 2003. The researcher logged the client number, start (i.e., arrival time) and end (i.e., time transaction was completed) of service time, purpose of visit, and remarks, if any. A number of the clients were respondents to the survey. The CPDO staff attending to the clients would explain to the researcher the purpose of visit and the procedures undertaken.

The service monitor was conducted at the latter part of the fieldwork, which was the only time available for the activity. The researcher stayed in CPDO from 9:00 to 17:00. There were occasions, however, that the researcher had to leave CPDO while following up sample datasets in other offices and appointments for last-minute interviews. The service monitor was conducted after the weeklong fiesta celebration in Naga City. CPDO staff observed that the turnout of applications was relatively low. Statistics on the number of applications for zoning clearances, certificates for site zoning classification, and private individuals securing data were also collected for various years.

3. EVOLVING CONCEPTS AND EMERGING TRENDS: A LITERATURE SURVEY

3.1. INTRODUCTION

This chapter provides an overview of the developments in the field of information system and land use. It describes the context of change as reflected in the continuing redefinition of concepts in the literature and the emerging ways of doing things. Concepts change through time as new issues emerge and measures are adapted to changing environment. These evolving concepts and emerging trends are mapped out based on research studies and innovations happening in practice. This literature review shows how things are developing and what should be learned from these developments.

This chapter serves as backdrop to examining the case of Naga City in the next chapter. Understanding context in terms of concepts and trends and the actual experiences of Naga City is essential to defining the content of the information system that will be developed in this study.

3.2. INFORMATION SYSTEM

Information system has been defined in many ways. The definitions can be classified into two groups. One group follows a narrow definition that looks at information system in terms of databases. Most of these definitions, however, recognize other aspects of the system but focus on the data requirements and the mechanism to store, organize, process, and analyze data. The other group takes on a broad perspective encompassing all components of the system, such as data, software and hardware, people, methods, and procedures.

The following are examples of such definitions. They are taken from articles that deal with land use information system. The one below illustrates the former case.

> An information system is defined as a group of different data bases and other documentation put together in a systematic manner for transfer of knowledge and communication of data on any subject. Such a system is generally created to identify and analyse problems, set priorities and formulate policies and programme, and monitor and evaluate policies and programme performance (Narain 1997: 38).

The following definition takes on a broad perspective.

> Information system is defined as a collection of people, procedures, data, software and hardware that collects, processes, stores and communicates data and information to support operational tasks and decision-making (van Helden 1994: 489).

Common to these definitions is the development of a mechanism to translate data into information that would have meaning to organizations in terms of fulfilling certain goals and objectives. One objective is to support decision-making. Thus, information system is popularly linked to concepts like Decision Support System or Planning Support System. In those systems, information takes the form of an answer to decision question. The information system then serves as a tool to determine "what information is required for what decision as part of what function" (van Helden 1994: 486).

Until recently, information system has been evolving from an inward into more outward-looking perspective. The objective now is not so much to support decision-making but more to meet the demands and satisfaction of users and clients. Organization is not seen solely as a decision-making system but more of an enterprise with a business purpose and a customer to satisfy. Thus, information system is brought from the "boardroom to customer interface" (Bacon and Fitzgerald 2001: 56).

Along with this development is the growing interest in knowledge work, which looks at how people in organizations use and process information. This brings into sharper focus the fact that people and not databases create knowledge. This also goes hand in hand with the changing concerns of information technology, that is, from data to information, and now to knowledge and intelligence (Klosterman 2001: 11).

Knowledge Management has become a popular movement in the United States in recent years. This puts premium on the intellectual capital of organizations. It is defined as the "process of creating value from an organization's intangible assets" (Liebowitz 2001: 2). Intangible assets include human capital (i.e., people knowledge), structural capital (e.g., patents, trademarks, databases), and customer or relationship capital (i.e., what is learned from customers, stakeholders, and community) (Liebowitz 2001: 2). Knowledge Management can be traced to the field of Knowledge Engineering, an outgrowth of Artificial Intelligence, which is concerned with developing computerized systems that are able to simulate tasks usually performed by human experts (Liebowitz 2001: 3).

Another effort to bring organization back in the equation of system development and computing is the socio-technical approach (see Reeve and Petch 1999). The techno-centric approach has led to many failed attempts to install and institutionalize Geographic Information System (GIS) in many organizations. The socio-technical approach, on the other hand, sees system development and computing not wholly an issue about technology but about the organization where the technology will be rooted and about the people who will use it. In socio-technical approach, organization and people take precedence over technology.

There is now a growing recognition of the need to understand the context within which information system would be embedded. This is a hard lesson learned after many projects on information system have met limited success despite the promise of technology. Public expectation has been tempered

with the realization that technology alone does not solve the multi-faceted problems of society. Thus, practitioners and researchers alike are taking a second look at how information systems are actually developed and implemented in organizations, and how institutions should be re-defined to reap the benefits of technology. They know that developing an information system is not as easy as setting up a computer system. It is a complex process that involves people, procedures, policies, clients, funds, software and hardware, methods, culture, and more. It is a demanding task of shepherding the process, from analysis, design, development to implementation and evaluation.

This development does not denigrate information system and technology. Rather, it highlights the need to align information system with organizational goals and business processes. It brings to the fore the important objective of information system, that of meeting the requirements of users and clients.

These various developments are captured in the systemic framework for information systems of Bacon and Fitzgerald (2001), which they developed through grounded research. The framework purports to be an integrated and holistic view of information system comprising of five interrelated areas, namely: 1) information system development, acquisition, and support; 2) people and organization; 3) information and communications technology; 4) operation and communications technology; and 5) information for knowledge work, customer satisfaction, and business performance. The last item is the central and distinguishing theme of the integrated framework. Figure 3-1 below shows this framework.

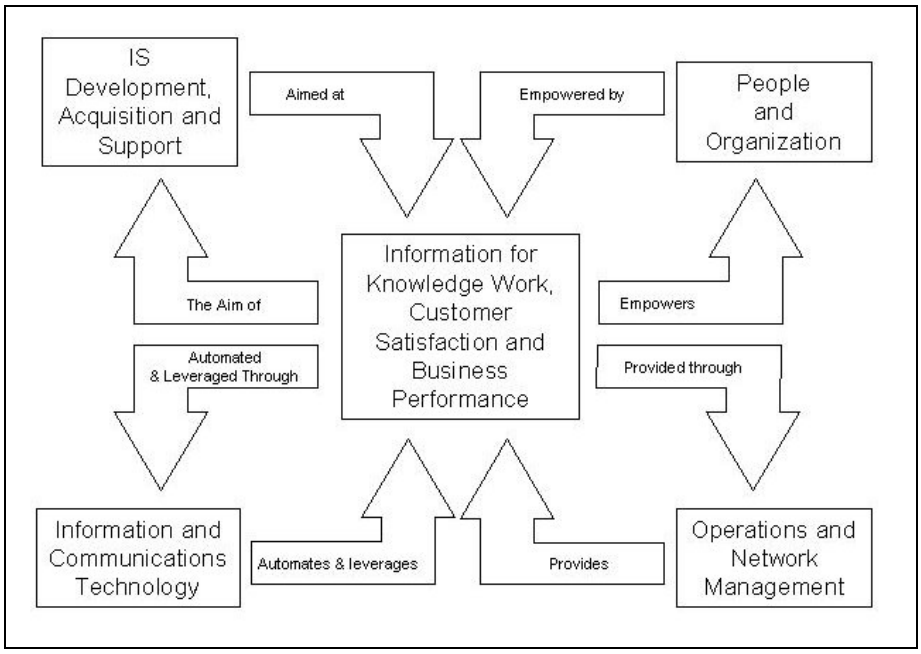

Figure 3-1. Systemic Framework for the Field of Information Systems (Adapted from Bacon and Fitzgerald 2001: 53)

3.3. LAND USE

3.3.1. Land Use As A Dynamic Concept

Land use is defined as the "economic and cultural activities practiced upon the land" (Dale and McLaughlin 1999: 73). This is distinguished from land cover, which "denotes the physical state of the land and describes the quantity and type of vegetation and other material that occurs on the earth's surface" (Dale and McLaughlin 1999: 73). Land use is about the relationship of man to land and how man act upon this relationship. Land use therefore should be viewed more as a process than an output. It should not be equated to a map layer of a GIS or a land use classification scheme, but should be seen as the process of determining, allocating, and realizing the use of land for sustainable development. This makes land use a dynamic concept denoting complex interaction and changes occurring over time.

Urban land use has become more relevant especially in the light of rapid urban growth happening around the globe. It is estimated that "urban revolution will escalate over the next three decades when urban populations will grow to twice the size of rural population" (GTZ 1999a). Problems associated with urban growth are many, such as urban poverty, crime, pollution, poor basic services, squatting, and the like. One major issue in developing countries is the wanton conversion of agricultural lands whose consequences are proving to be irreversible. These problems highlight the dynamic and complex nature of land use.

The definition below captures the complexity of the land use process, which requires a multi-disciplinary analysis and interpretation.

> Land use is the result of interaction between physical, social, economic and legal factors within specific geographic contexts. The study and analysis of such an interacting, dynamic, and complex set of factors is agreed to be a multi-disciplinary endeavor that requires a holistic approach with the distinct geographic component adding to the complexity of analysis and interpretation (Hill and Aspinal 2000: 1-2).

One way to look at the dynamic aspect of land use is through activity patterns (Carter 1982; Kaiser et al. 1995: 201). Carter (1983: 9-10) sees urban and regional system in terms of activity flows and adapted spaces. Urban land use is described as an interaction between activities and space, such as journeys (as activity) through communication channels (as adapted space) of road, rail, or public transport. In organizing a land use information system, Kaiser et al. (1995: 201) propose an activity system inventory that records the "dynamics of urban movement by land-users." One common activity pattern in urban areas is the journey-to-work commuting.

Another framework considers the dynamics of rural and urban land use in terms of spatial economics (de Meijere 2003). It models changes in rural land use as an interaction between man and natural resources, tracing the development from the first stage of hunting and gathering, subsistence agriculture, specialization in agricultural land use, to advanced rural and urban development. Urban land use is modeled in an industry-service economy where the functional use of space supports urban activities.

The dynamics of land use can be further understood by examining the drivers of change. Van der Molen (2002: 377-378) identified the following change drivers: human behavior, imposed land use, restricted land use, policy and tax measures. As opposed to the dynamic concept, the static aspect records existing land use, which is usually represented in a map output. It can refer to land cover and land use classifications (van der Molen 2002: 377).

3.3.2. Land Use in Land Administration and Management

Land administration has been defined by the United Nations as the "process of recording and disseminating information about the ownership, value and use of land and its associated resources" (UN 1996: 14). The United Nations goes on to recommend that:

> A good land administration system should permit the integration of records of land ownership, land value and land use with sociological, economic and environmental data in support of physical planning. The availability of up-to-date large-scale cadastral plans of urban areas provides the basic framework within which development schemes can be planned and assessed and acceptable designs implemented (UN 1996: 17).

The need for an information system for land administration is evident in this definition. However, the definition is limiting insofar as it is "narrowly focused and too cadastral and parcel-based" (Fourie et al. 2002: 352). In an effort to look for a common geo-spatial framework for developing countries, the article by Fourie, van der Molen and Groot (2002) recommends that a land administration/ management perspective be adopted to account for the various institutions—not only the cadastre—involved in generating data and concerned with different spatial units. As defined in the literature, land management is:

> …the formulation of land policy, the preparation of land development and land use plans, and the administration of a variety of land-related programmes (Dale and McLaughlin 1988: 6).

In developing an information system for land use, the reality that many institutions, offices, and actors are involved should be taken into account. This implies that local government may have to mobilize participation, use other spatial units apart from legal cadastre, and accommodate other forms and sources of information.

3.3.3. Land Use Planning and Monitoring

Traditionally, the focus of land use planning has been on the physical aspect. That is, planning is mainly done to carve out areas for agriculture, housing, industries, commerce, institutions, and so on. The tools commonly applied in this type of planning are comprehensive general plans, master plans, or strategic plans to promote certain land use pattern (UN 1995: 25). However, these plans assume slow-growing cities and are found to be time-consuming, too detailed and costly, and do not consider the consequences of economic demand for space (UN 1995: 25). As noted below, the process is observed to be static and ineffective to meet the demands of urban growth in most developing countries.

> Physical planning in developing countries is most often regarded as essentially static in nature, lacking effective land-use control mechanisms and investment priorities. Planning is restricted by the lack of feasible means to ensure implementation, anticipate market reactions, as well as means to consider the cost implications for various government agencies and the economic impact on various income groups (UN 1995: 25).

Out of the need to look into the issue of implementation in land use planning, urban management has become a major concern of local government. Planning becomes part of urban management, which encompasses resource allocation and policy implementation (Masser 2003: 5). Thus, issues on implementation and monitoring become salient. With this perspective, planning goes beyond the formulation of comprehensive plans that are updated every 5 or 10 years. Planning now calls for constant review and the development of strategies for enforcement and communication to realize the vision set out in land use plans.

Monitoring is a crucial issue as it deals with the actual implementation of plans. It is concerned with land use changes, which government is trying to direct, influence, record, and disseminate. That's why government employs various tools to implement land use plans within its boundaries, such as zoning ordinances, building regulations and by-laws, permits, inspections and penalties (UN 1995: 25). In most developing countries, however, these implementing tools are poorly, if at all, enforced and monitored.

Monitoring allows local government to see trends and effects, to check progress, and to make necessary adjustments and strategies. An information infrastructure can support monitoring process as it provides current and changing patterns of land use in the area (Dale and McLaughlin 1999: 83). The passage below highlights the essence of monitoring land use.

> All landscapes change over time, whether through human interference or by natural processes. It is essential that these changes are monitored and understood and that the uses to which the land is put are sustainable and that development "meets the needs of the present without compromising the ability of the future generations to meet their own needs" (Dale and McLaughlin 1999: 73, quoting the World Commission on Environment and Development 1987).

Masser (2003: 4-6) traces the shifting focus of urban planning in developing countries from physical planning to urban management and now to urban governance. The call for government to include and mobilize people and various sectors in the affairs of the state is what governance is about. Thus, effective governance "requires the establishment of partnerships between public and private agencies as well as NGOs and community groups. It also needs integrated action on the part of all levels of government and parastatal organizations" (Masser 2003: 6). Land use planning and monitoring should now find ways to genuinely involve people in planning the future use of land and in monitoring progress or the lack of it.

Recently, development projects are injecting community participation and the notion of continuous planning and review—especially with regard to rural land use—which in a way addresses the static nature of planning. For example, the GTZ (1999b: 4, 36) defines land use planning as an iterative process of dialogue with participants aimed at defining sustainable land use in rural areas and

identifying appropriate measures for implementation and monitoring. It entails continuous review and rechecking of these plans and measures.

3.3.4. Land Use Information System

Land use relies on varied information from different databases. The information requirement is, in fact, becoming complicated as planning and monitoring are now being integrated into various applications, such as economics, demography, agriculture, and the like. The expected outputs are also becoming diverse as land use information is widely being used in many activities of different sectors, such as in real property taxation, social service delivery, development permits, land valuation, infrastructure projects, municipal development planning, and many more.

Thus, the need for a land use information system has become necessary not only to handle and integrate data but also to provide products and services to clients. The use of GIS in land use is becoming popular as it has the ability to link attribute data to spatial data, integrate several map layers, do spatial analysis and modeling, and automates map processing.

Land use information system is seen as a tool for planners to do spatial and non-spatial analysis and to produce relevant information for policymakers. As a planning system, its function is described in the following manner.

> A planning information system should be able to answer, in accurate and timely fashion, critical questions about the location, nature, rate, amount, and type of land use change taking place in the community. It should be able to provide the information necessary to analyze the social, environmental, fiscal, and economic impacts of the changes and to compare historic, current, and projected changes. It should enable the planner to advise decision-makers about the potential for substituting alternative types of changes for those proposed, and about the calculus of winners and losers associated with each. The system should be able to relate these answers to more complex issues of the public interest in terms of how they affect the balance of land market values, social uses, and environmental quality (Kaiser et al. 1995: 89).

Beyond analysis and decision-making, the information system can also be developed to track and manage change, generate knowledge, and stimulate public discourse. This broad functional view is emphasized in the passage below.

> Planning information systems are collection of spatially referenced data, studies, analyses, and models used for public planning and change management recommendations, negotiations, debates, and decisions. Planning information systems differ from other information systems in their need for relating information to space and spatial location, and in their focus on the action implications of community planning and change knowledge (Kaiser et al. 1995: 90).

An important aspect in the design of a land use information system is defining the data requirements necessary to meet the various applications and needs of organization. One framework is to include land supply inventory (i.e., existing and projected supply of developed and developable land), land policy inventory (i.e., formal and informal regulations, procedures, and programs in the local

jurisdiction), and activity system inventory (Kaiser et al. 1995: 199-201). Another proposes to integrate two main databases for land use: one for urban management (planning data) and one for office management (administrative data) (van Helden 1994: 488-490).

3.4. LAND USE AND INFORMATION SYSTEM CONTEXT

To conclude this literature survey, a contextual view of land use and information system is presented in Figure 3-2. This incorporates the essential elements in understanding context when developing the system.

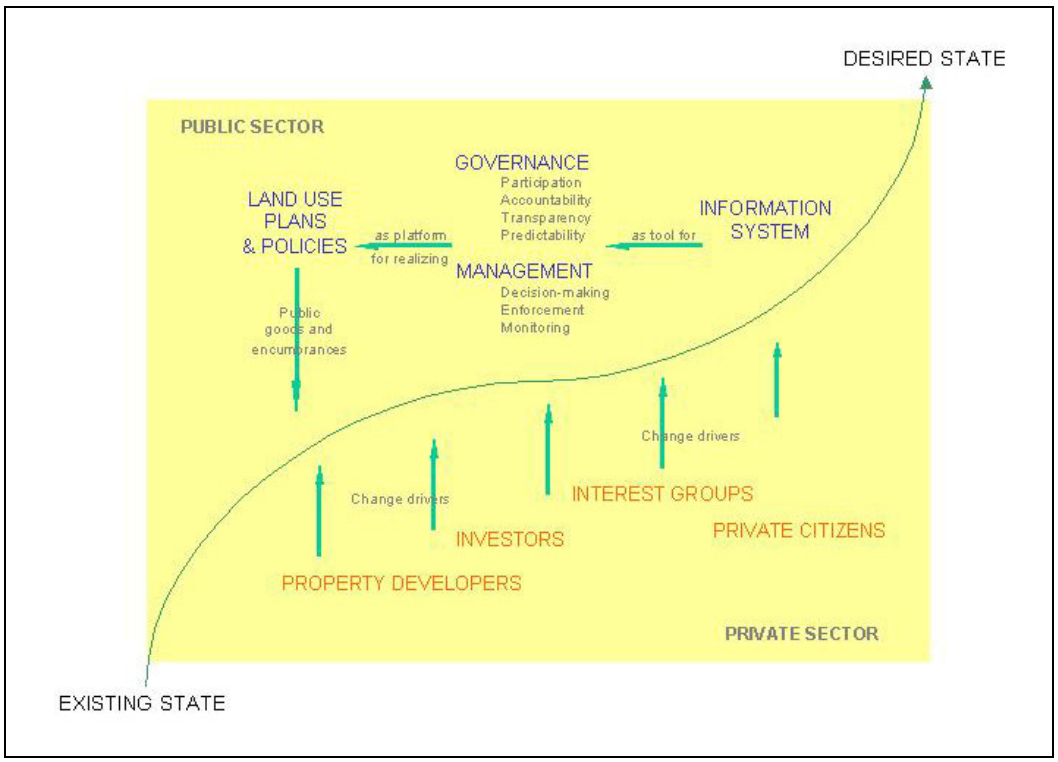

Figure 3-2. A Contextual View of Land Use and Information System

The existing state dictates how land use plan and information system would take shape. A good grasp of local condition is important in planning and developing the system. This entails an appreciation of the priorities and concerns of local government, the processes and activities involved in land use planning and monitoring, and the users and clients of such a system.

Planning is done to improve the current condition and to chart the path toward the desired change. It articulates and structures priorities and needs of the community and local government, and defines the direction and pattern of urban growth. The desired state represents the collective vision of the community in promoting the public interest, which can be measured in terms of sustainability and community benefit.

Two major players are involved in land use, i.e., the public and the private sectors. The public sector—represented by local and national government—manages change in land use through planning,

monitoring, and control. The private sector or civil society is a heterogeneous and oftentimes nebulous group of private citizens, interest groups, developers, investors, and non-profit organizations. Their actions and motivations are driving changes in local land use. Thus, an inherent tension exists between the two players. The public sector regulates, imposes restrictions, provides goods and services, and influences the behavior of the other, while the private sector directly acts on his environment through investments, housing, daily travels, and economic activities. This tension is depicted in the curve line and arrows in the above figure.

The public sector through the local government plays a critical role in land use issues. As discussed in this chapter, local government concerns have evolved from mere physical planning to management and now to governance. An information system can be a valuable tool to support these land use concerns. It can be used to decide, enforce, and monitor land use plans and policies. It can be a means to promote participation, transparency, and accountability.

4. EXAMINING THE CASE OF NAGA CITY: UNDERSTANDING CONTEXT

4.1. INTRODUCTION

This chapter examines the case of Naga City. It takes a critical look at how the local government practices land use planning and monitoring, and applies information technology to support such functions. In examining the information processes in Naga City Hall, the focus is not on how existing process can be automated. It is on how it can be improved and how an information system can facilitate any proposed change. Further, the focus is not on what information are currently available and how to use it, but rather on what information is needed—which may not be currently existing—to plan and monitor land use effectively.

The chapter is divided into four parts: policy direction and priorities; land use planning; land use monitoring; and databases and GIS. These are the major themes under which existing condition will be examined, and challenges and opportunities identified.

4.2. POLICY DIRECTION AND PRIORITIES

4.2.1. Harnessing Urban Governance

Naga City has been widely recognized for its innovative leadership and governance. The many awards the city has garnered for the past years are proof to the various initiatives of the local government to improve its performance and to reach out to its constituencies. One example of such initiatives is the Performance Improvement Program (PIP), which resulted in the high morale of local government personnel and a 200% increase in revenues from 1987-1994 (LGA et al. 2001: 16-22). The PIP has evolved into Public Service Excellence Program (PSEP), where each office in Naga City Hall publishes its performance pledge containing the procedures of frontline services, the expected service time, and the people accountable for the services.

Another effort is forging partnership with the private sector. The local government provided the investment opportunities and business climate for the private sector to participate in many city projects, such as the following: the Central Business District II Project; the Panganiban Upgrading and Beautification Project, which is a build-operate lease project; the South Riverfront Growth Center Project; the East Highland Eco-Tourism Zone, which involves the development of 2 upland *barangays*, namely Pacol and Carolina (Robredo 2002: 1-2).

The participation of non-government organizations (NGOs) in policymaking has been institutionalized with the creation of Naga City People's Council (NCPC). This has been further strengthened with the People Empowerment Ordinance passed by the local legislature or the *Sangguniang Panlungsod* (Robredo 2002: 2). The NCPC is composed of more than a hundred NGOs and government organizations. Members of the NCPC sit in various decision-making bodies. Its involvement goes as far as to include project formulation and implementation, the selection of relocation sites for the urban poor, and the monitoring of graft-prone activities such as bidding and awards of public projects. The guiding principles for these initiatives are: innovative governance, empowered citizenry, and active non-government sector (Robredo 2002: 23).

These guiding principles sum up urban governance, which is the thrust of the current administration and wherein lies the strength of the local government. This is something to take into account and to capitalize on when developing an information system for land use planning and monitoring.

4.2.2. Empowering People through i-Governance

The latest of these initiatives comes under the name i-Governance. It stands for "inclusive governance, information openness, interactive engagement, and innovative management" (Naga City n.d.: 5). The objective is primarily "to build an informed constituency so that the people will know what City Hall is doing and in turn for the City Hall to get feedback" (Robredo 2003). i-Governance aims to bring information to the people and to open communication channel where average citizens, not just organized groups, are given voice in the affairs of the city.

i-Governance is made operational through the Naga City website and the Naga City Citizens Charter. Services and information come through the internet and in printed form. Emails and letters average 5 to 6 a day touching issues from solid waste to public terminals. Now text messaging or SMS—which is popular in the Philippines—has been added as medium to communicate with City Hall (Robredo 2003). Application forms, Naga City Hall budgets, public bidding schedules, news and reports, among other things, are included in the Naga City website. The Electronic Data Processing Unit (EDP) reported that citizens can now access through the website payment history of business licenses. Doing transaction in the website, however, is not yet in the agenda considering that other agencies are involved, signatures are required, and the banking sector is not yet that developed (Padre 2003; Robredo 2003).

The use of the internet for urban governance is timely considering the improved telecommunication facilities of Naga City. Two big telecommunication companies—i.e., DIGITEL and BAYANTEL—are providing landline connections. There are 3 Internet Service Providers (ISPs) and many "cyber cafes" operating in the city. Of the 27 *barangays*, 24 have landline connections. The remaining are upland *barangays* with VSAT telephone service. Household-to-telephone ratio is 1:2, which is high by national standard. The local government is making available the computers in the *barangays* and public schools. It purchased 230 computers and distributed them to public schools and it is targeting to install "cyber station" in each *barangay* to make internet accessible to ordinary people (Robredo 2003).

i-Governance, although recently implemented, could be a potential vehicle for the development of a land use information system. The creation of a Naga City community through the web is a veritable source of information and knowledge that could be steered toward issues concerning land issues.

4.3. LAND USE PLANNING

4.3.1. The Local Government Mandate

Under the Local Government Code of 1991, local government has increasingly shaped land policies as it plans and manages land resources within its jurisdiction. The Code has mandated local government to:

- Adopt a Comprehensive Land Use Plan (CLUP) as basis for future use of land resources;
- Enact a zoning ordinance based on the CLUP and monitor its implementation;
- Reclassify agricultural lands for non-agricultural use; and
- Issue and approve development permits and subdivision plans.

The Local Government Code mandates that land use plan of each city and municipality must be comprehensive to include sector studies, such as demography, socio-economy, infrastructure and utilities, local administration, and land use. The CLUP is the instrument by which local government identifies the community's needs, and translates these needs into policies, programs, and projects (HLURB et al. 2001: 3). A national agency called the Housing and Land Use Regulatory Board (HLURB) provides the guidelines and standards, and approves the various CLUPs.

The process of formulating and adopting a CLUP require the collection of data from various agencies, the conduct of survey, and the compliance with national standards. Thus, local government has to acquire data from different sources including but not limited to: National Mapping and Resource Information Authority (NAMRIA); Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAG-ASA); Bureau of Soils and Water Management (BSWM); Mines and Geosciences Bureau (MGB) of the Philippine Volcanology and Seismology (PHIVOLCS) (HLURB n.d.: 10).

In the classification and reclassification of lands, the process is not as straightforward as it may appear. Local government has to comply with many national laws such as the following: reservation of urban lands for urban development and social housing purposes; restrictions on the classification of agricultural and agrarian lands; areas for economic zone development; network of protected areas for agriculture and agro-industrial development; ancestral domains on lands, among other things.

The CLUP serves as the basis for the local legislature to enact a zoning ordinance. Local government monitors and ensures compliance with the zoning ordinance through the issuance of zoning clearances and certificates of site zoning classification.

4.3.2. The Urban Challenge

Land use will continue to be a critical concern of Naga City. The unprecedented growth it experienced for the past 10 years is exerting pressure on existing services and facilities. The projected rise in population and the growing importance of Naga City in Metro Naga and Bicol as service and commercial hub will impact on land use processes and priorities. The draft Metro Naga Physical Framework Plan observes that:

> Naga will continue to be the primate city in Metro Naga and Camarines Sur. Compared to its neighboring LGUs, its urbanization rate is relatively slower (10%) and so its population growth rate (1.94%). Still due to its high density, its population would still exert pressure for the conversion of land to urban use. We could therefore expects its built up area to edge to peripheral communities, for gaps within urban barangays to be in-filled by developments, and for self-contained communities to emerge in its upland communities (MNDC 2002).

Land use conversion would therefore be in the agenda. The City Mayor sees that "in the next five years, actual use of properties would change drastically since conversion is very fast" (Robredo 2003). In fact, the planned urban expansion in the 2000 CLUP affected 25% of existing agricultural lands (Naga City 2000: 174). The Zoning Administrator likewise sees a trend of conversion from residential to commercial particularly in most of the areas in the city center.

> Naga City will continue to provide commercial and service facilities to contiguous municipalities. I see more residential areas being converted into commercial use, as we are witnessing now in Barlin Street. Almost all areas in the *poblacion* [city center] will become commercial. Owners will see the practicality of converting from residential to commercial (Villegas 2003)

Conversion of prime agricultural lands is one of the development constraints identified in the CLUP, including deforestation, flooding, pollution, and incompatible uses of land. The CLUP also identified 4 development needs that call for urgent attention, namely: controlled urban growth; increased agricultural income and productivity; additional/enhanced basic services; and sustained growth (Naga City 2000: 177).

In Figure 4-1, a SWOT (Strength, Weaknesses, Opportunities, Threats) matrix in the CLUP reflects similar issues and concerns.

All these issues pose real challenge to the carrying capacity of existing land use and to the future direction of land use changes. They highlight the importance of planning and continuous monitoring to prevent the adverse effects of urbanization.

Strengths (+)	Weaknesses (-)
• Geographical advantage • Strategic central location • Topography: Generally flat terrain • Accessible by almost all modes of transportation • More areas for expansion	• Obsolete Land Use Plan • Overpopulation within the downtown area and its peripheries • Skyrocketing prices of prime downtown area lots
Opportunities (+)	**Threats (-)**
• Metro Naga strategy • Legaspi-Iriga-Naga Growth Corridor Project • CLUP 2000 and Zoning Ordinance	• Low elevation of CBD I • Flood-prone • High tide at San Miguel bay • Clogging of Naga and Bikol rivers

Figure 4-1. Land Use SWOT (Naga City 2000: 182)

4.3.3. Issues on Land Use Planning

Naga City has its CLUP approved in 2000. A zoning ordinance has been passed and the City Planning and Development Office (CPDO) issues zoning clearances and certificates for site zoning classification. CPDO has been collecting fees for clearances and certificates, thus generating revenues for Naga City Hall.

The following are issues on land use planning in Naga City culled from interviews, observations, and documents collected in the field. The researcher did not have the chance to observe the actual formulation of CLUP—which was done in 1999-2000—or any process of planning for land use issues. Together with the issues are proposed scenarios for improvement.

- *From focusing on data acquisition to strengthening analysis*

The CLUP is a rich source of data assembled from various sources about sector concerns. CPDO has followed the minimum standards set in the HLURB guidelines, particularly on data requirements and collection.

Much can be done with the data collected during the formulation of CLUP. That is, analysis is one area that can be strengthened in land use planning. The data collected can be used not only for description but also for evaluation, scenario building, forecasting, and other forms of analysis. The City Mayor has expressed the desire to have a system that would help planners in City Hall build scenarios for land use from the present to say, 3, 5 or 10 years (Robredo 2003). Considering scenarios and policy alternatives could be a means to structure problems, choose from among many and conflicting objectives, define evaluation criteria, evaluate plans, and define course of action.

The CLUP has identified programs and projects, such as construction of school buildings, roads, satellite markets, Central Business District II, and development of settlements in formerly agricultural area, to name a few. Questions as to whether these would contribute to the desired change in land

use could be explored. For instance, issues on how these would contribute to quality of life, ease of traffic, population dispersion or congestion, density, and demand for services could be considered.

The seeming lack of analysis in planning in many local government units may be traced to supply-side planning. That is, the practice is to determine available area, then assign this area for various uses (SURP n.d.: 4). Demand-driven planning, on the other hand, investigates processes first (population growth, urbanization, density, conversion, etc.), and then determines land requirements for the sectors (SURP n.d.: 4). The formulation of Naga City's CLUP may have leaned toward the former. In the interviews conducted, the following are common replies when asked how each office participated in the CLUP: "identify areas for particular zones"; "classify commercial, residential, or mixed used"; "identify and classify agro-livestock zone and eco-tourism area"; "identify areas for socialized housing program and resettlement sites"; "coordinate in identifying areas classified as agricultural but are now used for other purposes."

- *From locating existing facilities to conducting spatial analysis*

The Electronic Data Processing Unit (EDP) provided technical support during the formulation of CLUP. It digitized maps through AUTOCAD and used the data collected by CPDO to generate map outputs in ArcView. It participated in a number of workshops together with CPDO for the GIS component (Padre 2003).

In the CLUP, GIS was used more to map the terrain and locate existing facilities than to do spatial analysis. It was helpful in automating the cartographic process, which otherwise could have been tedious if done manually. Several map layers were produced, such as the following: population density; soil fertility; slope; protected area; and facilities such as schools, hospitals, day care centers, protective services, cemeteries, evacuation centers, and dumpsite. In formulating the CLUP, the potential of GIS as a tool has not been maximized. For instance, no land use suitability assessment was done to help identify suitable areas for conversion or to determine whether a proposed facility is appropriate given a set of criteria, such as accessibility and compliance with regulations. Also, GIS could have been used to map changes in land use over time to help in modeling future urban expansion.

- *From consultation as informing to consultation as planning and deciding*

Consultation is a communication process involving individuals or groups who are influencing decision-making. It is said to be mid-way along a continuum of community involvement, that is, "between 1) informing the community about decisions that have already been made, 2) and handing over the final decision-making power to the community" (HLURB 2001: 43-44). Consulting the community on land use has a number of benefits, as follows:

  - Gaining valuable information from the people in the community about what is happening in the community;
  - Generating creative ideas about how to address particular issues of concern;
  - Identifying where there are similar and different viewpoints in the community, and the reasons for any difference of opinions so that likely conflicts can be resolved early;

- Gaining support from the community and engendering a sense of ownership in the CLUP, which will ultimately help to ensure the successful implementation of programs and projects;
- Identifying opportunities for working collaboratively to mobilize the best skills and resources in the community to implement the CLUP (HLURB 2001: 46).

The consultation conducted during the formulation of the CLUP was intended to get "feedback" from various sectors. A draft plan for each sector was already prepared and the consultation sessions were held to validate and arrive at a consensus. Consultation could have been undertaken from the initial stage of data gathering, to analysis, formulation, and finalization of the plan. Various stakeholders in the community could be involved at different stages as a way to win their support, to generate innovative ideas, and to capture local knowledge.

- *From planning as a one-shot activity to planning as a continuing concern*

The CLUP does not end with the passage of a zoning ordinance and the approval of HLURB. The CLUP is a multi-sector plan that spells out policies, programs, and projects affecting various sectors. It is a master plan of sorts that can be the basis for developing regulations and incentives for private sector investment, formulating specific plans for, say, traffic planning and management, infrastructure, and eco-system development. Planning then can be a continuing concern that happens not only during the updating or revising cycle, which is every 5 or 10 years.

When viewed from the perspective of urban management, planning is also concerned about implementation and monitoring. Implementation and monitoring strategies can be developed to ensure realization of plans. Issues arising from the implementation of CLUP can be defined and resolved. A phase-out plan to address non-conforming land use arising from the new CLUP is one example.

Land use conversion is another issue that needs further study and planning. Two interview respondents suggested the need to prepare investment plans for areas converted from agricultural to non-agricultural purposes (Cabague et al. 2003). This is the same sentiment of the Chair of the Land Use Committee of the *Sangguniang Panlungsod* who also sees the need to monitor the development of lands that were reclassified and converted into non-agricultural use (Lavadia 2003).

In Naga City Hall, the different offices implement programs according to their respective mandates. CPDO, as coordinating body, collates annual office programs and checks accomplishment of targets set by various offices. CPDO could use the review process to link the CLUP with the various office programs and with the fiscal and investment planning cycle.

- *From physical planning to urban management and governance*

Related to the above issues is the need to look at land use beyond physical planning. Land use planning is not only about subdividing lands and designating particular uses. It could encompass agenda setting, problem definition, formulation, implementation, monitoring, and evaluation. This entails strategic thinking and pro-active stance in land use issues.

Land use planning can also be seen within the framework of urban governance. That is, land use planning can extend beyond CPDO and Naga City Hall. As noted above, consultation with the community can go beyond information sharing to actual planning and decision-making.

4.4. LAND USE MONITORING

A land use plan is not self-enforcing. It is only as good as it is implemented and monitored. Although coming up with a good plan or design is important, monitoring is equally crucial in that it deals with implementation and is essential for continuous review and updating of policies and plans.

There is a strong emphasis on planning as evidenced by the many guidelines produced to help local government come up with a CLUP. Although the importance of monitoring is recognized, there is not much guidelines on how to go about it. Monitoring land use in local government is done by keeping and updating records on actual land use, conducting on-site inspection, and issuing permits, clearances, and certificates.

This section looks at monitoring activities of Naga City's CPDO. Issues and challenges are identified based on interviews and insights gained from documenting and observing the actual process of issuing clearances and certificates.

4.4.1. Monitoring Activities of CPDO

CPDO is the planning and coordinating office in local government. Apart from its role of planner, CPDO performs the dual role of administrator and "watchdog" of land use, as described below:

> The CPDO is responsible for the preparation of the CLUP… The CPDO also plays the important role of "community watchdog" and is responsible for safeguarding local amenity and community standards through the application and enforcement of the LGUs [local government units] rules, regulations, and guidelines (HLURB et al. 2001: 3).

The CPDO ensures public compliance with CLUP and zoning ordinance through the issuance of zoning clearances and certificates of site zoning classifications. Zoning clearances must be secured when applying for business and building permits as a means to ensure that the enterprise or the building are "allowed in the chosen location as per the CLUP and other relevant zoning and land use ordinances" (Naga City n.d.: 31, 33). Certificates for site zoning classification, on the other hand, are issued mostly to developers and investors verifying if their proposed business sites comply with the CLUP (Naga City n.d.: 30). On-site inspections are undertaken if proposed projects are classified as critical or those that may cause public complaints—such as junk shops, auto-repair shops, videoke bars—usually located in mixed used areas. CPDO also uses available information to monitor land use changes, as the Zoning Administrator, who is the CPDO head, mentioned in the interview:

- types of application/requests, e.g., how many are requesting site zoning classification who may be prospective buyers, sellers;
- applications for building permits, e.g., where and for what purpose;

- requests for projects of cities, e.g., requesting parties can be direct or indirect participants in utilizing resources;
- committee hearings on proposed projects in *barangays* to determine zoning; and
- inquiries from private individuals and investors, e.g., how many approved subdivisions, schools, banks, hotels (Villegas 2003).

4.4.2. Issues on Land Use Monitoring

- *From document processing to decision-making*

By convention, organization is depicted as a triangle composed of three layers, namely: policy, management, and operation. This is illustrated at the left-hand diagram of Figure 4-2. The three levels perform different roles: policy, "establishing the long-term, overall direction of the organization"; management, "controlling the organization's resources needed to run its operations"; and operation, "producing or delivering the product or service," which constitutes the bulk of the organization (Huxhold 2003).

Decision-making is basically top-down. Policy determines decisions, which are allocated with resources by management, and enforced by operation. This conventional view may not help in clarifying the developmental role of CPDO in issuing clearances and certificates. It may not depict the reality of decision-making process in organizations, which happens at different levels, sites, and units of the organization. Decisions are not only the exclusive domain of policy, but also occur at the management and operation levels, which can be depicted in the right-hand diagram of Figure 4-2.

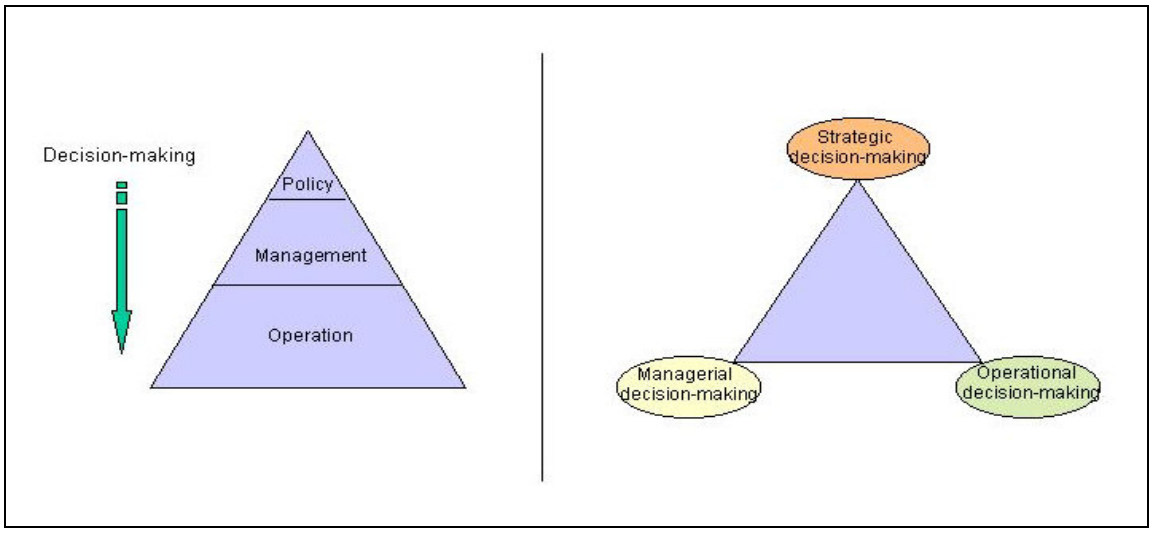

Figure 4-2. Conventional and Alternative Views of Decision-making

Issuing zoning clearances and certificates for site zoning classification are frontline services performed by staff of CPDO in their day-to-day operation. The alternative decision-making perspective underscores the fact that these services involve more than just processing of documents. The services entail decision-making that requires information, judgment, and a consideration of strategic factors and long-term effects.

As can be gleaned from Appendices D, E, F, and G—which document the procedures of these frontline services—the current practice of CPDO is focused on checking completeness and consistency of documents, ensuring lot ownership and tax payments, classifying the type of activity, locating projects in zoning maps, which basically are procedural concerns. Issuances of clearances and certificates should be guided by more substantive concerns, which leads to the next issue.

- *From checking compliance to assessing sustainability*

CPDO performs the function of "community watchdog" to safeguard local amenity and community standards. As such, the task of issuing clearances and certificates goes beyond checking for compliance of proposed projects with planned zoning. One interview respondent considered the possible scenario of automating the checking of location with the zoning map to do away with paper work (Palmiano 2003). Clearly, the idea of automating can be done, but the process of deciding in favor of sustainability and community benefit cannot.

The left-hand diagram of Figure 4-3 indicates the existing practice. Clearances and certificates are issued primarily to comply with planned and approved zone. Alternatively, the right-hand diagram shows how the process could be used to promote sustainable development, amenity, and community benefit. It introduces these strategic concepts to guide planners decide on applications. Sustainable development means "development that improves the total quality of life both now and in the future"; amenity is the "general well being of an individual or a community"; net community benefit examines the economic, social, cultural and environmental impacts (HLURB et al. 2001: 103-105).

Deciding on the basis of planned zone does not automatically mean benefit for the community. One case cited during the interview concerns a Globe Tower, a telecommunication facility for mobile phones. Naga City Hall received complaints from nearby residents about the facility, which got a zoning clearance from CPDO since the area has been classified as commercial based on the new zoning ordinance (Palmiano 2003). Another case involves a housing project for the urban poor in *barangay* Cararayan. CPDO refused to issue clearance since about 20 meters of the area fall under an agricultural zone. But in reality, that area has become residential. The case was elevated to HLURB, which decided in favor of the project (Campillos 2003).

Land use change happens not only with a new zoning ordinance. It happens with every decision to grant a clearance or certificate. Every approval or denial of applications would have implications for how things would be in the future. The implications cannot be predicted by or cannot be equated to how much the project cost or how big the project is. Simple decision to allow a shop, for instance, could have considerable effect that might lead to development in the area that is not intended. Further, accumulation of permits issued does not always add up to a planned zone. It can mean better living condition, at best, or pollution and urban blight, at worst. The right diagram indicates that reality.

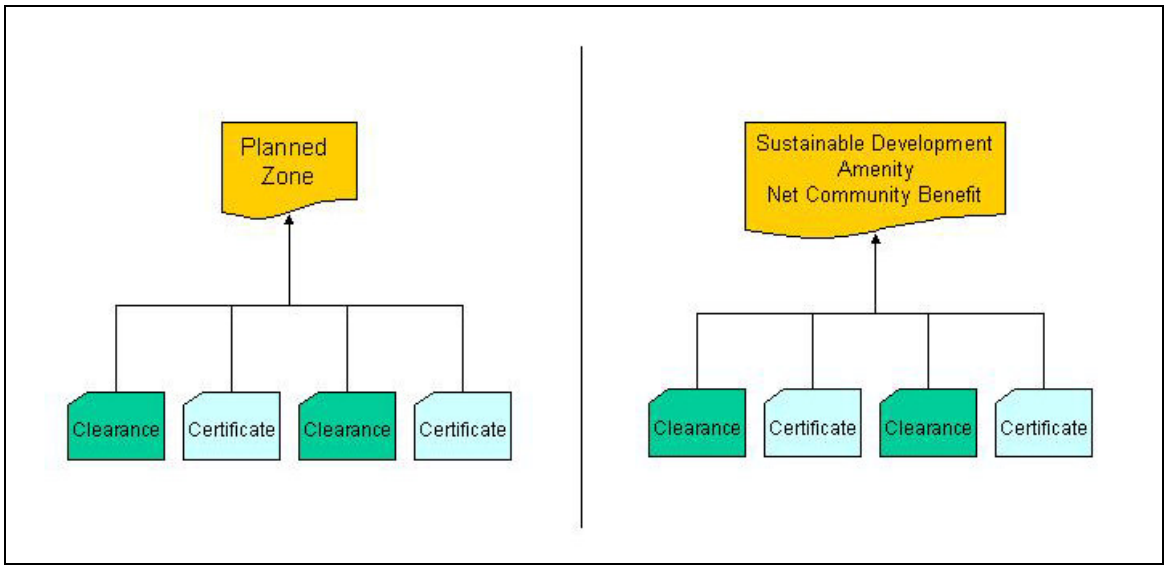

Figure 4-3. Conventional and Alternative Views of Issuing Clearances and Certificates

Thus, land use change does not happen in one momentous event as in a new approved zoning. Cities do not develop out of a map or design. Rather, it is an accretion of decisions made each day by CPDO and by each citizen of Naga City.

- *From acquiring aerial photos and satellite images to monitor land use to using available data and mobilizing community involvement*

The traditional way to monitor land use is costly. Acquiring aerial photos or satellite images, or conducting on-site inspection are prohibitive for local government faced with many problems and dwindling resources. The City Mayor recognizes the fact that existing data may not be reflective of actual situation and that the local government needs resources to keep data current (Robredo 2003). Naga City Hall acquired a satellite image through a USAID project in 1994. Another satellite image came with the SLARIM project of ITC.

The Zoning Administrator is finding alternative ways to monitor land use. He is using available data generated by Naga City Hall to know what is happening in the field. This can be facilitated by an information system and institutionalized by the staff through regular monitoring and updating. In addition, this can be supplemented by capturing local knowledge through consultations and through the i-Governance project.

4.5. DATABASES AND GIS

4.5.1. Brief Background

The day-to-day operation of Naga City Hall and its transaction with the public create, use, and re-use considerable amount of data. Efforts have been made to digitize analog data and automate processes. GIS software has been acquired and map layers have been generated through technical assistance projects. Naga City Hall has an Electronic Data Processing Unit (EDP) tasked with computerizing the various city government offices and functions, and operating and maintaining the local GIS and the Naga City website. Information technology has been introduced in the organization. Problems, however, still exists. This section identifies a number of issues and proposed improvements relating to databases and GIS in Naga City Hall.

4.5.2. Issues on Databases and GIS

- *From unstructured analog data to digital storage and maintenance*

Reliable, current, and accurate data is necessary for planning and monitoring. The HLURB has, in fact, included in its guidelines the data requirements concerning each sector in the CLUP. Local governments have invested resources to collect the data from different sources. The need to store, catalogue, and maintain these data is necessary for easy retrieval and access, for keeping current and historical information, and for analysis and updating. Thus, setting up a computerized information system has become relevant to local government, as explained below.

> Data collection, including relevant sector data, land use surveys, situation analysis and sieve mapping [map overlays] are all very important activities in any planning exercise. Once these activities have been undertaken, the LGU should develop systems for their storage (preferably electronically or digitally—GIS/MIS) and conduct their regular updates…The ease which the CLUP can be updated will depend on the commitment of the LGU to the storage, maintenance, and ongoing updating of data (HLURB et al. 2001: 25).

In formulating its CLUP in 1999 and 2000, CPDO collected data through surveys, published reports, and those generated by offices inside Naga City Hall. CPDO presented in table forms the data using word processing and spreadsheet. No database has been created in the sense that data have not been modeled, stored, catalogued, or cross-referenced to allow manipulation and concurrent use. The same is true with the daily transaction for clearances and certificates, where data generated remain in filled-out application forms and where certificates, clearances, and summary reports are encoded in MsWord each time they have to be produced.

There are a number of computers in CPDO that need upgrading. These computers are linked through a Local Area Network (LAN) inside Naga City Hall, which are used for internet connection. CPDO relies on EDP for maps and computer-related assistance. With the current setup, efficiency of operations of CPDO and other offices is hampered, as the following problems were identified in the interviews: “retrieving data is difficult”; “copying and encoding technical description for certificates

and clearances take time"; "review and verification of applications can eat up a lot of time"; "personnel still have to look for files which are sometimes borrowed by other offices or files kept by one person who is absent"; "data takes time before they are made available, i.e., on the average three days" (Daplin 2003; Orozco 2003).

- *From islands of automation to data integration and sharing*

The following are the databases inside Naga City Hall based on the offices interviewed for the research.

- Tax declaration data encoded in FoxPro (Office of the City Assessor)
- Tax payment data encoded in FoxPro (Office of the City Treasurer)
- Business permits encoded in FoxPro (Office of the City Treasurer)
- Building permits encoded in MsAccess and Visual Basic (Office of the City Engineer)
- Profiles and payment history of urban poor beneficiaries encoded in FoxPro (Office of the Urban Poor Affairs)
- Land use map layers encoded in ArcView (Electronic Data Processing Unit)

These databases are not integrated. Only the 2 offices maintaining tax declaration and tax payment records share the same database program with specified fields for view, encoding, and updating. Integrating databases would facilitate data sharing among the various offices inside City Hall. This should be considered in the computerization program of EDP considering the frequency of internal transactions within the various offices and the volume of data flows from one office to the other. Developing an integrated system should examine the processes, data, and people involved. In the interviews, respondents identified the data they exchange between CPDO and EDP. This is summarized in Figure 4-4 below.

The Office of the City Assessor keeps data on ownership, property, and location—although still in analog form—which the CPDO uses in issuing clearances and certificates. The Office of the City Engineer keeps building permit database, which can be linked with building footprint and road network maps of EDP. CPDO issues zoning clearances, which are needed by the City Engineer's Office to issue building permits. The two offices also collaborate in city project inspections, and in checking compliance with zoning, national building code, and sanitation. The Office of the City Treasurer also needs zoning clearance from CPDO to be able to issue business permits. CPDO and EDP keep information on streets, population in the area, household density, which are used by the Environment and Natural Resources Office in collecting garbage in the *barangays*. The Urban Poor Affairs Office, on the other hand, obtains statistics and land use maps from CPDO and EDP in preparing feasibility study for relocation sites for the urban poor. The City Agriculturist Office requires land use and soil fertility maps when providing technical assistance to farmer beneficiaries.

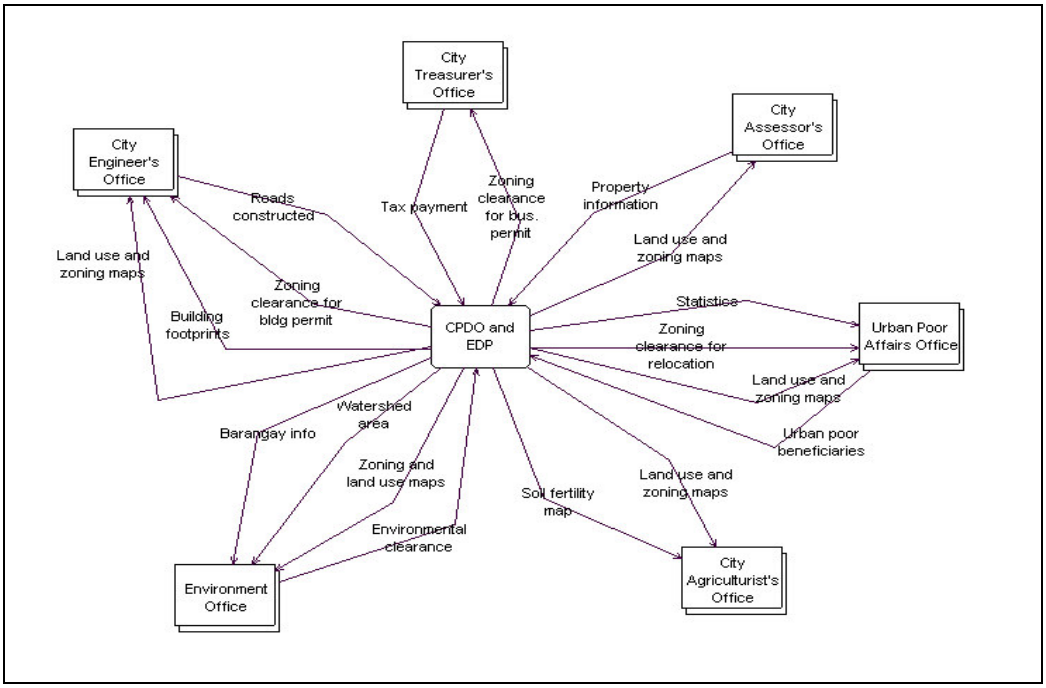

Figure 4-4. Data Flows Between CPDO/EDP and Other Offices

- *From pilot-testing to institutionalizing and sustaining initiatives*

As a recipient of technical foreign aid, Naga City was able to set up its GIS. The first was in 1993-1994 when Naga City was selected by the USAID for the Decentralized Shelter and Urban Development Project. It pilot-tested a GIS project called, "Support for Land Use Mapping: Utilizing Satellite Imagery and PC-Based GIS for Rapid Land Use Assessment" (PADCO 1994). The pilot-test involved Cebu, Lipa, Davao and Naga. Naga City joined the second phase of the project in 1994. Training was conducted in Naga City on manual methods of fieldwork and land use classification scheme (PADCO 1994: 11). Further training was conducted in Cebu using necessary facilities including a 2.8 meter Russian KVR satellite image of Naga City at 1:25000 scale. However, Naga City was not able to complete the land use map. The difficulty experienced by Naga and Davao after the training was attributed to "the lack of senior 'champion' capable of moving the applications forward" (PADCO 1994: 3).

A second technical assistance came in 1999 under the USAID GOLD Project. The objective is to improve selected standard operating procedure through the use of GIS in local government. Trainings were provided in basic GIS activities and in writing Requirements Document, Systems Development, and Systems Installation (USAID et al. 2000). Naga City did a pilot-test of GIS applications on the following: fire risk assessment; building information; real property tax; monitoring socialized housing amortization; monitoring business permits; and nutrition for pre-school children.

These initiatives were not sustained. The offices concerned were not able to continue the use of GIS in their operations. Two GIS applications, however, have remained relevant, that is, land use and tax mapping. GIS has been found useful in the formulation of CLUP. The tax mapping division of the Office of the City Assessor has continued digitizing tax maps and hopes to link its database to these maps. The City Mayor sees the usefulness of GIS in land use planning and disaster management,

which are priority concerns (Robredo 2003). Many interview respondents see the problem of retaining personnel trained in GIS as the main culprit. EDP already had three generations of personnel handling GIS. There is difficulty in transferring technical expertise once GIS staff leaves EDP (Padre 2003).

- *From automation to decision-making and customer satisfaction*

The City Mayor estimated that about 60 to 65% of Naga City Hall employees are computer literate. He noted, however, that there are still many employees who do not see yet the potentials of information and communication technology (ICT). He cited, for instance, the mortality statistics generated in the Civil Registrar's Office which he said are kept only for record-keeping. He pointed out the need to develop and manage a system to help his office in decision-making. Further, he noted the importance of information system in improving internal operation for governance:

> Internal operation is important in i-Governance. Things presented outside should be well-understood by people inside. Therefore, there is a need for a continuing systems improvement inside City Hall for effective external engagement (Robredo 2003).

Client satisfaction should also be a major consideration in developing an information system. The client survey conducted during the research fieldwork indicated a high level of satisfaction with the performance and service of CPDO. However, when asked what areas need improvement, the following were recommended:

- Availability of updated information
- Availability of summarized information
- Availability of digitized/computerized data
- Directory of information
- Use of computers to disseminate information
- Availability of information in the website
- Improved customer service
- A more confined office/personnel site or table for speedy transaction
- Availability of copying machine
- Larger and clearer bulletin board showing step-by-step procedures
- Spacious office with up-to-date facilities

5. LAND USE INFORMATION SYSTEM FOR NAGA CITY: A DESIGN SOLUTION

5.1. INTRODUCTION

This chapter proposes an information system design to support land use management in Naga City. The design is based on the analysis of context done in Chapters 3 and 4.

This chapter defines the system requirements through a set of development guidelines and an analysis of user needs. The guidelines are translated into a System Architecture, which is then elaborated by modeling its structure and functionalities applying the Unified Modeling Language (UML) notation. The design of the structure and functionalities is guided by an analysis of user needs based on interviews and client survey conducted during fieldwork.

Figure 5-1 summarizes the structure of this chapter.

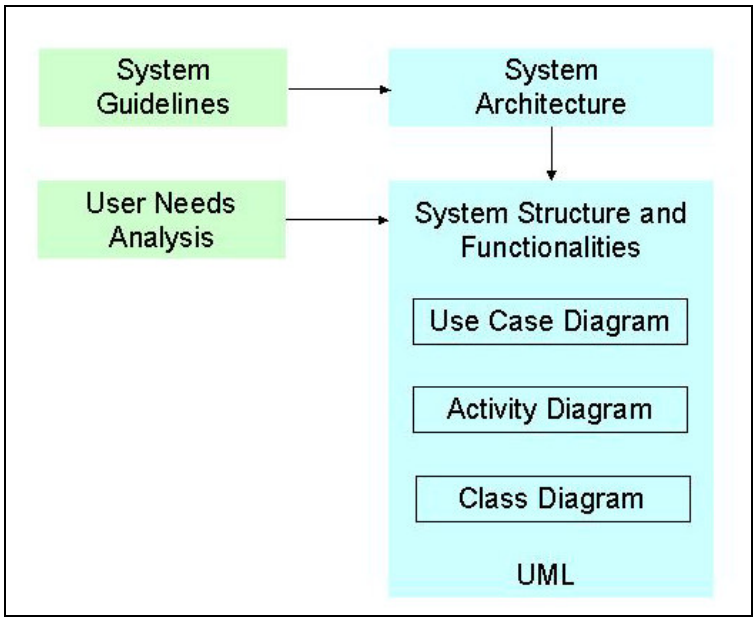

Figure 5-1. Outline of Chapter 5

5.2. GUIDELINES FOR SYSTEM DEVELOPMENT

The following are general principles in developing the information system. Drawn from the analysis of context, this set of guidelines outlines the specifications for the information system.

- *Develop an information system that captures data and local knowledge*

The land use information system for Naga City should be able to incorporate data and local knowledge. It should be able to store and organize the data generated in various land use processes inside Naga City Hall. In addition, it should be able to capture local knowledge through the active involvement of the community. That is, the information system should provide a mechanism through which insights, reports, and observations from different stakeholders are stored in and linked to databases. Incorporating local knowledge into databases could supplement the data generated from daily operations used in planning and monitoring.

Naga City is a unique case in that urban governance is high priority, and well developed and practiced by local government. This is something to capitalize on when designing the system considering that "the community is one of the most valuable sources of data" (HLURB et al. 2001: 33). Generating local knowledge could be a source of innovative ideas for planning, source of information on developments in the field, as well as a mechanism for the public to channel feedback.

- *Design a system that is open and non-proprietary*

To generate response from the community and to induce public discourse on land use, information should be made available. Therefore, the information system should be accessible to the public. It should be designed not exclusively for use of planners in CPDO. This does not mean, however, that complete access to the system is required. Shareable data could be identified and even packaged and popularized to make it meaningful to local residents. The shareable part and the metadata or the "data about data" to help local residents locate information should be an important component of the system.

- *Focus on usefulness and not on comprehensiveness*

The information system should be responsive to users' needs. The objective is to define how information will be used to determine what information should the system contain and support. The system should avoid acquiring and maintaining data that the users will not use anyway. Comprehensiveness has cost implications that should be considered in system design. The Comprehensive Land Use Plan (CLUP) required of local government should not mean a comprehensive information system, but more of a system that would cater to the needs of its users.

- *Make the system operational for updating records and deciding applications*

The system should support the procedures and activities of land use management in planning and monitoring. It should include the functionality of updating land use records and keeping track of land use changes. CPDO personnel must be able to use the system to help them decide on applications for

zoning clearances and certificates for site zoning classifications. This necessitates the linking of different databases inside City Hall by making use of local knowledge, integrating decision-making factors for certain areas, e.g., community benefit, carrying capacity threshold.

- *Make the system progressive and adaptable*

The design should be technically simple (i.e., progressive) so that it is adaptable, that is, it can be upgraded and can be easily integrated with other data sources. It should consider the variety of data from different sources needed for planning and monitoring. Land use involves various organizations as providers and users of data looking at the phenomenon at different spatial units. As such, the information system should allow for other spatial units, apart from cadastre, as bases for developing the system. Naga City Hall is still digitizing its parcel maps based on tax assessments and payments. Thus, information on street, address, neighborhood, block, or at higher aggregate levels—such as *barangay*, district, and city—can be developed and maintained.

Making the system technically simple would allow for easy upgrading. That is, the system can be easily upgraded when new system is introduced and old ones are improved (UN 1995: 67). This considers the reality that technology and requirements are not stable and are changing over time. The earlier databases in Naga City Hall, for instance, have been encoded in FoxPro and the latest is encoded in MSAccess and Visual Basic. Although legacy systems does not yet pose a problem in the Philippines as it is now in most countries in Europe, the design should anticipate such problem in the future. The following are proposed measures to keep the cadastre system technically simple, which can be adapted for land use: reduce functions; establish cadastre initially on a higher scale; use simpler methods of delimitation and demarcation; reduce standards of accuracy for land registration surveys; minimize field work; establish provisional registers (UN 1995: 67).

Using an object-oriented technology for the information system should also be considered. Object-oriented design is easy to modify and extend. That is, objects can be re-used to form new objects. Attributes and operations of objects can be associated into a single unit for easy access and modification. Operations can be realized through multiple methods. A brief discussion on the principles of object-oriented technology in UML is presented at the latter part of this chapter.

5.3. THE SYSTEM ARCHITECTURE

Following the guidelines above, the System Architecture is hereby proposed, shown in Figure 5-2, which provides a global view of the proposed information system.

The System Architecture shows the various components of the system and the roles and relationships of these components. The components are defined in terms of data and processes. They are grouped into three organizational domains or areas of concern, namely: operational domain, strategic domain, and management domain.

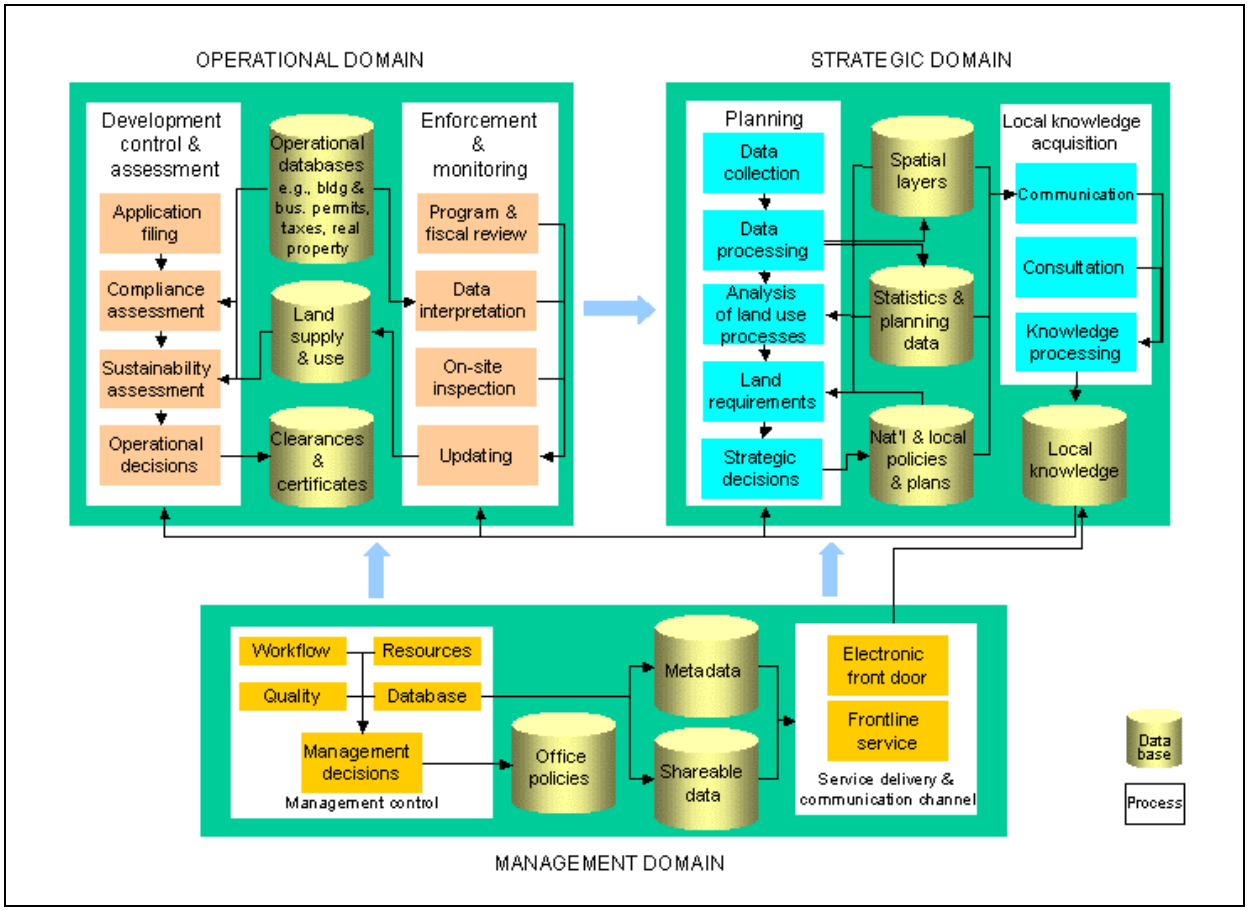

Figure 5-2. Information System Architecture for Land Use Management

- *Development control and assessment*

Presently, filing of application (e.g., acceptance of application, checking for completeness of documents) and compliance assessment (e.g., establishing ownership, ensuring updated tax payments, ensuring area falls within planned zone) are done manually. A new addition to the design is the sustainability assessment. This would integrate strategic concerns such as community benefit and sustainability. The process needs to integrate the databases arising from daily transactions inside City Hall. Data on land supply and use shall be gathered to input to sustainability assessment and also to planning in the strategic domain. Zoning clearances and certificates for site zoning classifications, which are held in analog format, shall be stored in a database.

- *Enforcement and monitoring*

The sub-processes are currently practiced in one form or the other. However, they are not applied to land use enforcement and monitoring. Program and fiscal review, for instance, falls within the mandate of CPDO but are not clearly linked to CLUP as indicated in the interviews. The formation of a monitoring team composed of CPDO and the City Engineer's Office to conduct on-site inspection remains a proposal in the CLUP. Interpretation of land-related data to monitor developments is done on an ad-hoc basis. The need to update land use on a regular basis shall be part of the monitoring process.

- *Planning*

Data generated from the operational domain shall input to the strategic domain, particularly in the planning process. As noted, planning would largely depend on how available data are current and reliable to represent reality on the ground. The planning process is fairly established with the guidelines set by the Housing and Land Use Regulatory Board (HLURB). The proposed process, starts with data collection and processing, e.g., data extraction, conversion. It establishes a demand-driven planning. That is, it focuses on the analysis of land use process as an important step in determining land requirements. Map layers developed through GIS would be used more for spatial analysis, and data generated from planning would be structured and stored in a database system.

- *Local knowledge acquisition*

This is a new component in the sense that the concern to systematically collect and store inputs from the community is made part of the system. The concept is not new, however, insofar as community participation in local decision-making is institutionalized through the i-Governance project, public-private partnership in city projects, and the Naga City People's Council. The City Mayor mentioned about emails and text messaging as means by which ordinary citizens communicate with City Hall.

An important part of the process is the development of a communication plan and strategies to induce public participation in land use planning and monitoring. Public consultations can be used as means to gather local knowledge. Two types of inputs from the community are seen. One type is structured input, which can be collected during regular public consultations such as forums, surveys, and focus group discussions. The other type is unstructured, which opens a line of communication to allow individual citizens to report freely about happenings in a neighborhood, street, or address.

There are preconditions for the acquisition of local knowledge to be meaningful and relevant. As noted, a communication plan is needed. Further, there is a need to define what inputs are important and how to collect them. Thus, the processing of inputs, structured or unstructured, shall be undertaken before storing in a local knowledge database. This database shall input into development control and assessment, enforcement and monitoring, and planning.

- *Management control*

This is the process that coordinates and controls activities in the operational and strategic domains. It ensures intra and inter-organizational communication, resource allocation, quality standards, and data sharing. From this process, management decisions are formulated, which in turn are stored as office policies affecting the 3 domains. One example of such policy is a memorandum from the Office of the City Mayor on 6 June 2002 requiring personnel to inspect documents for completeness before processing applications. An important component of the control process is database management, which coordinates the production of metadata and shareable data from the other domains for public access. This also provides for the interface needed for data conversion, handling, and exchange.

- *Service delivery and communication channel*

Services and information shall be delivered in two ways: through the electronic front door which is currently available through the Naga City website and through frontline services which are the face-to-face transactions with the public. The electronic front door and frontline services are open lines of communication to the public, which can be exploited for land use planning and monitoring. Transactions, such as application processing, however, are still limited in the internet by institutional and banking regulations. This electronic front door shall be tapped to generate inputs from local residents and to make publicly available mapped and thematic information on land use.

Below is a summary of the various components and the proposed changes. Statistically, 12 out of the 22 sub-processes identified in the System Architecture are proposed for adoption while 10 already exist. For the databases, 7 are new and 3 are in place. Overall, about 60% of the system is new and has to be developed. Those existing mean that they are already being undertaken. But this does not mean that improvements are no longer called for, which as noted here are still necessary for the system to work effectively.

Table 5-3. Existing and Proposed Changes in Land Use Processes and Databases

Processes and Databases	Existing or Proposed	Proposed Changes and Comments
Development control & assessment		
Application filing	Existing	Procedures for application are clearly established. There is a checklist of requirements for each type of applications for zoning clearances and certificates of site zoning classifications. Completeness of documents is checked before applications are accepted.
Compliance assessment	Existing	Various applications for site development are currently evaluated based on consistency with zoning ordinance and map, ownership information, location and purpose of application, updated tax payments, building plans, etc. The current process is documented in Appendices D, E, F, and G.
Sustainability assessment	Proposed	This is a new component introducing other evaluation criteria in assessing applications, e.g., amenity of the area; proximity of the development to any public land and likely impacts; effect of existing uses on nearby or adjacent land; extent and nature of vegetation on the site and likelihood of its destruction; availability and provision of utility services; effect on the free movement of pedestrians, public transport, etc. (HLURB et al. 2001: 109-112). Thus, issuance of clearances and certificates goes from mere processing of documents to decision-making.

Operational decisions	Existing	Currently, decisions are largely based on compliance assessment. Clearances and certificates are not stored in a database.
Enforcement & monitoring		
Program & fiscal review	Existing	This is a regular activity of the local government. However, translation of CLUP into concrete programs should be supported by budget appropriation. A review of the implementation of CLUP has yet to be done.
On-site inspection	Existing	Inspections are undertaken for applications considered as critical projects and those with approval but are the subject of public complaints. Proposal in CLUP to establish a monitoring team has not been realized.
Data interpretation	Proposed	In the interview, the Zoning Administrator noted some ways to monitor land use changes by interpreting available data. However, this is done on an ad-hoc basis.
Updating	Proposed	Changes in land supply and use shall be regularly monitored and updated in the database. Monitoring can be done through data interpretation, on-site inspection, and local knowledge acquisition.
Databases in operational domain		
Operational databases	Existing	Various databases encoded in different programming languages need to be integrated. Data models should be reviewed to facilitate data sharing. These databases shall input into data interpretation, compliance and sustainability assessment.
Land supply and use	Proposed	An inventory of developed and developable lands and their uses is valuable information for decision-making and planning. Changes in supply and use shall be monitored. Data generated from the inventory and monitoring shall be stored in a database.
Clearances & certificates	Proposed	The CPDO does not keep database for zoning clearances and certificates for site zoning classification. Summary reports are encoded monthly and annually for zoning clearances in MsWord. The CPDO keeps a handwritten list of certificates for site zoning classification.
Planning		
Data collection	Existing	The CPDO followed the guidelines issued by the HLURB in collecting data required for CLUP.
Data processing	Existing	Data extraction and conversion for GIS application have been done to compile land use map layers. As noted in the previous chapter, more spatial analysis can be done to maximize the potential of GIS and the use of available data.

Analysis of land use processes	Existing	This shall be given more emphasis and has to be strengthened as a step toward determining land requirements. Analysis of spatial and thematic data can provide a better understanding of the current situation of land use and can lead to wider options and courses of action.
Land requirements	Existing	Determining the best use of areas and their conversion from one use to the other shall follow after analysis of land use processes. That is, land use shall be supported by analysis.
Strategic decisions	Existing	The quality of planning and strategic decisions would depend in large part on the sub-processes above.
Local knowledge acquisition		
Communication	Proposed	Communication strategies (e.g., popularizing and packaging information) shall be defined to mobilize citizen participation and induce public discourse on land use. They are means to bring land use issues to the public and to get feedback.
Consultation	Existing	Public consultations, which are held regularly by the local government, shall be used as venues for discussing land use issues and getting inputs from the public.
Knowledge processing	Proposed	Inputs from the public through surveys, discussion groups, public forums, and individual reports/observations would have to be collected and stored systematically. They represent local knowledge on land use.
Databases in strategic domain		
Spatial layers	Existing	As noted in the previous chapter, the spatial layers in GIS were produced in early 1994 with USAID technical assistance. Efforts were then directed to apply GIS to Naga City Hall operations. However, GIS has been most useful in producing land use maps for CLUP and currently in preparing tax maps. There is still the need to increase local government capacity in GIS.
Statistics & planning data	Proposed	Data from various sources are collected during the formulation of the CLUP but they were not stored and organized in a database structure. They are summarized in tables in the approved CLUP.
National & local policies & plans	Proposed	No database exists to access and retrieve policies and plans at national, regional and local levels. The database can be useful in analyzing land use processes, determining land requirements, and defining sustainability criteria.
Local knowledge	Proposed	The capture and storage of local knowledge in a database is an innovation that can prove to be valuable in development control and assessment, enforcement and

		monitoring, and planning. Reports, suggestions, or complaints from the public shall be grounded spatially using parcel, address, street, or neighborhood as map units.
Management control		
Workflow	Existing	There are existing procedures defining the activities inside City Hall. With the development and installation of an information system, however, managing workflows may have to be revisited considering that coordination and resource exchange through electronic means would be introduced.
Resources	Existing	Resource allocation is a management concern that would have to be reviewed in the light of implementing the CLUP.
Quality	Existing	Quality management may have to be re-defined in keeping with the new workflows affecting the whole processes and the concern for continuous improvement.
Database	Existing	Electronic Data Processing Unit (EDP) is task to oversee and manage the different databases inside City Hall. With the land use information system, its new tasks include data integration, production of metadata and shareable parts, and provision of user interface.
Service delivery & communication channel		
Electronic front door	Existing	This exists through the Naga City website, which can be enhanced by providing land use information. It can also be used as forum for public consultation and feedback.
Frontline service	Existing	Procedures to go about delivering services to the public are well defined in the Citizen's Charter.
Databases in management domain		
Office policies	Existing	Policies to manage resources, quality, database, and workflow shall be structured and organized in a database.
Metadata	Proposed	Description of the data as to its origin, accuracy, resolution, date of creation, publisher, etc. would be provided. Standard metadata structure, e.g., templates found in ESRI's ArcCatalog, can be adopted.
Shareable data	Proposed	Data that would be made available to the public shall be identified to avoid privacy and liability issues. Land use information may need to be packaged and made meaningful to the public to solicit feedback.

5.4. ANALYSIS OF USER NEEDS

The objective of this section is two-fold: to identify the actors who are users of the system and to examine their needs. The analysis will guide the design of the system structure and functionalities in the next section.

5.4.1. Primary and Supporting Actors

Users can be categorized according to three types of actors: primary actor who "has user goals fulfilled through using services of the system"; supporting actor who "provides a service to the system"; and offstage actor who "has an interest in the behavior of the use case, but is not primary or supporting" (Larman 2002: 70).

The primary actors for the proposed system are the CPDO and EDP. The information system is intended to support land use management, which is the mandate of CPDO. Thus, initiating and overseeing the development of the system fall squarely on the shoulder of CPDO. EDP, on the other hand, being the computer and network office inside Naga City Hall, has the technical know-how on GIS and databases. These are the core offices that shall develop and maintain the system. They used to be one office but EDP is now under the supervision of the Office of the City Mayor. CPDO needs to develop its in-house capacity in GIS to be able to respond quickly and pro-actively to its own needs of planning and monitoring.

As shown in Figure 4-4 of Chapter 4, other offices inside City Hall transact with CPDO and EDP on a frequent basis. These offices have also been involved in the formulation of the CLUP. They include: the Office of the City Treasurer; the Office of the City Assessor; the Office of the City Engineer; the Urban Poor Affairs Office; the Environment and Natural Resources Office; and the Office of the City Agriculturist. The development of a land use information system would facilitate the transaction between these offices and CPDO/EDP. These various offices shall support the system through their operational databases.

The system is envisioned to be open and non-proprietary. As such, users outside Naga City Hall shall be accommodated through the electronic front door and frontline services, and shall be given access to the metadata and the shareable part of the system. One group of supporting actors shall be the customers or clients. They are the people transacting business with Naga City Hall, those taking part in public consultations, and any private citizens and groups interested in land use issues. They are both service recipients and users of the system. Another group shall consist of government bodies, both local and national, which are mainly data providers but can be potential users of the system once local data become accessible and shareable. This group is identified in Chapter 4 on local government mandate in land use planning.

5.4.2. User Requirements

Based on the client survey conducted during fieldwork, most applicants go to CPDO to apply for zoning clearances. Of the 23 clients surveyed, 12 applied for zoning clearances, that is, 6 applications for business permits and another 6 for building permits. Clients also come to CPDO to secure data or to make inquiries. Of the total, 7 clients came to secure data, while 4 came to inquire. During the five-day survey, no certificate for site zoning classification was issued.

The same trend is observable in CPDO records. A total of 831 zoning clearances for building permit were issued in 2002, averaging 69 applications per month. Based on the data from the City Treasurer's Office, 4,401 zoning clearances for business permits were issued in the same year, averaging 367 permits per month. With regard to certificates for site zoning classifications, handwritten summary shows that CPDO approved 550 applications from 1990 to 2000, at an average of 50 per year or 4 a month. These applications involve more than 1 parcel or group of parcels for real property developments. On data provision, there is a logbook that keeps tab of people securing data but the list is incomplete. The logbook lists 131 clients from July to September 2003 or about 44 clients a month.

The statistics above shows that transactions in CPDO largely involve issuance of zoning clearances for business and building permits. This validated the interviews in CPDO that claimed that this service eats up staff hours and takes away time to do things such as planning. Data provision comes in second in terms of client demand. Majority of the respondents prefer that land use data and general information about Naga City are available in digital format and accessible in the website, as noted in Chapter 4.

In terms of service time, 11 clients finished their transactions with CPDO between 30 minutes and 1 hour as reflected in the client survey. 10 clients reported a service time of less than 15 minutes, while 2 respondents reported two days, that is, the first day was for filing application and the second day for claiming clearance. 12 of them had to deal with only one personnel in CPDO, 7 clients dealt with two personnel, while 3 had to deal with more than three personnel to get the service they need. There is room for improvement in providing service to clients. Service time can be maintained or even shortened while improving the quality of decision through sustainability assessment in issuing clearances.

The needs of users inside City Hall were also surfaced through interviews. Respondents were asked to identify tasks they want the system to perform. These define user needs at operational level. The interviews got a variety of responses, such as the following: Is this area zoned as residential or agricultural? Where are the areas with high population density, number of households, and volume of waste? How much areas have been converted or reclassified? In a particular area, how many establishments have been constructed for the year? Is this area suitable for resettlement site? Where in Naga City can we invest? What would be the implication of a project for the environment? Are we making the city livable?

In sum, user requirements are about service improvement and information provision. Specifically, they refer to the list below, which also reflects the interview responses regarding benefits of a land use information system in Naga City Hall.

- facilitate issuance of zoning clearances and certificates for site zoning classifications;
- ensure availability of and immediate access to data;
- provide means to update, process, and analyze land use data; and
- improve decision-making.

5.5. SYSTEM STRUCTURE AND FUNCTIONALITIES

This section models the structure and functionalities of the information system applying UML notation. The design focuses on development control and assessment identified in the System Architecture. This is the process that the researcher was able to observe and document while on fieldwork. It currently constitutes the major task of CPDO. In detailing the process, however, other components (e.g., operational databases, local knowledge) are also included in the design to exhibit important aspects of the system.

A brief description of UML is presented below. This is followed by the system design using UML diagrams, which are implemented in the next chapter through a prototype.

5.5.1. Unified Modeling Language

UML is a "visual language for modeling and communicating about systems through the use of diagrams and supporting text" (Alhir 2003: 4). This has been the industry standard since 1997. It unifies the best modeling techniques in the industry. What has been standardized is the notation or vocabulary, not the methodology or the process of developing a system. UML therefore can be applied to any development methodologies, such as Structured System Development Methodology, Unified Process, and Shlaer-Mellor Method. It can be used for different types of systems, processes, and applications. Further, it is applied to different phases of system development, from inception, design, to installation and maintenance. As the industry standard, UML is widely supported by computer-aided tools.

UML is based on the object-oriented paradigm. It models real-world phenomena as system of interacting objects. This paradigm is based on 4 principles: abstractions, encapsulation, generalization, and polymorphism (Alhir 2003: 23-26). Abstractions describe reality through concepts (i.e., classes and objects) and relationships (i.e., associations and links), representing the information essential to users. Encapsulation combines attributes and operations (i.e., internal implementation) of concepts into single units, which enables users to locate and modify concepts easily. Encapsulation also provides "information hiding," i.e., users may not know the attributes and operations of a system but can use it through an interface. Generalization allows specific classes to be grouped into general class, such that the former inherits the properties (e.g., attributes, relationships, operations, and methods) of the latter. Polymorphism provides that an operation of a system can be realized through

multiple methods. In UML, this means that the general class carries the common operation (for instance, validate property information) of the specific classes, which in turn has the same operation unique to that class.

These principles enable one to manage change and complexity of system (Alhir 2003). With information hiding, for instance, user access can be controlled and defined, and methods to realize operation can be modified, enhanced or replaced without presenting problems to users and other objects in the system. In applying the principle of generalization, concepts can be re-used to define new concepts and properties can be propagated. With polymorphism, operations and methods in both general and specific classes can be re-used for new classes.

UML develops a variety of diagrams for system development identified in Figure 5-4. The functional view shows how a system works. The static view shows the components of the system, while the dynamic view represents how components behave and interact (Pender 2002: 23-28). There are two other diagrams, i.e., Component and Deployment diagrams, which are commonly used for system installation.

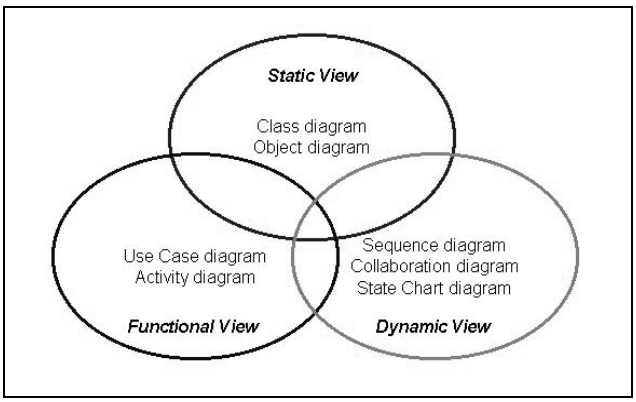

Figure 5-4. UML Diagrams (Pender 2002: 24)

For this study, the Use Case diagram, Activity diagram, and Class diagram will be applied to design the structure and functionalities of the system.

5.5.2. Use Case Diagram

Use Case diagram shows the functions, boundary, and actors of the system. It is a tool to communicate system context. It identifies the functions that the system needs to provide and the relationship of these functions. It defines system boundary showing what is outside and inside the system and how the system relates to the outside world. It identifies the actors, i.e., people and systems, interacting with the system. Below is the Use Case diagram of the proposed land use information system.

Based on the System Architecture and the user requirements, the functions or features of the system are enumerated below. They are user goals for the primary actors (i.e., CPDO and EDP) in fulfilling

their mandate and meeting user needs. In Figure 5-5, they are represented as Use Cases depicted as ellipses inside the land use information system.

- Process and decide on applications
- Provide and disseminate land use data
- Formulate and update land use plans
- Track and record land use changes
- Store and organize local knowledge
- Integrate and interpret databases related to land use

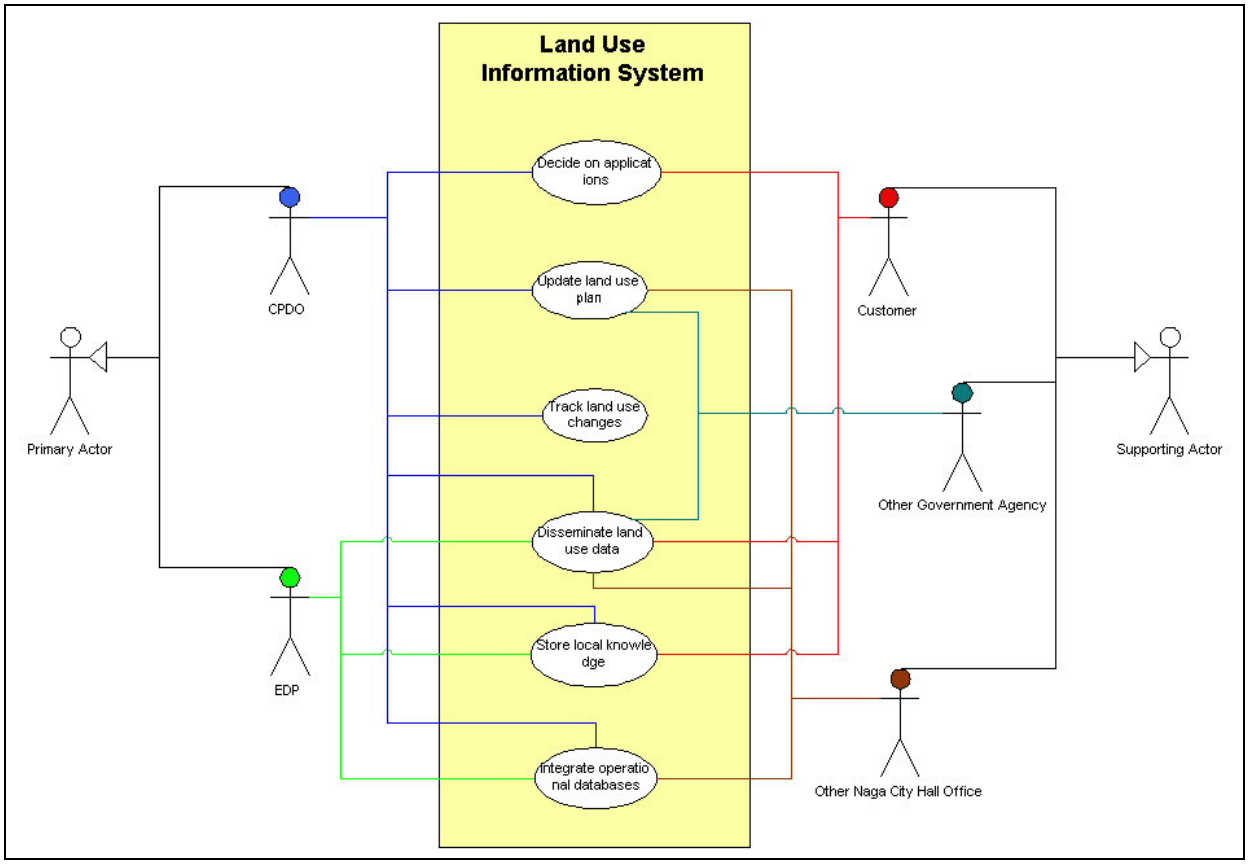

Figure 5-5. Use Case Diagram of Land Use Information System

The Use Case diagram is a high level representation of system functionalities, which will be elaborated at the task level with the Activity diagram. The system boundary encloses these various functionalities providing the context of system's internal behavior. The "stick figure" icons represent the Use Case Actors. They are identified in the previous section on user needs analysis.

The Actors communicate with the Use Cases through a relationship called Associations. In Figure 5-5, CPDO, the primary actor and user of the system, communicates with all the 6 Use Cases. It is responsible for deciding on applications for zoning clearances and certificates for site zoning classifications, for updating land use plans, for disseminating data on land use. The CPDO performs these responsibilities by tracking land use changes, capturing local knowledge, and accessing operational databases. The EDP is tasked to develop and maintain the databases and provide

technical support. The Customer initiates the application process, secures data, and participates in local knowledge acquisition. Concerned offices inside City Hall participates in updating land use plans, provides and disseminates relevant data. Other government offices provide data as inputs to land use planning and access data from local government.

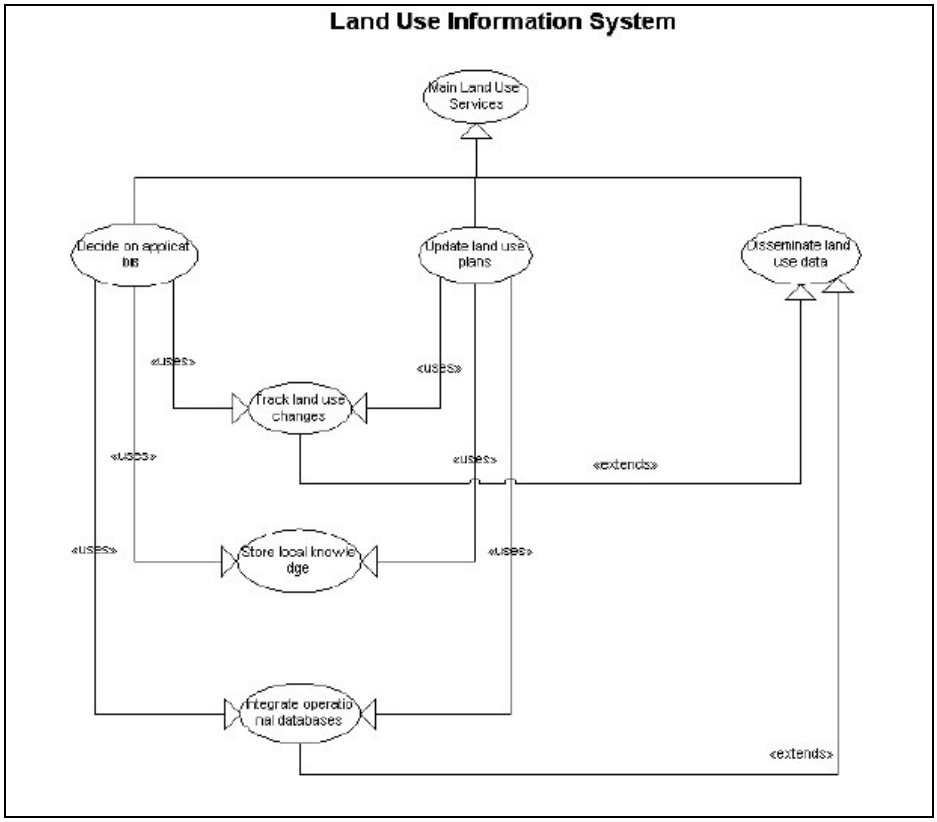

Figure 5-6. Dependencies of Use Cases

Figure 5-6 shows the dependencies of the 6 Use Cases. Three Use Cases are generalized as main land use services. The Use Cases Update land use plans and Decide on applications "use" the other three Use Cases. This means that these Use Cases depend on the other three. For the two Use Cases to function, they have to include or incorporate the Use Cases Track land use changes, Store local knowledge, and Integrate operational databases. The Use Case Disseminate land use data are extended or augmented by the Use Cases Track land use changes and Integrate operational databases. This means that this Use Case might need to use the Use Cases on land use changes and operational databases, implying a non-obligatory dependency.

5.5.3. Activity Diagram

Activity diagram depicts the activities and responsibilities of elements in a system (Alhir 2003: 156). This is similar to a flowchart but has been enhanced for object modeling to describe processes such as sequential tasks, conditional logic, and concurrency (Pender 2002: 25).

The Activity diagram is applied in this study to elaborate on the Use Case Decide on applications. It translates this high-level Use Case into task level diagram. The complete diagram is shown in

Appendix H. This integrates the various tasks involved in processing the different types of applications received by CPDO. As noted, the current process is documented in Appendices D, E, F, and G. The Activity diagram proposes to introduce improvements to this existing process.

The Activity diagram in Appendix H can be divided into four major processes: application filing, compliance assessment, sustainability assessment, and issuance and storage. They correspond to the development control and assessment in the System Architecture. They are shown in Figures 5-7 to 5-10.

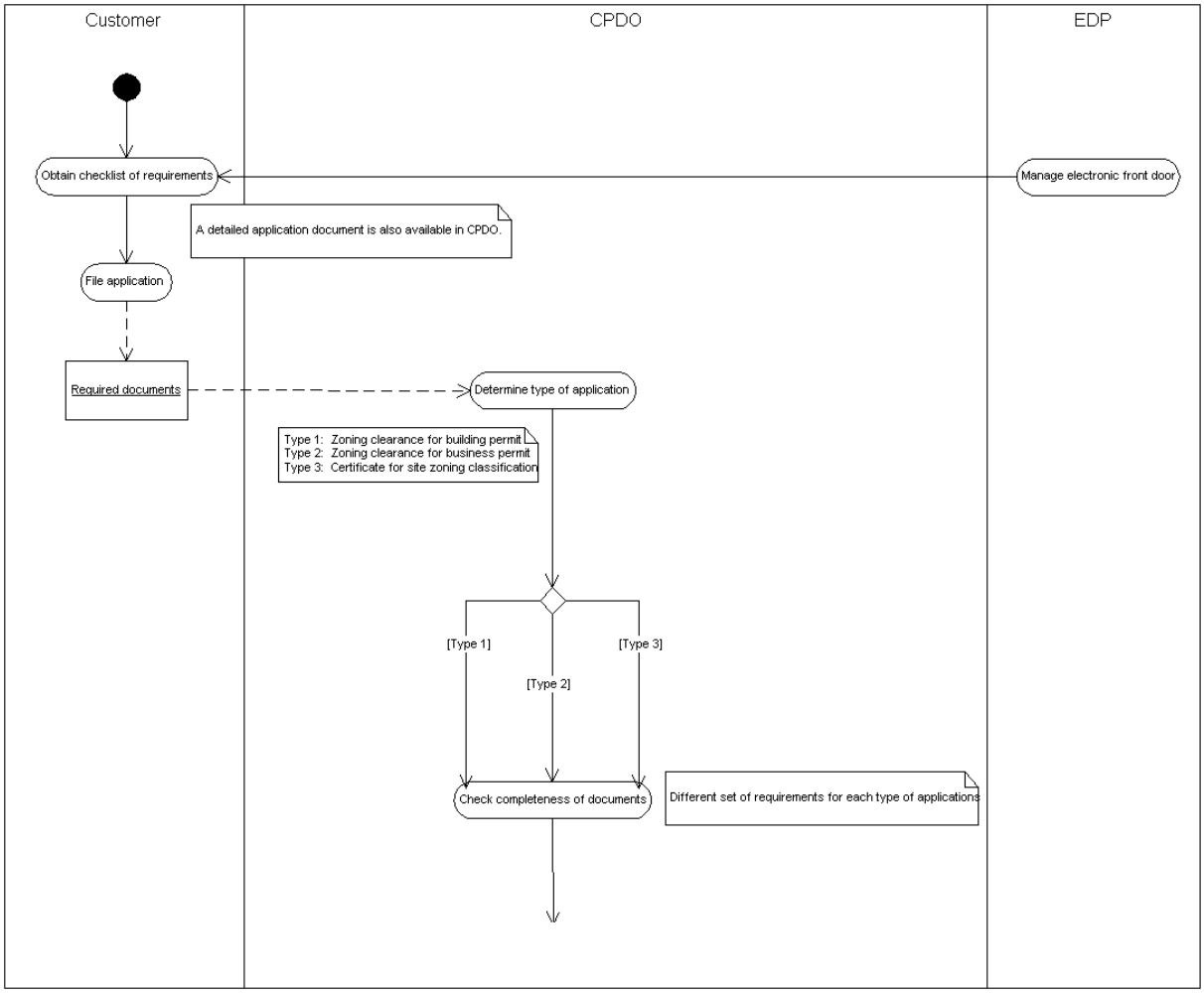

Figure 5-7. Activity Diagram on Filing of Application

The Activity diagram of UML is divided into regions called Swimlanes representing the actors or elements responsible for processing or performing a task. In Figure 5-7, Customer, CPDO and EDP are the Swimlanes. The processing is called an Action State. A solid circle denotes an initial Action State. In Figure 5-7, the Customer obtains a checklist of requirements through the electronic front door and then files the application. A note is included stating that an application document explaining in detail the requirements is also available in CPDO. When filing the application, the applicant produces an output called Required documents which becomes the input for the Action State Determine type of application, now within the Swimlane of CPDO. CPDO then decides on the type of application indicated by the diamond.

Naga City Hall has recently posted in their website the list of requirements and downloadable forms, thus improving dissemination. However, the number of documents required from applicants can be reduced. With an information system in place, applicants do not have to submit those documents that are available inside Naga City Hall, such as tax payment and assessment records.

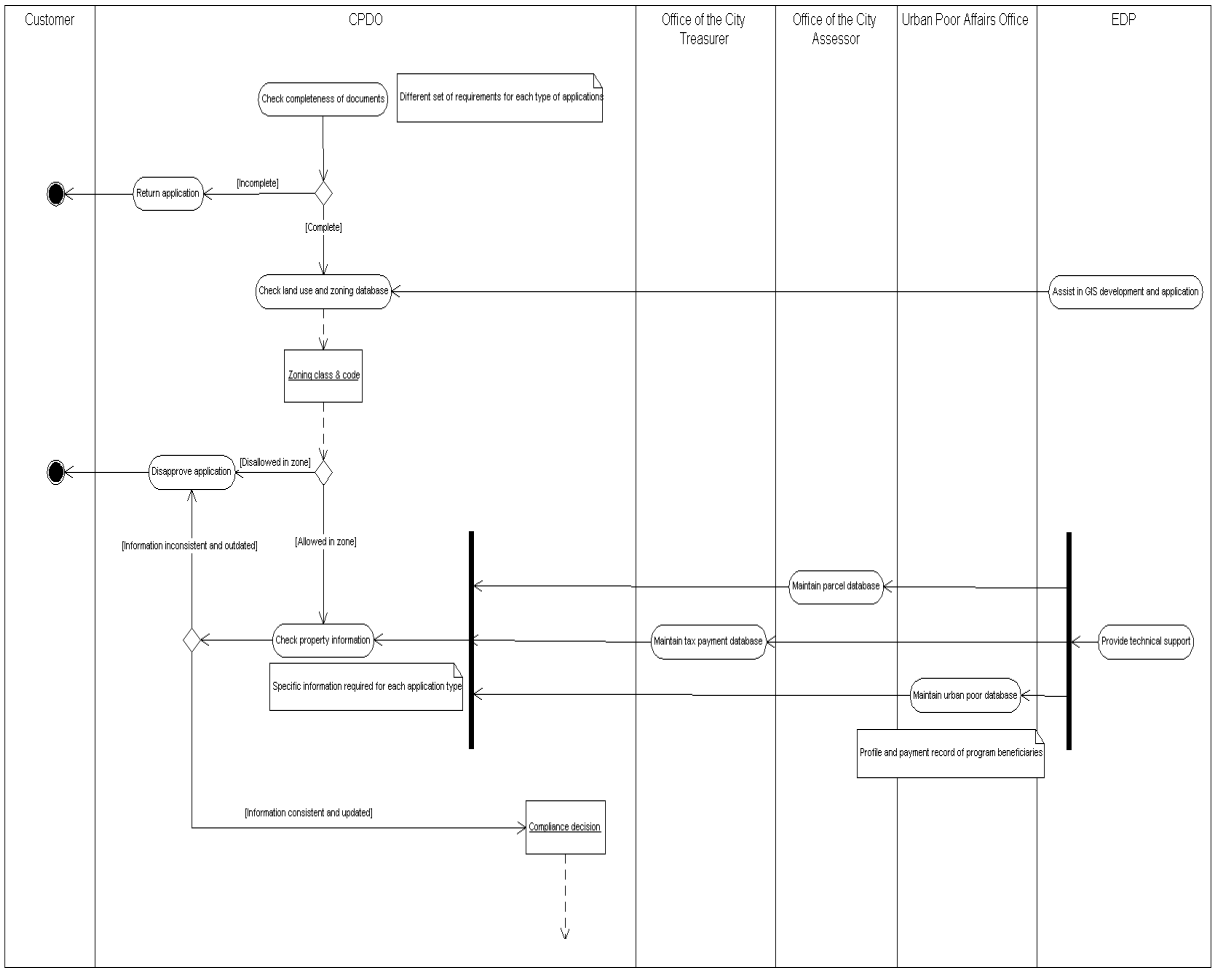

Figure 5-8. Activity Diagram on Compliance Assessment

The Activity diagram on compliance assessment in Figure 5-8 puts together and organizes the common tasks performed by CPDO in processing documents submitted for each application. As discussed in Chapter 4, applications are currently processed based on compliance. This is depicted in Action States Check completeness of document, Check land use and zoning, and Validate property information. If CPDO found that the application did not comply with the requirements, application is disapproved ending with a final Action State represented by a bull's eye.

In the diagram, the databases on parcel, tax payment, and urban poor are used to Validate property information. The current practice is to check the information manually, that is, CPDO staff checks zoning classification on a big zoning map pasted on the wall, records the zone district code, then goes to the Office of the City Assessor to verify parcel data that are kept in analog form. To validate property information, CPDO has to check the various databases. This involves multiple flows from different Action States followed by an outgoing flow, which is one type of concurrency represented by a short bar. The other type involves one incoming flow followed by two or more outgoing flows, as

seen in EDP providing technical assistance to different offices managing their own databases. Compiling the compliance data and coming up with a decision are the final tasks in the diagram. This Activity diagram assumes that a land use information system is in place where data are exchanged electronically between and among offices inside Naga City Hall. Such a system can result in the following benefits: staff time to process application is lessened; service time is reduced; and applicants do not have to go to different offices inside City Hall to obtain documents.

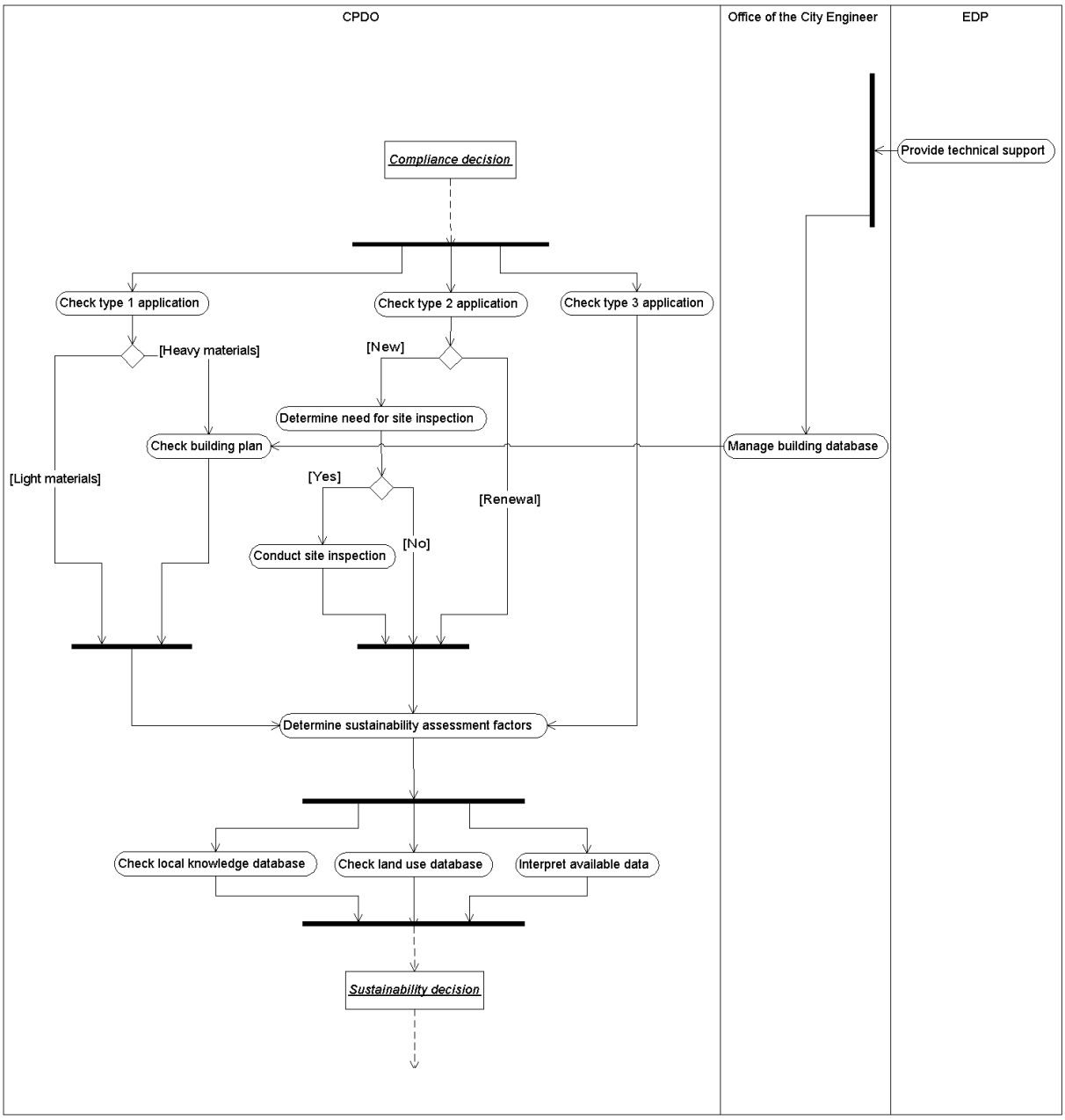

Figure 5-9. Activity Diagram on Sustainability Assessment

Sustainability assessment is the next phase depicted in Figure 5-9. The first part adopts the current practice of checking building plans—but this time with the help of the building database of City Engineer's Office—and of determining the need to conduct site inspection for business applications. Assessing sustainability is proposed, which evaluates applications based on strategic factors and looks at possible effects at community level. This requires the definition of a set of assessment factors for each type of application and other considerations for individual cases. The assessment is done with the help of land use and local knowledge databases, and available data inside City Hall. The information system should be able to help CPDO staff in coming up with informed decisions in assessing applications based on sustainability and community benefit.

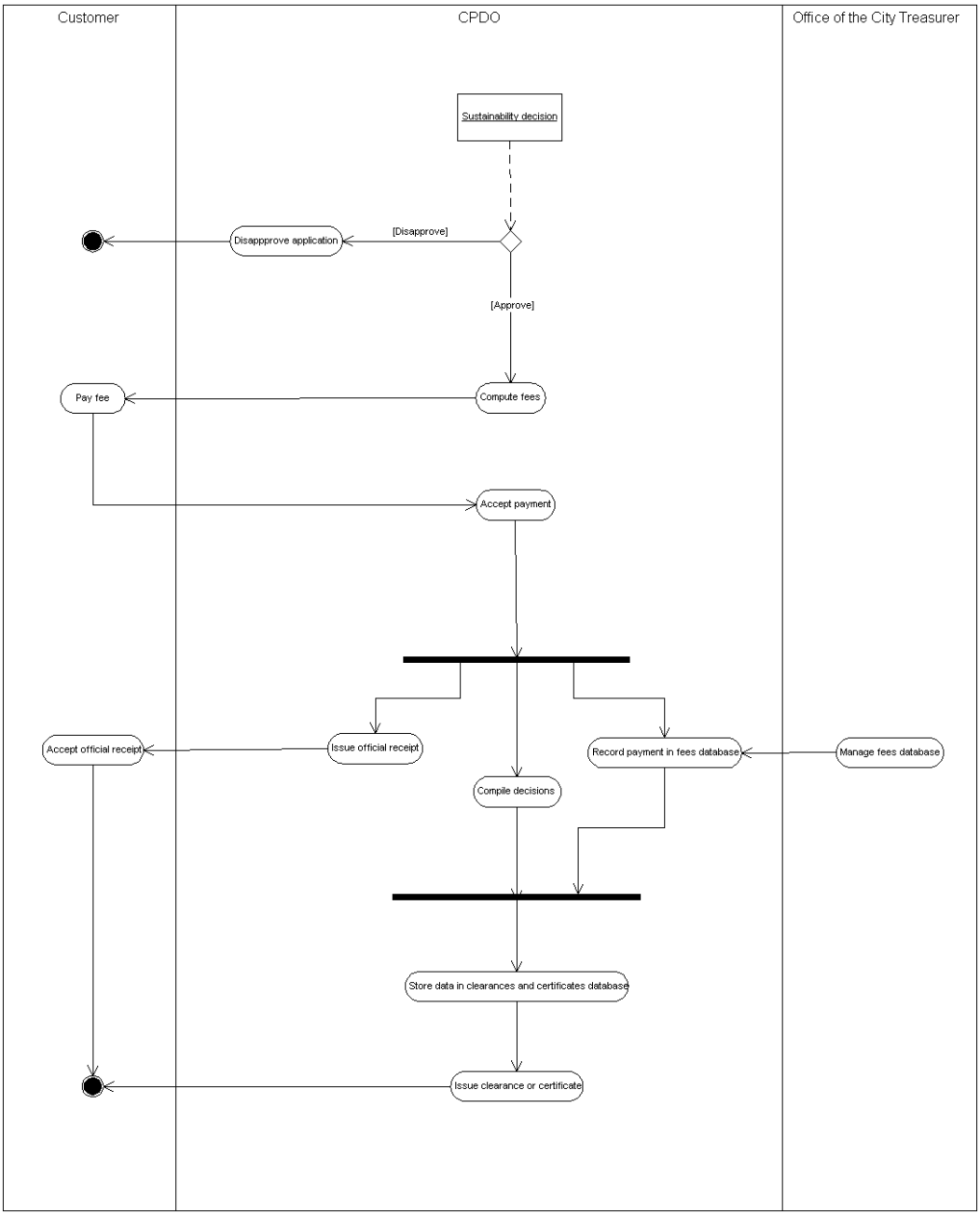

Figure 5-10. Activity Diagram on Issuance and Storage

Figure 5-10 involves the payment of fees, storage of assessment data, and issuance of clearances and certificates. Once the application passed the sustainability assessment, fees are computed and paid. The present practice is that applicant goes to the Office of the City Treasurer to make the payment. The proposed system provides that this is done in CPDO for the client to get the service immediately without having to transact business elsewhere. The Activity diagram indicates the need to compile and store data arising from compliance and sustainability assessments and decisions. Further, the system enables CPDO to generate reports and issue clearances and certificates.

In sum, the following improvements are envisioned with the proposed information system:

For the customer

- Forms and information on requirements are widely available
- Fewer documents to submit
- One-stop transaction dealing with one office and one personnel

For CPDO

- Less staff time to process application
- Databases are developed, integrated, and used
- Two-pronged assessment with compliance and sustainability as decision factors
- Validation, fees payment, and storage are done systematically and electronically
- Reports, clearances, and certificates are immediately generated

5.5.4. Class Diagram

Class diagram shows the general structure of the system (Alhir 2003: 43-44). It is composed of classes, attributes, operations, and associations. Classes are represented in a rectangle with three compartments depicting its class name in the first compartment, the attributes in the second, and operations in the third. Associations are relationships between and among classes, which can be simple association, aggregation, composition, and reflexive relationship. Association ends are defined in terms of multiplicity (e.g., 1, 1*, 0, 0..1, 0..*, 3, 2..9, etc.), which adopts the same principle of cardinality and optionality in Entity-Relationship diagram. A class diagram is similar to the ER diagram of the Relational Database Management System (RDBMS) but is enhanced for object modeling.

Figure 5-11 on the next page is the Class diagram for the proposed land use information system for Naga City Hall. It builds new relationships on existing datasets and incorporates new classes. This is at conceptual level, which can be updated once implemented in a database system. For this study, class operations are not defined, which can be done using the Sequence diagram of UML.

To facilitate discussion, the different classes are grouped into the following: Spatial Features, Applications, Land Use, Operational Databases, and Local Knowledge. The last four are adapted from the Use Cases in the previous section.

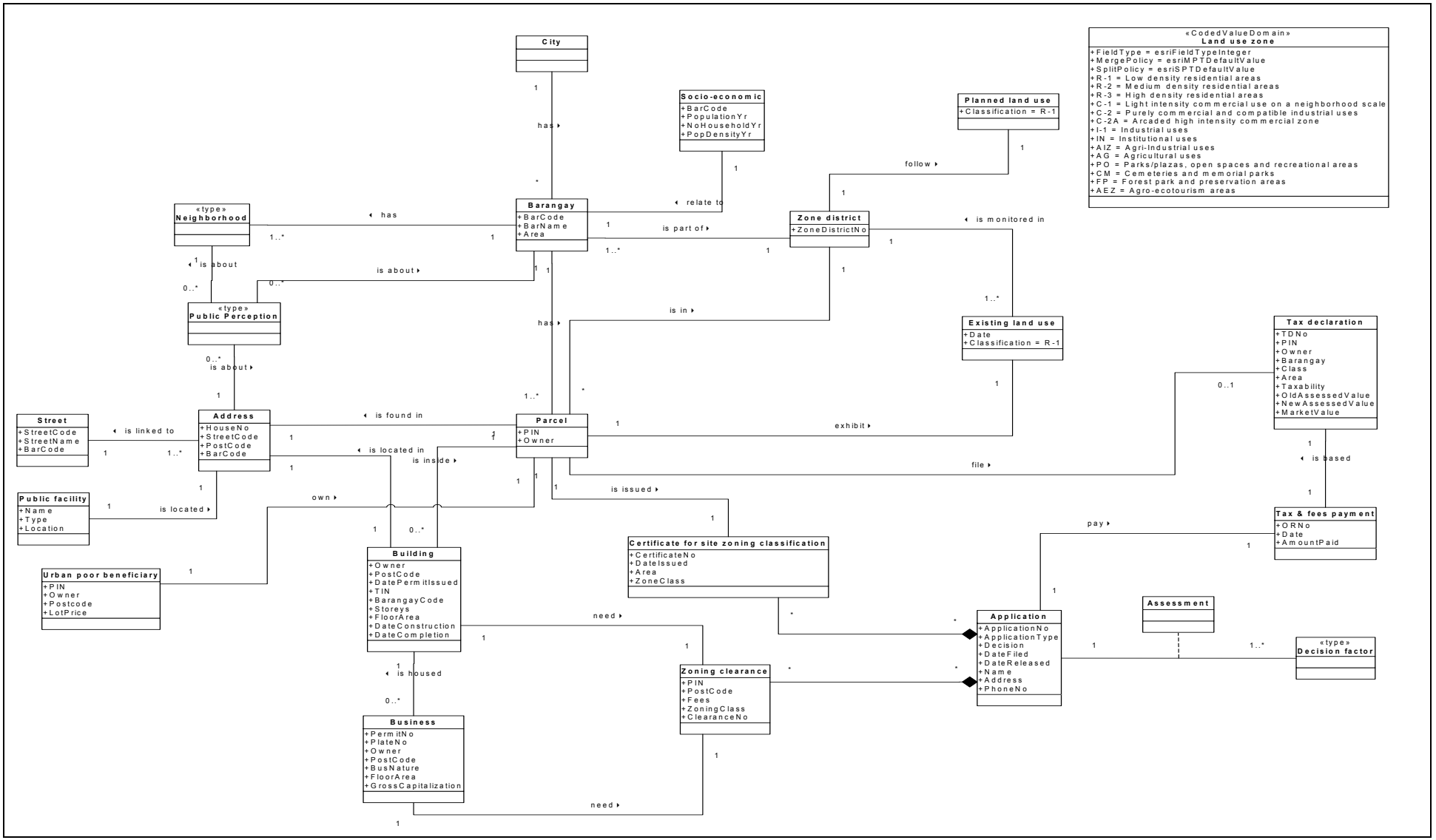

Figure 5-11. Class Diagram for Land Use Information System at Conceptual Level

Spatial Features include the classes Parcel, Street, Barangay, Neighborhood, Zone District, and City. Parcel data are kept for tax purposes. As noted in Chapter 4, efforts are underway in Naga City Hall to digitize parcel maps and use GIS application for tax administration. Street or road network is an existing map layer, which can be linked to Address. Address is the data commonly used to identify location of people and things, but has not been organized in a database structure and integrated in GIS. Neighborhood or block can be a smaller unit of *barangay*. This has been identified as Type in Figure 5-11, suggesting an idea for a possible class. The spatial units can be assembled into a single class such that aggregation, a special type of association, is applied. Aggregation is used for a "whole-part" or "has a" relationship. A group of parcels can be aggregated into a *barangay*, a neighborhood into *barangay*, and a *barangay* into a city. In UML, this signals an assembly of objects whose integrity can be protected by identifying a control object that can dictate how the member objects can act and respond (Pender 2002: 118-119).

The group Land Use includes the classes Planned land use and Existing land use. These classes use Zone district and Parcel as spatial units. A Zone District has Planned land use specified in the zoning ordinance. Existing land use, which is currently determined through field survey of parcels during CLUP formulation, can be regularly monitored to keep records updated. This is related to Zone district implying the need to keep track of how plans are developing in the field. The classifications of Planned land use and Existing land use are coded in ESRI template to facilitate the building of geodatabase in the next chapter.

The next group is Application. These include classes needed for deciding applications submitted to CPDO. The class Application is composed of two classes, i.e., Certificate for site zoning classification and Zoning clearance. This specialized type of association is called composition. It is also a "whole-part" type of relationship where the life span of the parts depends on the whole (Pender 2002: 119). Certificate for site zoning classification is issued for parcels, while Zoning clearance is issued for buildings and business. Further, the class Decision factor is associated with Application. An Association class called Assessment results from the relationship of these two classes. For assessing sustainability, higher spatial units—such as neighborhood, *barangay*, and city—may have to be applied.

Another group is Operational Database. These include the classes Building, Business, Tax declaration, Tax & fees payment, Urban poor beneficiary, Address, Public facility, and Socio-economic. They are generated and used in the day-to-day operations of Naga City Hall. The Application group uses most of these classes when processing clearances and certificates. Administratively, the Office of the City Engineer, the Office of the City Treasurer, and the Urban Poor Affairs Office maintain the datasets relating to these classes.

The next class is Public Perception, which is associated with Address, Neighborhood, and Barangay. This follows through the need to capture local knowledge, which has been discussed in the previous chapter.

6. DEMONSTRATING SYSTEM FUNCTIONALITIES: A PROTOTYPE

6.1. INTRODUCTION

This chapter aims to demonstrate system features through a prototype. A prototype is "a working model of a system or part of a system which may emphasize some specific aspects of it" (Reeve and Petch 1999: 119). Its use has become essential in the iterative process of system development. Through prototyping, the users experience or get a preview of the working parts of the system. It is a way to check progress, to validate and re-define requirements and solutions, and to ensure the participation of users throughout the stages of developing the system.

The prototype built here is a working data model of the Class diagram in the previous chapter. It is subjected to three tasks to demonstrate the following system features or functionalities: 1) providing immediate access to data; 2) facilitating decision-making; and 3) facilitating spatial analysis for land use planning. These tasks correspond to the user requirements identified in Chapter 5. Prototyping has various types and this one would qualify for what is called a decision support prototyping, which "involves subjecting a database structure to ad hoc enquiries or tasks required by different levels of management in order to refine the data structure" (Reeve and Petch 1999: 124).

This chapter has 5 sections. The first deals briefly with the steps in developing the prototype. The next 3 present the specific tasks of the working model. The final section defines potential problems in developing the system.

6.2. IMPLEMENTING THE DATA MODEL IN GIS

The UML diagrams in Chapter 5 were developed in Microsoft Visio using the template of ESRI ArcInfo UML System. The ESRI template is used to migrate the data model to ArcGIS 8.3. The ArcCatalog and ArcMap of ArcGIS were applied for building the geodatabase, loading existing map layers, and integrating spatial and non-spatial data. In populating the database, Microsoft Access and ArcMap were used.

Appendix I shows the steps done in translating the Class diagram into a geodatabase. The initial steps involve building the Class diagram in Visio, checking for UML semantics, defining primary and foreign keys using tagged values, ensuring consistency of data types, and generalizing the classes into ESRI feature classes and objects. These steps resulted in a Class diagram shown in Figure 6-1 below.

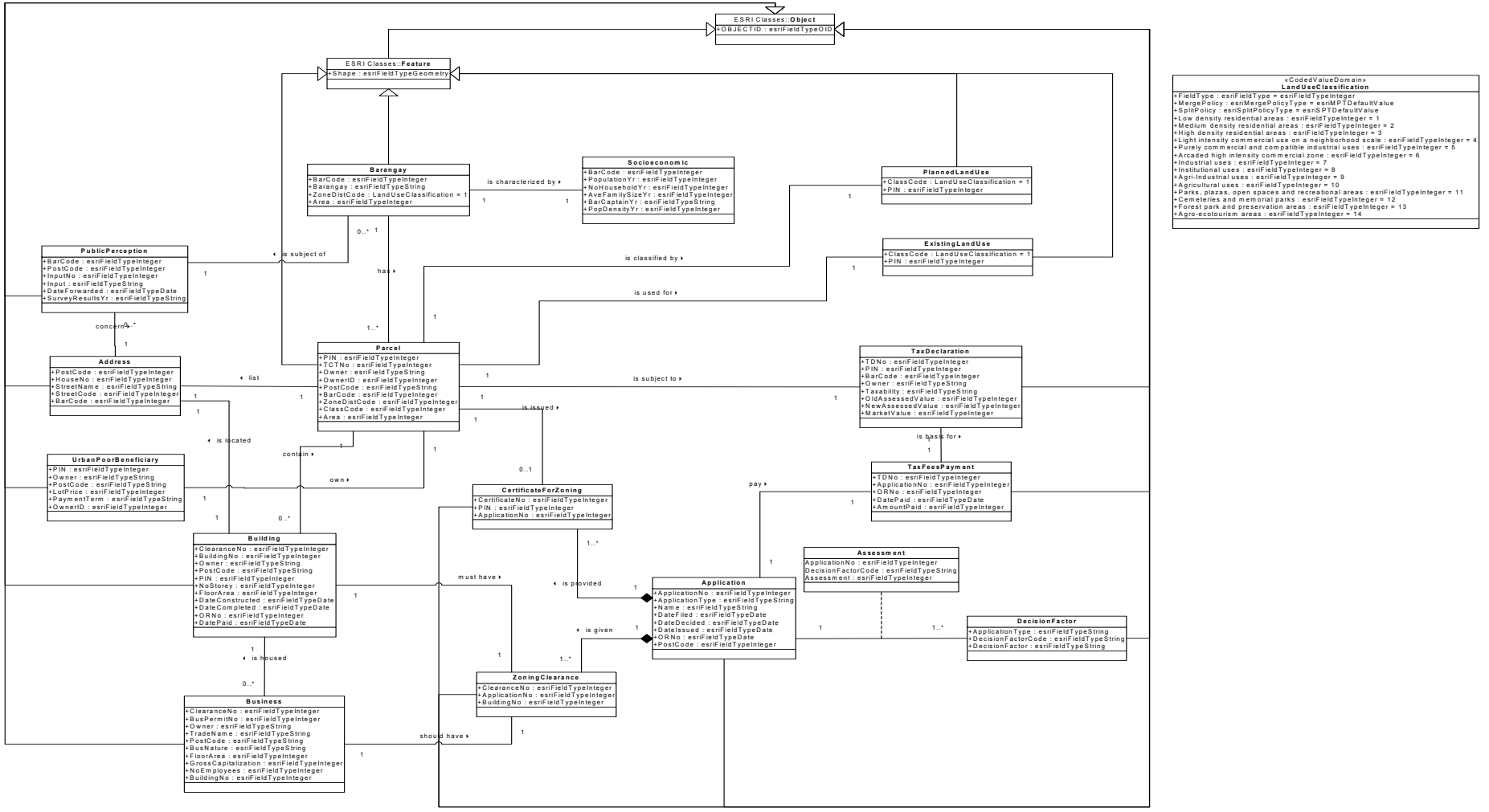

Figure 6-1. Class Diagram at Logical Level Complying with Semantics of ArcInfo UML System

Figure 6-1 translates the design in the preceding chapter from conceptual into logical level including relevant classes for the prototyping. This is exported and stored in a Repository that produces a database format. The Repository then is subjected to the semantics of the ArcInfo UML system.

When the Repository is cleaned of errors, this is then migrated to ArcGIS. First, a personal geodatabase is created in ArcCatalog. With the CASE (Computer Aided Software Engineering) Tool subsystem of ArcCatalog, a geodatabase schema is generated. This is done through the help of Schema Wizard, which identifies properties of classes and defines the spatial reference system. The next steps involve populating the geodatabase by either loading feature classes with existing map layer or digitizing scanned maps or images. Thematic data can be stored in the geodatabase using MSAccess or ArcMap. These various steps follow the guidelines set in building geodatabases (see ESRI 2002).

6.3. PROVIDING IMMEDIATE ACCESS TO DATA

The prototype performs the task of validating property information to show that the system can provide immediate data access and retrieval. The CPDO staff does the routine job of checking compliance with zoning, tax payment, building plan regulations, and the like, when processing applications. This is an Action State in the Activity diagram of Figure 5-8.

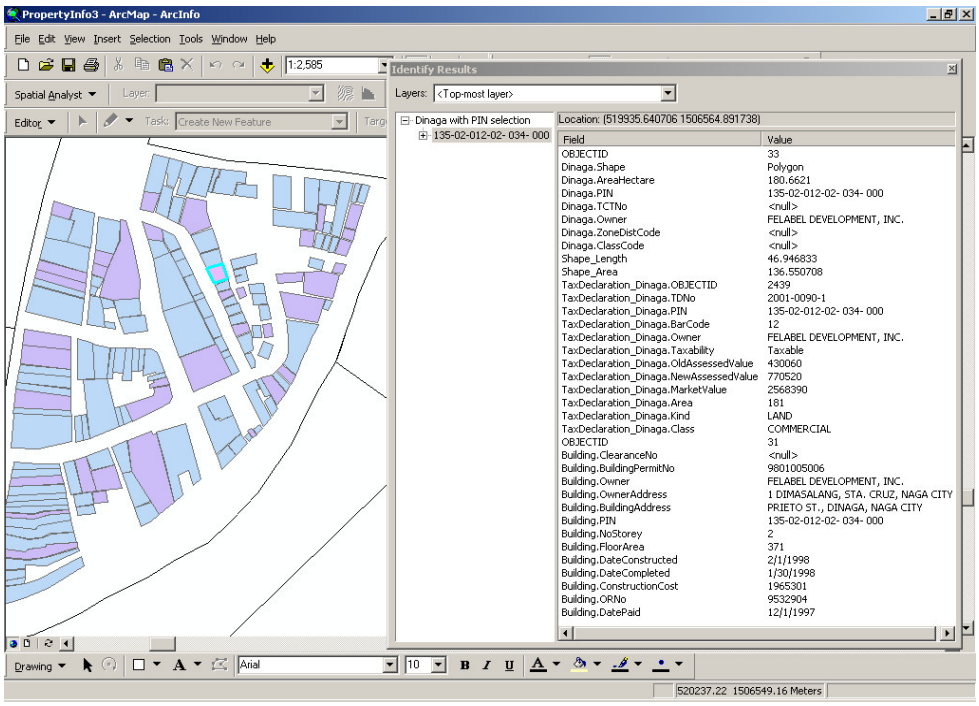

Figure 6-2. Screenshot of Accessing Property Data

Figure 6-1 is a screenshot of the prototype, which shows that the system is able to present "on the fly" all the needed data on a particular property or parcel. This is shown visually through ArcGIS that has the functionality to join and relate spatial and non-spatial data. The Parcel and Barangay feature

classes have been projected to the correct Philippine national grid at Luzon Zone IV using metric coordinates.

For this prototype, the classes Barangay, Parcel, TaxDeclaration, and Building are used. The Property Identification Number (PIN) is made as the unique identifier for Parcel and defined as foreign keys in the TaxDeclaration and Building. The PIN is composed of 13 digits to represent City, district, *barangay*, section, and property, with additional 3 digits as extension for buildings or machines. Property data including PIN are kept by the Office of the City Assessor based on tax declarations and payments of property owners.

The PIN can be used to relate the various operational databases inside Naga City Hall and to link spatial and non-spatial data. However, its use is confined in the Office of the City Assessor and the Office of the City Treasurer. Using a common system for identifying parcels such as the PIN can be a step toward integrating databases inside Naga City Hall.

The Office of the City Assessor has the big task ahead of cleaning parcel data and the PIN. In building the prototype, which only deals with only small *barangay*, i.e, Dinaga, the use of PIN as unique identifier was problematic. Firstly, the digitized parcels of Dinaga are shape files without attributes, which means that the PINs are not incorporated yet. This is the case since digitizing parcel maps is still ongoing. This presents difficulty in linking the shape file with data on tax declarations when building the prototype. Further complicating the problem is the fact that the PIN is not unique. Tax declarations extracted from the FoxPro database for year 2002 reveal duplicate PINs for two or even three parcels usually with the same owner or group of owners. In some cases, parcels do not have PINs.

These problems occur in the Dinaga sample data. To deal with the problem of matching shape file with the PINs, unique shape areas were identified and then matched with declared property area in the TaxDeclaration. This yielded 40 records for the prototype. Only a few records were used to join Parcel with PINs with data on Building, which are maintained by the Office of the City Engineer. Since Building are not related to Parcel and therefore do not use PIN, the prototype has used the attributes Owner and Address to match records.

Naga City Hall should pursue the completion of digitizing the parcel maps. Efforts should now be directed at uniquely identifying each parcel or property. Producing its own parcel maps has been a wise move on the part of the local government. This makes the system technically simple, adaptable, readily available, and useful for Naga City Hall. Relying on the Land Management Bureau of the Department of Environment and Natural Resources (i.e., responsible for cadastre survey) and the Land Registration Authority of the Department of Justice (i.e., responsible for keeping titles and deeds) would present delay and difficulty where the standards for boundary accuracy is very high and the methods of property demarcation can be complex.

With the parcel maps in place, the system can be upgradeable. Data from Parcel can be complemented with that of Address, which are ubiquitously present in any transactions inside Naga City Hall. Naga City Hall may have to think of ways to structure addresses, which are currently encoded in one long field in the database with string data type. As proposed in the Class diagram, the Address may have to be structured by house number, street, *barangay*, city, and postcode with well-

defined properties. Again, an identifier—such as the postcode or house number and street as composite identifier—may have to be decided. Unlike in the case of European countries, use of postcode in the Philippines is not yet established. To locate the address in the parcel map, the identifier may have to be joined with the PIN or can be located as parcel centroid or linked to street segments.

The next two figures illustrate other ways to access data with the prototype. As may be noted in Figure 6-1, land use classification code has null value. Information about this can be easily determined by overlaying PlannedLandUse as shown below. The map shows that Dinaga is located in high intensity commercial zone.

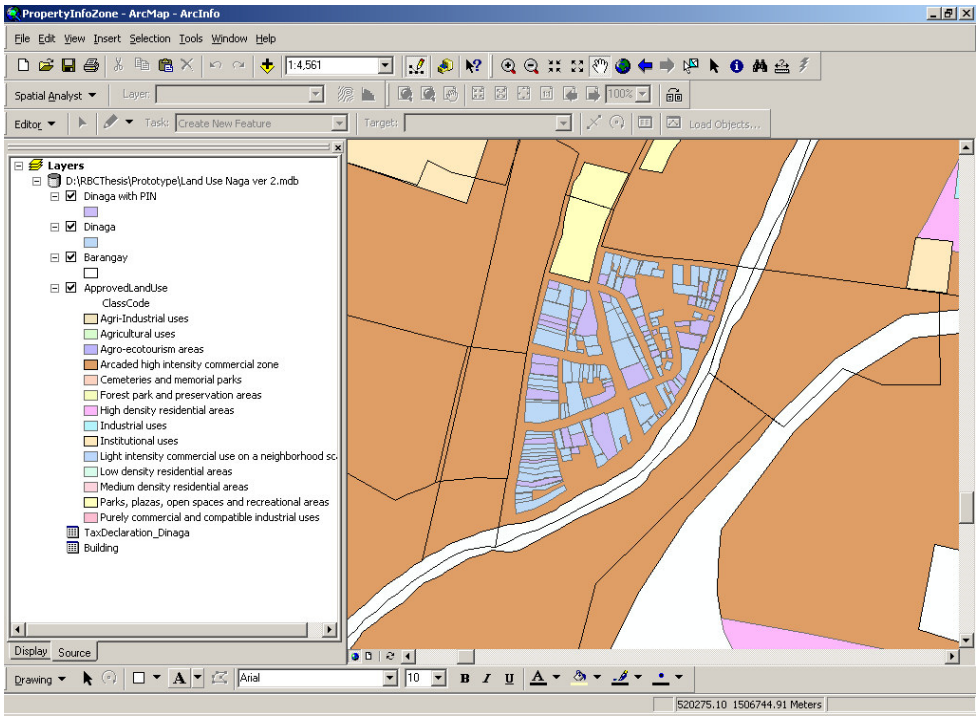

Figure 6-3. Screenshot of *Barangay* Dinaga with Planned Land Use Overlay

Another feature of the prototype is the use of Coded Value Domain in the UML Class Diagram. This resulted in a field with defined domain in ArcMap indicated by the pull-down menu in **Figure 6-4**. This ensures consistency and makes for easy updating.

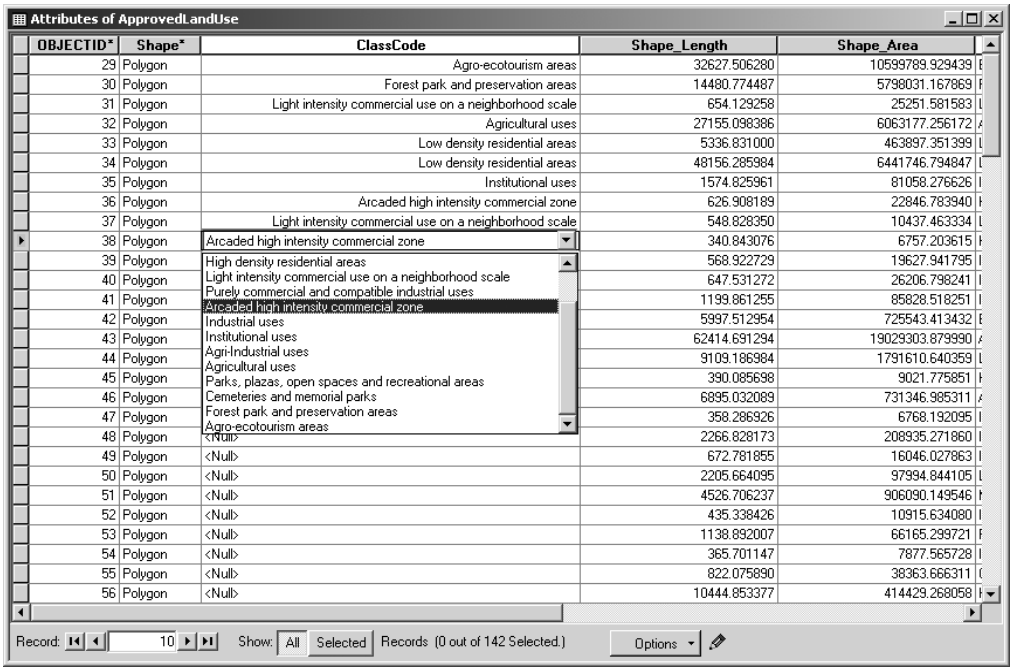

Figure 6-4. Screenshot of Land Use Classification with Coded Value Domain

6.4. FACILITATING DECISION-MAKING

The next task is to demonstrate how the system can help CPDO staff decide on applications. The issue about community benefit and sustainability becomes salient when applications are decided beyond completeness of documents and consistency of property information. The process is envisioned in the Activity diagram of Figure 5-9. The activities include determining decision factors, conducting assessment, and deciding on applications.

There is a need to come up with a set of decision factors to evaluate applications against community benefit and sustainability. This set of factors can be incorporated in the database. For this prototype, the decision factors are taken from available literature and zoning regulations. Appendix J is a sample decision table focusing on type 2 applications. The decision factors for evaluating an application for zoning clearance for a gasoline station, for instance, may include the following:

- Proximity to public land and likely impact
- Effects on free movement of pedestrians and public transport
- Impacts on natural physical features and resources in the area
- Availability of utility services
- At least 200 meters away from schools, churches, hospitals and similar institutions
- Provision of safety hazard prevention for residential area
- Provision of buffer strip and fire fighting equipment

Assessing the application against the 200-meter distance can be done in GIS as illustrated in the figure below.

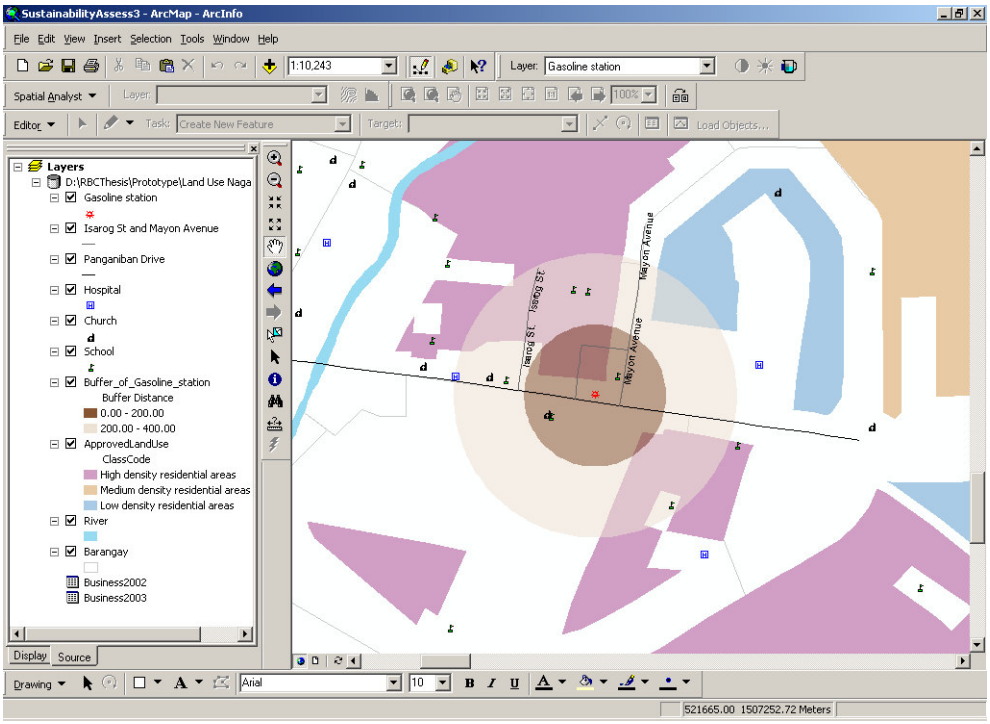

Figure 6-5. Screenshot of Gasoline Station with 200 to 400 Buffer Rings

The prototype uses an existing filling station extracted from the Business class to serve as example of an application. Figure 6-5 shows the application located along Panganiban Drive, which is in a high intensity commercial zone. In the figure, one can see that the gasoline station is adjacent to a high-density residential area. How the gasoline filling station could affect residential areas and what preventive measures could be required from owners should be considered in approving the application.

Using available map layer on public facilities in the area, such as schools, hospitals, and churches, one could determine proximity of these facilities to the filling station. As seen in Figure 6-4, the buffer ring indicated 2 schools and 1 church within the 200-meter radius. This may be a cause to disapprove the application or conduct an on-site inspection or require stringent rules for safety measures.

In addition to Barangay, PlannedLandUse, and map layer on public facilities, the prototype uses the class Business for years 2002 and 2003. Data from Business can give information on how many business permits were issued so far and what types of business are being set up along Panganiban Drive. This kind of information could be used for assessing the application and monitoring developments in the area. Panganiban Drive stretches 1,738 meters as measured in ArcMap. A query using the attribute table reveals that about 125 permits were issued in 2003 out of 4000 records and 91 in 2002 out of 2000. These figures are based on the data extracted during fieldwork from the Office of the City Treasurer, which maintains the database. They could reveal added information in assessing the application.

The assessment can be incorporated in the land use information system. A sample interface and a hypothetical assessment are shown below using attribute tables in ArcMap, integrating Assessment and DecisionFactor classes.

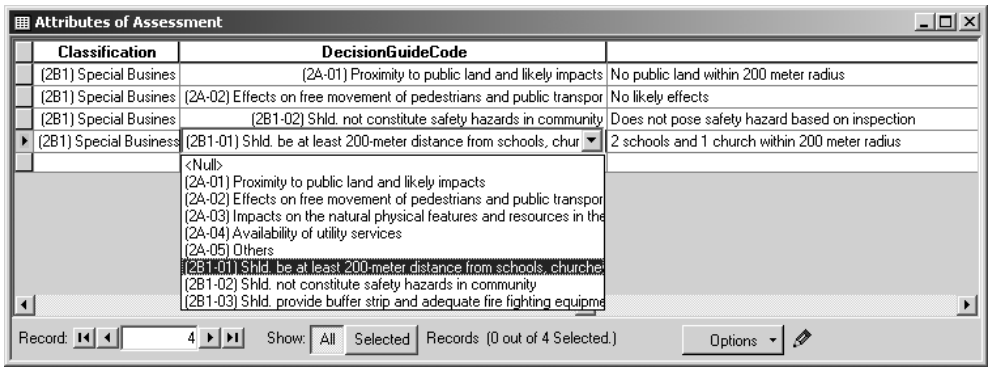

Figure 6-6. Screenshot of An Assessment Made on Gasoline Station Application

6.5. FACILITATING SPATIAL ANALYSIS FOR LAND USE PLANNING

The third task for the prototype is to conduct spatial analysis for land use planning. The task done here is straightforward given the limited data and policy information available. It uses the following classes in the Class diagram: Barangay, PlannedLandUse, SocioEconomic, PublicPerception, and slope map layer prepared by the Electronic Data Processing (EDP) Unit of the Naga City Hall.

As required by the Housing and Land Use Regulatory Board (HLURB), Naga City has to revisit its Comprehensive Land Use Plan (CLUP) every 5 years and update it, if necessary. 2005 is thus a planning year for Naga City Hall. One nagging concern that is sure to crop up is the issue of land conversion, which is a problem identified in the CLUP and has been noted many times in the fieldwork interviews. Local governments are faced with the conflicting demand to increase the size of urban lands and to keep agricultural lands for food production and development. This is a complex issue that straddles social, political, and economic dimensions. The prototype only shows a set of simplified procedures to demonstrate the use of the data model in GIS to facilitate and communicate analysis. It produces a suitability map as a means to help land use planners delineate suitable or developable areas.

Determining suitable areas for conversion from agricultural lands to other uses, such as to residential, should proceed from a good understanding of existing land use patterns and processes. As noted in previous chapters and in the System Architecture, analysis of demand should be done before carving out areas for certain use. For example, one of the many indicators that may be considered is population density, which can be mapped easily using GIS. A time-series data might reveal that in 2010 the city center at the western part could become overly populated beyond the city's carrying capacity if planned residential areas in 2000 were maintained. Decision-makers may have the knowledge of the negative implications of this for quality of life, provision of public services, peace and order, and the like. Maps can be generated joining the classes Barangay and SocioEconomic, with the latter containing time-series data on population.

After determining how much area to convert, decision-makers and land use planners may now proceed to identify suitable areas. A set of suitability criteria needs to be discussed and formulated. For this prototype, only the following criteria are considered. Other criteria—such as soil condition, natural hazards, water table, accessibility, and related public policies—may have to be defined in actual planning, which indicates the complicated nature of this type of decision-making.

- Land should not be covered under the Network of Protected Areas for Agriculture and Agro-industrial Development (NPAAAD) under Republic Act No. 8435.
- The area should be fairly flat and not more than 5% in slope.
- Public preference should be factored in the decision.
- The area should be located in low population density.

For the first criterion, the prototype uses PlannedLandUse to determine agricultural areas, excluding other zones especially forest and protected areas. This is shown in Figure 6-6. The selection function in ArcGIS is used to single out these areas. The figure is a simplified illustration considering that primary agricultural lands, irrigated areas, and those covered under agrarian reform program should also be excluded.

For the second criterion, the prototype uses a map layer that characterizes areas according to their slope ranging from flat to undulating to steep. The layer was originally generated in a different format using an older version of a GIS software. Thus, a number of procedures have to be done in ArcGIS to be able to integrate the layer in the prototype. Three slope categories are adopted for the analysis, that is, nearly level, slightly sloping, and moderately undulating to steep. Ranks are assigned for each of the categories, with nearly level getting the highest rank of 3. This is done in ArcGIS by adding rank and class fields in the attribute table of Slope. Finally, with ArcGIS, the prototype intersects the two layers, agricultural areas and the slope, to produce the suitability map based on slope.

The third criterion uses PublicPerception and Barangay classes. This illustrates the application of local knowledge in planning. As noted in the previous chapters, the capture of local knowledge can either be structured (e.g., survey, interviews, public forum) or unstructured (e.g., open suggestions and reports from individuals through the electronic front door). For this prototype, assumption was made that the local government has conducted a survey to surface preferences of citizens with regard to places where they want to reside. A set of hypothetical data is created on aggregate ranking of *barangays*, from most preferred to least preferred. The agricultural areas are then intersected with the Barangay feature class containing the public ranking, resulting in suitability map based on public perception.

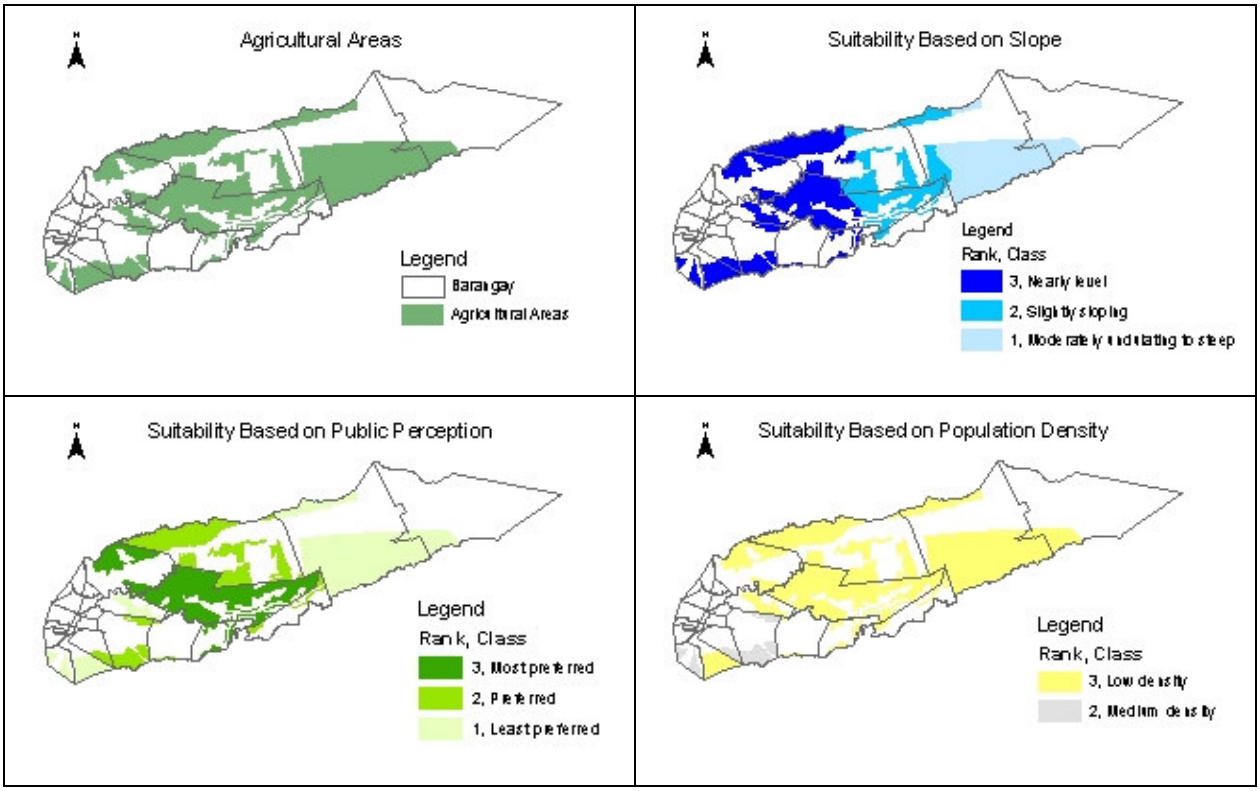

Figure 6-7. Map Series Determining Suitable Agricultural Areas for Conversion

The fourth criterion considers population density. Assumption was made that land use planners have decided to put up residential areas in *barangays* with low population density. Population density was computed in ArcGIS using population figures of 2004 and shape areas. Barangay and SocioEconomic classes are joined and then intersected with the map layer on agricultural areas.

The final output is a suitability map shown below incorporating the various criteria.

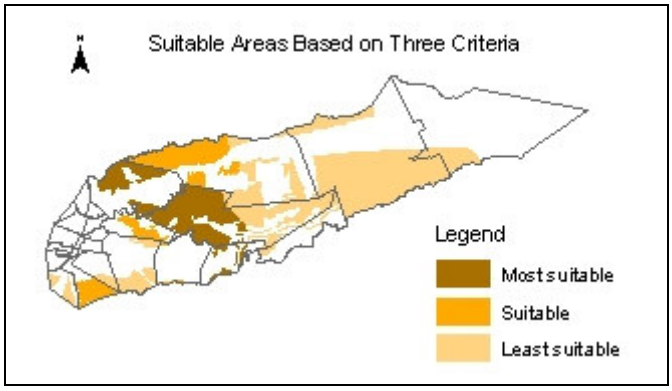

Figure 6-8. Suitable Agricultural Areas for Conversion

To arrive at the final suitability map, the prototype assumes that the decision-makers and planners have fixed weights on the three criteria of slope, public perception, and population density. Slope, being considered as the most critical, is given the highest weight of 3, then public perception 2, and population density the weight of 1. The degree of suitability is determined with the following formula (adapted from Kaiser et al. 1995: 217).

Degree of Suitability = (Rank Slope x 3) + (Rank PublicPerception x 2) + (Rank PopulationDensity x 1)

The prototype then uses the suitability maps based on these three criteria. First the suitability maps Slope and Public Perception are joined through spatial union in ArcGIS. Then, the product of the first union is again joined through the same procedure. The attribute table of the resulting map is used to compute for the weighted ranks. Finally, the weighted ranks are distributed according to the most suitable, suitable, and least suitable areas.

The various steps taken to produce the maps in Figures 6-6 and 6-7 are summarized in Appendix K. These steps, including those of the other two tasks of the prototype, can be programmed in ArcGIS using Visual Basic so that by just clicking an icon the tasks are automatically executed. Such functionality is especially helpful in doing regular tasks. A land use extension module can thus be created to customize the software for land use application and to develop a user-friendly graphical interface.

6.6. POTENTIAL PROBLEMS IN IMPLEMENTATION

Developing the prototype has revealed a number of problems that can become stumbling blocks in fully implementing the system. These problems can serve as agenda for local government to ensure successful development of an information system.

- *Absence of a key identifier to link datasets*

This is evident in prototyping data retrieval and access. The difficulty is traced to the absence of a key identifier that would allow datasets kept by various offices inside Naga City Hall to be joined and related. A key identifier is essential to link spatial to non-spatial data, such as parcel map to tax records or streets to address. This is a basic principle in relational databases enabling one to relate and manipulate thematic data or tables, such as that of building and business.

Since most of the data concerning land use is based on property information, the use of PIN is recommended. Various offices dealing with zoning clearances and certificates, building and business permits, tax declarations and payments, can use this to identify property and ownership. This has been demonstrated in the prototype. With the effort of the local government to digitize tax maps based on parcel, incorporating tables in GIS can be straightforward. However, as noted in the prototyping, there is a need to clean the tax records for duplicate PINs and parcels without PINs. Again, making the identifier unique for each record and not allowing null values are essential in database management.

- *Heterogeneous data models and software applications*

Presently, each office inside Naga City Hall maintains its datasets and has its own way of keeping records. As noted in Chapter 4, individual offices have undergone computerization at different points in time with the objective to automate specific tasks inside the office. This has resulted in the use of different software applications and different data models.

Tax records are encoded in FoxPro. Building data are encoded in MsAccess. Zoning clearances and certificates for site zoning classifications are generated in MsWord. Map layers are produced in ArcView and AUTOCAD. In building the prototype, files were integrated in MsAccess and ArcGIS, which required migrating from one application to the other. The use of different software applications presents problem for computers to communicate and for data to be integrated.

Related to the first problem is the use of different data models. As already mentioned, the use of identifiers that are common to these data models is not practiced. Further, the same attributes in various datasets apply different data types (e.g., integer or string) and domain values (e.g., different classification codes for the same class). As illustrated in the prototype, domain values can be coded in the model for consistency and easy updating. Apart from the difficulty in integrating data, having different data models can lead to redundant storage and conflicting data, such is often the case with property information kept by various offices.

- *Untapped location-based datasets collected in daily operations*

There are datasets in local government that are collected in almost every transaction. Often, these datasets are not used or reused. One such dataset is address. Address is location-based, which can be applied to code and identify areas, properties, facilities, and similar objects in space. This can therefore be incorporated in a GIS. As noted, however, address dataset is oftentimes incomplete since data properties are not well defined. This is usually set as long data string, which yields records with either the name of street only or the name of *barangay*. As noted in the prototype, the use of postcode is not prevalent in the Philippines.

There is a need to look into address datasets and standardize a system to make it useful for local government. Building an address system for local government incorporated in a GIS can be a topic for further research.

- *Unstructured sustainability and suitability criteria for land use*

The prototype has noted the importance of arriving at sets of criteria for assessing sustainability of applications, and for determining suitability of developable areas. This follows through the proposal for the information system to keep a database of land-related policies and plans from where these sets of criteria can be derived. This facilitates the definition of criteria considering that these policies, programs, formal and informal regulations, and plans are found in different offices and may have provisions that are inconsistent. Having a land policies inventory stored in a database system and easily accessible can guide land use assessment and planning.

7. CONCLUSION

The study is about developing a land use information system for Naga City. It examines land use practices in local government with the view of designing a system to improve the current setup. This has been accomplished through analysis, design, and prototyping. The analysis starts with the literature review (i.e., in Chapter 3) as evolving concepts and emerging trends are surveyed and then used as lens through which to examine critically the existing condition of Naga City in land use planning and monitoring, and in the application of GIS and database technology (i.e., in Chapter 4). The analysis then serves as backdrop to defining system requirements and designing the System Architecture (i.e., Chapter 5). From there, the study determines user requirements and proposes the design for system structure and functionalities (i.e., also in Chapter 5). It then runs a working model to demonstrate system features and identify implementation problems (i.e., in Chapter 6).

7.1. IMPLICATIONS FOR LOCAL GOVERNMENT

This concluding chapter defines how the information system with its components and functionalities can improve land use processes in Naga City Hall. That is, guided by the analysis, design and prototype, it spells out the implications of the proposed system for land use planning and monitoring in local government. The following can thus be concluded.

- *The development of land use information system can serve as platform to integrate data and facilitate data exchange in Naga City Hall.*

In the analysis, various issues were discussed, such as the unstructured yet rich datasets of various offices and the computerization efforts of the local government that resulted in islands of automation. Developing an information system for land use presents an opportunity for local government to store, maintain, integrate, and share data. Land use is a common concern of various offices inside Naga City Hall. Transactions on building and business permits, tax assessments and payments, are all tied to zoning regulations and land use policies.

Thus, in the design, operational databases are integrated within the land use processes of development control, assessment, and monitoring, as illustrated in the System Architecture. Going down to the task level design, these databases, which are maintained by different offices, are accessed and used in processing applications for zoning clearances and certificates for site zoning classifications. At both global and task level, the integration of these databases is seen as an important aspect of the system.

The prototype reveals, however, that integration is not as straightforward as it seems. In validating property information, for instance, the prototype found difficulty in uniquely identifying records, joining tables, and matching data. The prototype recommends making the Property Identification

Number (PIN) as identifier and key to link datasets. However, this entails cleaning records, digitizing and identifying parcels, setting standards, and coordinating efforts. Further, problems relating to heterogeneous data models and software applications need to be resolved to ensure that computers communicate and data are integrated.

- *A land use information system enables proactive decision-making*.

The processing of applications for clearances and certificates is a critical function for local government, which was highlighted in the analysis. Currently, the practice is to process applications based on compliance with zoning. As proposed, processing of applications should be seen as a decision-making function that evaluates applications in terms of strategic factors, such as community benefit and sustainability. An information system enables such function to be realized where developments in an area can be monitored, possible effects can be anticipated, and impacts of applications around surrounding areas can be evaluated.

In the design, sustainability assessment is incorporated in the System Architecture as part of the process of development control. This is further elaborated in the Activity diagram. Assessment and decision factor are built in the Class diagram and are related to application for zoning clearances and certificates.

As emphasized in the prototype, there is a need to define the decision factors that have to be incorporated in the database. These factors can be culled from existing regulations, studies, or formulated through public consultation. A land policies database is therefore included in the proposed system to guide assessment and planning. With an information system, available data can be retrieved easily, aggregated, and interpreted for decision-making. Analysis of spatial and non-spatial data can be done to relate an application to its environment and visualize it at different scales and various levels of details.

- *A land use information system can be a means to induce community involvement in land use issues.*

Public consultation is a basic tenet of local governance. As discussed in the analysis, the present local administration has pursued this through public-private partnership, creation of the People's Council, and lately with i-Governance. Public consultation that involves community action can be a venue for planning and deciding land use issues. A land use information system can be a tool for community involvement through which land use information is disseminated and inputs from the public are gathered. Results of public consultation, both structured and unstructured, can be processed and recorded in the system.

In the design, this is realized through acquisition and data storage of local knowledge in the System Architecture. Local knowledge is envisioned to input into the assessment, monitoring, and planning processes. As indicated, acquiring local knowledge requires communication (i.e., strategies and channels) and consultation. One potential channel is the electronic front door.

In the prototype, public perception as a form of local knowledge is used to determine suitable areas for land use conversion. The prototype illustrates the application of local knowledge as decision criterion in planning developable areas.

- *A land use information system can facilitate and enhance analysis for land use planning.*

As noted in the analysis, Naga City Hall is rich in both spatial and non-spatial data acquired during the formulation of the Comprehensive Land Use Plan (CLUP) and generated daily from operations and transactions with the public. With the support of an information system, these data can be related and joined thus facilitating and enhancing analysis. This then can be used as input to planning. With an information system, planning can be done even outside the planning cycle that happens every 5 to 10 years, tackling land-related issues from traffic management, infrastructure, to eco-system development and private sector investment.

In the design, the System Architecture envisions land use planning supported by analysis of processes and requirements. For this to be realized, an integrated database is necessary to enable analysis and planning.

In the prototype, spatial analysis is undertaken to illustrate the potential of an information system in structuring and visualizing analysis. A series of suitability maps to determine agricultural areas for conversion was generated to inform the planning process. Again, the need to incorporate policies and regulations in the database for defining criteria in decision-making becomes relevant.

- *A land use information system can be a tool for improving public service.*

The information system is intended to support changes proposed in the land use processes of Naga City Hall. In the System Architecture, these changes range from the introduction of integrated databases, sustainability assessment, data interpretation, knowledge processing, to land supply and use, metadata and shareable data. Improving operations inside Naga City and using the information system for disseminating information and inducing community involvement can result in benefits for the public. As noted in modeling the process of issuing clearances and certificates, positive consequences of the design include less staff time in processing application, fewer documents for applicants to submit, consideration of community benefit, and one-stop transaction.

7.2. AGENDA FOR FURTHER RESEARCH

The land use information system proposed in this study has touched on many issues and aspects of local government and land use management. The following are components and implications of the information system that may have to be studied more in-depth. They are proposed as topics for further research.

- Local knowledge acquisition and processing for land use management
- Metadata and shareable part for land use data infrastructure
- Monitoring and recording land use changes through interpretation of operational datasets
- Development of an address system in local government
- Institutional and organizational arrangements for land use information system, e.g., capacity building for personnel to perform planning and development assessment; workflow and quality management
- Evaluation of Information and Communication Technology (ICT) development in Naga City Hall.

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APPENDICES

APPENDIX A. Guide Questions for Individual Interview

Plans and Priorities

1. What are the current priorities of Naga City Hall?
2. Are you meeting the targets for these priorities? If no, why?
3. Which targets are not met because of problem on information or computers?
4. Will the budget for information and communication technology (ICT) increase in the future? If no, why?
5. If yes, how would you spend the budget?

Existing Situation

Land Use Planning

6. What are the activities of local government in land use planning?
7. What problems did you encounter in formulating the Comprehensive Land Use Plan (CLUP)? Data? Resources? Expertise? Time constraints?
8. Which offices/people collaborated in making the CLUP?
9. With the CLUP in place, what other land use planning activities does local government do? Cite specific cases.

Land Use Monitoring

10. What are the activities/services of local government in land use monitoring?
11. How do you disseminate the procedures for the following services:
    - issuance of certificate for site zoning classification
    - issuance of zoning clearances for building and business permits
    - supply of land use data
12. Are there complaints about these services? If yes, how many? Nature of complaints?
13. What other land use monitoring activities does local government do? Cite specific cases.

Need for Information System

14. Was a database created during the formulation of the CLUP in 2000? If yes, what and how was the data stored? If no, why?
15. Is the processing of certificates and clearances automated? If yes, to what extent? If no, why?
16. What are the commonly requested data from CPDO? Are you able to provide them? If no, why?
17. What part of the land use activities works all the time with maps? With statistics or aggregated tables?
18. Is an information system on land use planning and monitoring necessary? If no, why?
19. If yes, in which land use activities/services could the greatest improvement be realized with an information system in place?

System Functionalities (information requirements)

20. What are the top five (5) questions on land use planning that an information system should be able to answer?
21. What are the top five (5) questions on land use monitoring that an information system should be able to answer?

22. What specific outputs should the system generate?
    a. Information
    b. Report
    c. Form
    d. Approval
    e. Others_____

System Services (quality of service requirements)

23. By how much should service time be reduced in processing certificates and clearances?
24. Do you think an information system would have an effect on how resources are used in land use planning and monitoring? For example, staff time, use of facility, data acquisition and use.
25. If no, why? If yes, how?
26. What other services should the CPDO provide with an information system?

APPENDIX B. Guide Questions for CPDO Staff Interview

About CPDO

Users

1. Can you name at least 3 users or customers of land use data and services inside Naga City Hall? Outside?
2. On the average, how many people come to CPDO in a day? Or call CPDO?
3. Does CPDO keep a database on users/customers? If so, what does CPDO store about these users/customers?

Services

4. What services do these users avail themselves of?
5. How much/how many of these services are provided on a daily or weekly basis?
6. Are there complaints about these services? If yes, how many? Nature of complaints?

Data

7. What data do you acquire and maintain to provide these services?
8. How about the data acquired to formulate the CLUP?
9. Where do you get the data? In what format?
10. How are they stored and organized?

Resources

11. What are the resources of the CPDO? Staff? Facility? Equipment?
12. How much are spent to acquire and maintain these resources? For example, in terms of personnel salary and benefits, facility and equipment costs. Figures for the last two (2) years, if available.
13. Does CPDO register staff activities and working time? Response time in delivering services?
14. How do you plan and manage office resources?

Procedures

15. What are the procedures for services identified in item 4? Or, can you explain the complete procedures for the following services?
    - Issue certificates of site zoning classification
    - Issue clearances for business and building permits
    - Supply land use information
    - Plan land use conversion
16. How do you disseminate the procedures and other relevant information (e.g., cost, service time) on these services?

Activities

Process

17. What are the activities and sub-activities involved in each procedure?
18. Who are doing which activity?
19. What do you expect to happen when you do the activity?
20. What happens when it doesn't work? Is there more than one possible outcome?

Data

16. What are the data used to perform the activity? What are the data created?
17. How are the data stored?

Constraints

18. Are there any regulations, contracts, or laws that dictate how you do the activity? Or, name at least 3 regulations that define how you perform your job.
19. Does this activity depend on other activities?

Resources

20. What resources/information do you rely on to do the activity?
21. What resource is involved in each activity?

Performance

22. How quickly does the activity have to be performed?
23. What factors influence or determine how quickly you can complete the activity?
24. Does the quantity and quality of resources affect how you perform the activity effectively? How?

APPENDIX C. Questionnaire for Client Survey

Dear respondent,

I am a staff member of the University of the Philippines. I am now enrolled at the International Institute for Geo-Information Science and Earth Observation (ITC), the Netherlands, as a graduate student. Your answers to this survey will be used in designing an information system on land use for Naga City, which I am doing with the support of the Mayor's Office. Your cooperation would be very much appreciated. *Mabalos po*.

Rizalino B. Cruz

Please check the boxes that correspond to your answer/s.

1. What is the purpose of your visit in the City Planning and Development Office (CPDO)?
   - ☐ Apply for certificate of site zoning classification
   - ☐ Apply for locational clearance for business permit
   - ☐ Apply for locational clearance for building permit
   - ☐ Secure data
     Please specify what data _____
   - ☐ Make inquiries
     Please specify nature of inquiry _____
   - ☐ Others _____

2. How many times have you visited the CPDO?
   - ☐ Once
   - ☐ Twice
   - ☐ Others _____

3. Did you get the service that you came here for?
   - ☐ Yes
   - ☐ No. Why not _____

4. Are the procedures for the service known and clear?
   - ☐ Yes
   - ☐ No
     Please specify what is not clear _____

5. How did you come to know of the service and the procedures?
   - ☐ Through the Naga City website
   - ☐ Through telephone
   - ☐ Through published documents
     Please specify _____
   - ☐ Through information posted in bulletin boards around the City Hall
   - ☐ Others _____

6. How much time did you wait before a staff from CPDO attended to your needs?
   - ☐ 1 to 10 minutes
   - ☐ 10 to 20 minutes
   - ☐ 20 to 30 minutes
   - ☐ Others _____

7. How much time did it take to finish your transaction?
   - ☐ 30 minutes to 1 hour
   - ☐ 1 to 1 ½ hours
   - ☐ 2 to 3 hours
   - ☐ 3 to 4 hours
   - ☐ Others _____

8. How do you find the service time?
   - ☐ Just enough
   - ☐ Too long
   - ☐ Other comments _____

9. How many persons in CPDO did you have to deal with to get the service you need?
   - ☐ One
   - ☐ Two
   - ☐ Others _____

10. Overall, are you satisfied with the service?
   - ☐ Yes
   - ☐ No

11. What needs improvement?

_____

_____

12. Can you suggest ways to improve the service?

_____

_____

13. What other services should CPDO provide?
   - ☐ Processing of application through the Naga City website
   - ☐ Availability of information in the Naga City website
   - ☐ Land use maps in digital or computer format
   - ☐ Other data
     Please specify what data _____
   - ☐ Others_____

14. Other comments and suggestions

_____

_____

APPENDIX D. Current Procedures in Issuing Zoning Clearance for Building Permit (for heavy materials)

Procedure*	Average Time*	Activities and sub-activities	Data used and created	How long the activity takes	Who is doing what	Re-source s used	Costs of re-sources
Accomplish-ment of re-quirements and assess-ment of fees Applicant fills up the Appli-cation Form and has it no-tarized. Zon-ing Official assesses the clearance fee to be paid. Applicant pro-ceeds to the Treasurer's Office.	30 min-utes	• Applicant inquires about requirements • Provide checklist of requirements in securing locational clearance for build-ing permit, as fol-lows: o Building Plans (1 set) o Application Form (3 copies) o Lot Plan (1 copy) o Bill of Materials (1 copy) o Specification (1 copy) o TCT/Deed of Sale (1 copy) o Tax Declaration (1 copy) o Updated Tax Payment (1 copy) o Environmental Compliance Certificate (ECC) o Contract of Lease (1 copy) o Official Receipt (O.R.) • Explain require-ments if there are questions. The fol-lowing are informa-tion commonly pro-vided to applicant. o Copy of Tax Declaration can be obtained	Require ments check-list	2 min 5 min 15 min	Cecille S. Daplin Planning Officer IV Job B. Oliva Statisti-cian II Rosemarie I. Ciu-dadano Planning Officer II	Staff time	Compute cost of staff time for each activity based on annual salary

		from the Assessor's Office. o A copy of an Updated Tax Payment can be obtained from the Treasurer's Office. o If applicant owns the lot, he/she should present a Transfer Certificate of Title and/or Deed of Sale. Otherwise, a Contract of Lease should be provided. o In case of environmentally critical projects (e.g., gasoline station, warehouses, commercial building) Certification/Endorsement should be obtained from the City Environment and Natural Resources Office (ENRO), then to the Environmental Management Bureau of the Department of Environment and Natural Resources to secure the ECC. • Provide applicant Application Form and Order of Payment Form. Payment depends on project cost. For	Project type Fee	2 min			

		building below P15,000 (built on light materials) a minimum fee of P20.00 is charged. For buildings made of heavy materials, a fee schedule issued by the HLURB is followed. Payment is paid at the Treasurer's Office. • If government property, no Order of Payment is required since government is exempted from tax, thus from locational clearance fee. • If applicant already has Bill of Materials, computation is made. If not, computation is done when applicant submits documents.	Bill of Materials	1 min 5 min			
Submission of requirements Applicant goes back to the CPDO with Official Receipt from Treasurer's Office and submits all requirements.	3 minutes	• Applicant submits required documents • Check if application form is duly accomplished and notarized. • Check completeness of documents. If complete, accept application and documents. If no, return documents. • If residential, application goes to the next phase, and is reviewed and processed. • If commercial, application is endorsed to Zoning Administrator for action.	Application Document Application type	0.25 min 0.5 min 2 min 0.25 min	Arc. Juan Villegas CPDO Head		

Review and verification Applicant waits while officer-in-charge reviews and verifies submitted requirements.	7 minutes	For residential and commercial: • Check that the following are contained in the Building Plan: o Signed by the owner o With Floor Plan signed by Engineer or Architect o With Electrical Plan signed by Electrical Engineer o With Plumbing signed by Sanitary Engineer • Check consistency of ownership, area, and location in the following documents: o Lot Plan o TCT or Deed of Sale o Tax Declaration o Updated Tax Payment • If Bill of Materials has not been computed, computation is made and applicant goes to the Treasurer's Office to pay. • In case ECC is needed for environmentally critical areas, check decision of DENR. If there is ECC, process application. If not, discontinue processing and return documents. • If applicant is not lot	Bldg Plan Owner Licensed Professional Area Location Bill of materials ECC DENR Lease contract	3 min 2 min			

		owner as the case in most business establishments, check contract of lease. • Ask applicant to present Official Receipt and note down the O.R. Number, date, and amount. If government property, this requirement is not necessary. • Check in Zoning Map, the zoning classification of location. • Check Zoning Matrix in Zoning Ordinance what is allowed in that zone. If type of building is allowed, proceed. Otherwise, deny application. • Get District Zone Code Number from Zoning Map.	Official receipt Zone class Zoning ordinance District Zone Code	1 min 1 min			
Preparation of locational clearance Officer-in-charge prepares, processes and records locational clearances.	15 minutes	• Prepare and encode Decision on Zoning with the following data: o Application number o Date of receipt o Decision no. o Date of issue o Applicant o Address o Name of Corporation o Address o Proposed activity o Area and location o Decision o Zone classification and Dis-	Data encoded	15 min			

		trict Zone Code Number o Conditions o O.R. No. o Date of issue of O.R. o Amount paid					
Approval of Locational clearance Applicant waits while officer-in-charge secures the signature of the Zoning Administrators.	2 minutes	• Zoning Administrator and the person who prepared the Decision sign the document. • Record in logbook the following data: o Decision number o Date o Applicant o Address o Project cost o Area o Fee o Zone Classification o District Zone Code Number • Applicant receives the Decision on Zoning and signs the logbook	Signatories Data recorded	1 min 1 min	Arch. Juan O. Villegas, Jr. Staff		

*Based on *The Naga City Citizens Charter: A Guidebook on Key City Government Services*. Naga City. (no date).

Activities and sub-activities were documented based on interviews with Rose Ciudadano on 10 September 2003 and Job Oliva on 29 September 2003. Documentation was validated with Job Oliva on 2 October 2003.

APPENDIX E. Current Procedures in Issuing Zoning Clearance for Building Permit (for light materials)

Procedure*	Average Time*	Activities and sub-activities	Data used and created	How long the activity takes	Who is doing what	Re-source s used	Costs of re-sources
Accomplish-ment of re-quirements and assess-ment of fees Applicant fills up the Appli-cation Form and has it nota-rized. Zoning Official as-sesses the clearance fee to be paid. Applicant pro-ceeds to the City Treas-urer's Office.	30 min-utes	• Applicant inquires about requirements • Ask applicant the project cost of building • If project cost is below P15,000, the project would qual-ify as building of light materials based on the Build-ing Code • Then, provide checklist of re-quirements in se-curing locational clearance for build-ing permit, as fol-lows: o Application Form (3 cop-ies) o Electrical Lay-out (1 copy) o Transfer Cer-tificate of Ti-tle/Deed of Sale/Urban Poor Certifica-tion (1 copy) o Sketch Plan of Proposed House (1 copy) o Bill of Materi-als (1 copy) • Explain require-ments. The ff. are information pro-vided to applicant. o If Urban Poor beneficiaries, copy of Award	Require ments check-list Urban Poor	1 min 1 min 1 min 5 min 15 min	Cecille S. Daplin Planning Officer IV Job B. Oliva Statisti-cian II Rosemarie I. Ciu-dadano Planning Officer II	Staff time	Compute cost of staff time for each activity based on annual salary

		Certification from the Urban Poor Affairs should be submitted. o If applicant owns the lot, he/she should present a Transfer Certificate of Title and/or Deed of Sale. If not, a Special Power of Attorney (SPA) from the real owner should be presented. • Provide applicant Application Form and Order of Payment Form. Payment depends on project cost. For building below P15,000 (light materials) a minimum fee of P20.00 is charged. Payment is paid at the Treasurer's Office.	beneficiary Ownership Project type Fee	 7 min			
Submission of requirements Applicant goes back to the CPDO with the Official Receipt and submits all requirements.	3 minutes	• Applicant submits required documents • Check completeness of documents. If complete, accept application and documents. If no, return documents.	Application Documents	1 min 2 min			
Review and verification Applicant waits while officer-in-charge reviews and verifies	7 minutes	• Check if application form is filled out, duly signed and notarized • Establish ownership o If applicant owns lot, ap-	Application Ownership	1 min 3 min			

submitted requirements.		owns lot, applicant submits TCT or Deed of Sale o If Urban Poor beneficiaries, applicant submits Certification from the Urban Poor Affairs Office o If applicant is not owner, applicant submits authorization from real owner • Check the sketch plan o Location—check Zoning Map for zone classification and get District Zone Code Number o Area—square meters o Signed by owner • Ask applicant to present Official Receipt and note down the O.R. Number, date, and amount.	ship Urban Poor beneficiary Representative Location District Zone No. Area O.R. No. Date Amount	3 min 1 min			
Preparation of locational clearance Officer-in-charge prepares, processes and records locational clearances.	15 minutes	• Prepare Decision on Zoning and encode the ff. data: o Application number o Date of receipt o Decision number o Date of issue o Applicant	Data encoded	15 min			

		○ Address ○ Name of Corporation ○ Address ○ Proposed activity ○ Area and location ○ Decision ○ Zone classification and District Zone Code Number ○ Conditions ○ O.R. No. and date of issue ○ Amount paid					
Approval of Locational clearance Applicant waits while officer-in-charge secures the signature of the Zoning Administrators.	2 minutes	• Zoning Administrator and the person who prepared the Decision sign the document. • Record in logbook the following data: ○ Decision number ○ Date ○ Applicant ○ Address ○ Project cost ○ Area ○ Fee ○ Zone Classification ○ District Zone Code Number • Applicant receives the Decision on Zoning and signs the logbook	Signatory Data recorded	1 min 1 min	Arch. Juan O. Villegas, Jr. City Government Development Head I		

*Based on *The Naga City Citizens Charter: A Guidebook on Key City Government Services*. Naga City. (no date).

Activities and sub-activities were documented based on the interviews with Rose Ciudadano on 10 September 2003 and Job Oliva on 29 September 2003. Documentation was validated with Ms. Rose Ciudadano on 3 October 2003.

APPENDIX F. Current Procedures in Issuing Zoning Clearances for Business Permit

Procedure*	Average Time*	Activities and sub-activities	Data used and created	How long the activity takes	Who is doing what	Re-source s used	Costs of re-sources
Filing of application Applicant goes to the CPDO frontline personnel and states his purpose	3 minutes	• Applicant brings application form for business license and mayor's permit • If applicant has no Application Form, inform applicant to get the form from Treasurer's Office • Applicant fills out the form and follow instructions and requirements of the Treasurer's Office • Applicant brings filled out form to CPDO for signature and approval as to zoning	Application	1 min 1 min 1 min	Cecille S. Daplin Planning Officer IV Job B. Oliva Statistician II Rosemarie I. Ciudadano Planning Officer II	Staff time	Compute cost of staff time for each activity based on annual salary
Review of documents Zoning official reviews the computer print-out from the City Treasurer's Office and checks the location of the business again the land use plan.	7 minutes	• Check if the ff. information are provided in the Application Form o Type of application, i.e., new or renewal o Name and signature of applicant o Business trade name o Business address o Nature of business o Number of employees o Capitalization • Check application form for the ff: o Activity o Location vs.	Data in application form Activity Loca-	3 min 2 min	Cecille S. Daplin Planning Officer IV Job B. Oliva Statistician II Rosemarie I. Ciudadano Planning Officer II		

		zoning map • If location is not in zoning, refer to Zoning Administrator for instruction. Usually, site inspection is conducted • If yes, process application and sign it for approval.	tion Zone	1 min 1 min			
Site inspection (optional) If site inspection is required, frontline officer refers the same to the Zoning Administrator, zoning official or their authorized representative. Site inspection is usually required for new enterprises.	1 hour	• In case of non-conforming to zoning, schedule site inspection. The following are examples of cases needed site inspection: o Squatting o Vulcaning and junk shops (e.g., must have work areas; does not occupy sidewalk; must not be in residential zone) o Videoke bars (e.g., must not be inside residential zone) o Auto-repair shops (e.g., must have transformer to avoid electric fluctuations around neighborhood) • Conduct site inspection	Site description	1 hour			
Processing of documents Frontline personnel processes and records the	5 minutes	• If application is new, record ff. data in log book o Date o Name of owner	Data encoded	5 min	Cecille S. Daplin Planning Officer IV Job B.		

documents		○ Business name/trade name ○ Location (business address) ○ Capitalization ○ Number of employees ○ Nature of business ○ Site zoning classification • If renewal, no need to record in log book			Oliva Statistician II Rosemarie I. Ciudadano Planning Officer II		
Approval The Zoning Administrator approves the clearance and signs the computer print-out.	5 minutes	▪ Zoning Administrator reviews application and signs the form indicating approval as to zoning • Applicant receives the signed Application Form	Approval	4 min 1 min	Arch. Juan O. Villegas, Jr. City Government Development Head I		

*Based on *The Naga City Citizens Charter: A Guidebook on Key City Government Services*. Naga City. (no date).

Activities and sub-activities were documented based on interviews with Ms. Rose Ciudadano on 10 September 2003 and Mr. Job Oliva on 29 September 2003. Documentation validated with Ms. Rose Ciudadano on 3 October 2003.

APPENDIX G. Current Procedures in Issuing Certificate of Site Zoning Classification

Procedure*	Average Time*	Activities and sub-activities	Data used and created	How long activity takes	Person Responsible	Resources used	Costs of resources
Filing of application Applicant goes to the CPDO frontline personnel and asks for the requirements	10 minutes	▪ Provide checklist of requirements to applicant o Letter-request to the City Planning and Development Coordinator, Arch. Juan O. Villegas, Jr. o Lot Plan with vicinity map drawn to scale o Transfer Certificate of Title and/or Deed of Sale o Tax Declaration o Updated Tax Payment o Certification Fee (P20.00) ▪ Explain requirements if there are questions. The following are information commonly provided to applicant. o If applicant does not know Lot Plan, a sample Lot Plan is shown. o A copy of the TCT or Deed of Sale can be obtained from the Register	Requirements checklist	1 minute 2 minutes	Cecille S. Daplin Planning Officer IV Job B. Oliva Statistician II Rosemarie I. Ciudadano Planning Officer II	Staff time	Compute cost of staff time for each activity based on annual salary

		of Deeds. o A copy of Tax Declaration can be obtained from the Assessor's Office. o A copy of Updated Tax Payment can be obtained from the Treasurer's Office. ▪ Ask ff. questions: o Ownership of the lot. If applicant is not lot owner, applicant is informed that a Special Power of Attorney (SAP) from the real owner should be submitted. o Location and purpose of the application (i.e., whether it is residential or agricultural). Then, check from zoning map if proposed project site is located within approved zone. If location is not in approved zone, application is not accepted. ▪ Provide applicant an Order of Payment form.	Owner Parcel Representative Location Zone Fee	5 minutes 2 minutes			

		○ Explain that payment of Location Clearance Fee in the amount of P20.00 should be paid in the Treasurer's Office. ○ Inform applicant that receipt of payment should be presented when submitting the documents.	O.R. No. Amount Date				
Submission of request letter Applicant submits letter of request addressed to the Zoning Administrator together with the above requirements	5 minutes	▪ Read application letter ▪ Check documents for completeness in compliance with the Mayor's memorandum dated 6 June 2002. The ff. should be submitted: ○ Letter request ○ Lot Plan ○ TCT/Deed of Sale (TCT and Deed of Sale if there is lot transfer. TCT only if no lot transfer has occurred.) ○ Tax Declaration ○ Updated Tax Payment ○ Special Power of Attorney if applicant is not real owner ▪ If documents are not complete, ap-	Application Document	1 minute 3 minutes	Cecille S. Daplin Planning Officer IV Job B. Oliva Statistician II Rosemarie I. Ciudadano Planning Officer II	Staff time	

		plication is not accepted. ▪ If documents are complete, accept application with the documents ▪ Record application data, i.e., date, name of applicant, description ▪ Endorse application to City Planning and Development Coordinator for action	Data recorded	1 minute 1 minute	Higinio E. Badong Clerk III Arch. Juan O. Villegas, Jr. City Government Development Head I		
Review and verification Applicant waits while CPDO staff does research, review and verification Issuance of Certificate Applicant receives the Certificate of Site Zoning Classification	Average of 3 hours and 45 minutes (Maximum of 4 hours)	▪ Receive instructions from Zoning Administrator ▪ Review documents. Check the following: o If Lot Plan has TCT or Deed of Sale (to establish ownership) o If name of owner is the same in TCT, Deed of Sale, Lot Plan, Tax Payment, and Tax Declaration o If Tax Payment is updated for the year o If area in square meters is consistent in Lot Plan, TCT, Deed of Sale, and Tax Declaration (note: Tax	Ownership Owner's Name Tax payment Area	1 minute 30 minutes	Cecille S. Daplin Planning Officer IV Job B. Oliva Statistician II Rosemarie I. Ciudadano Planning Officer II	Staff time	

		Payment does not reflect lot area) o If applicant is not owner, he/she must be properly deputized by the owner through an SPA. ▪ Go to Assessor's Office for the following: o Locate Parcel through PIN ▪ Identify *barangay* ▪ Get PIN from Tax Declaration, Application Form, or Lot Plan, and use this to find the same PIN in Parcel Map o Check if name of owner is consistent in Lot Plan and Parcel Map o Check if area is consistent in Lot Plan and Parcel Map o Check if location is consistent in Lot Plan (which includes a Vicinity Map) and Parcel Map (note: if	Representative *Barangay* PIN Owner Area Location	1 hour			

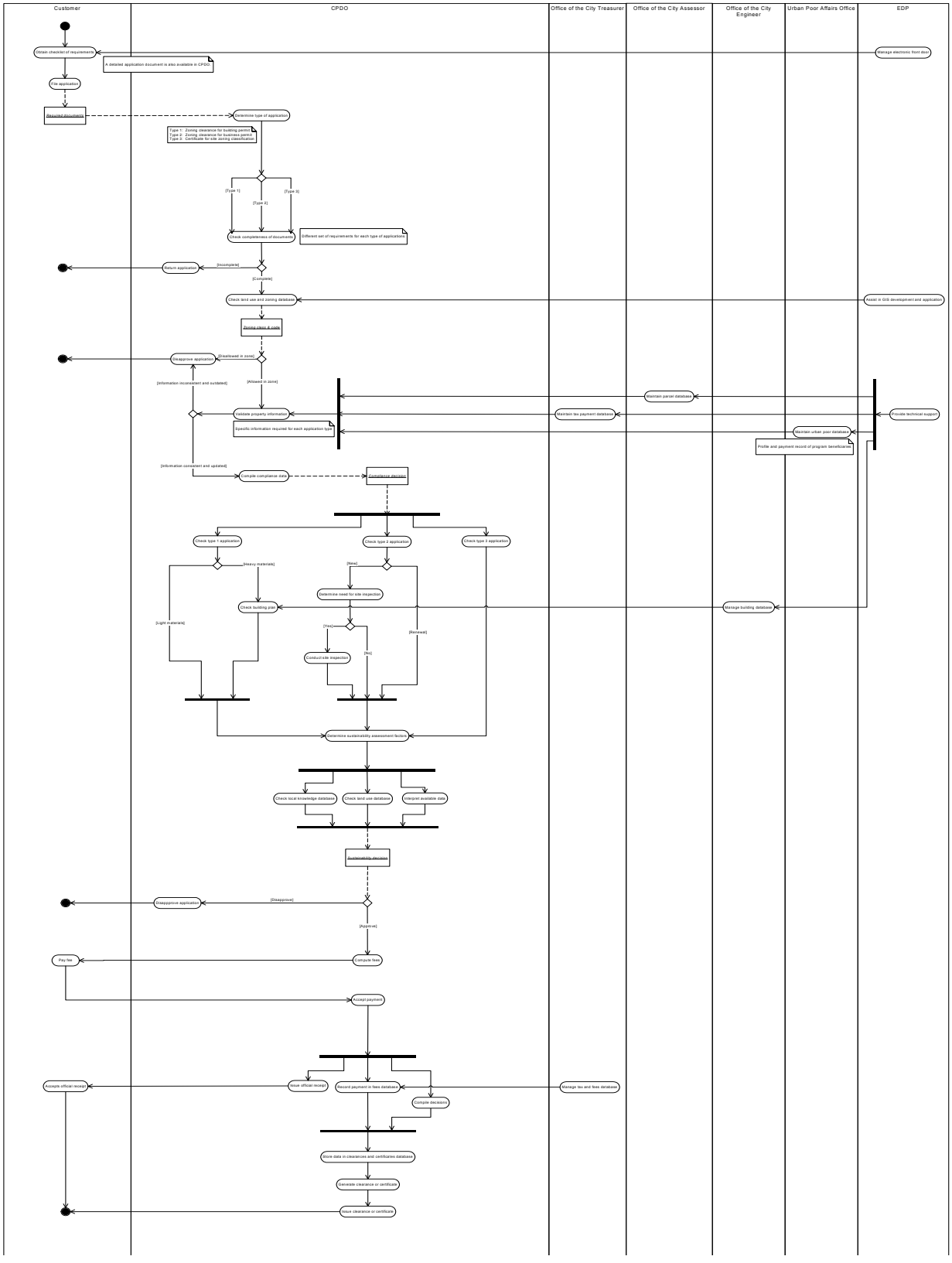
		no vicinity map is included, the PIN will do.) ▪ Come back to CPDO to o Check vicinity map and zoning map to identify classification of lot. Area should be located in the right zone as approved in the Zoning Ordinance. ▪ If area is located in more than one zone classification, the following are undertaken: o Determine proximate area using map scales in zoning map and lot plan o Determine dominant use. Application should correspond to dominant use. ▪ If the above requirements are not met, documents are returned and certification is not issued. ▪ If the above requirements are met, draft and encode certification in computer to include technical details/description in the TCT or Deed of	Zone class Zoning ordinance Dominant Use Data encoded	5 minutes 30 minutes 30 minutes	Jaime L. Servino Draftsman II		

		Sale, as follows: o Title number o Square meters o Location o Ownership Also include: o Name of person who applied with SPA o District Zone Code Number based on Zoning Classification o Date of issuance ▪ Include in Certificate data on Official Receipt, as follows: o O.R. Number o Date o Amount ▪ Place initial beside name of Zoning Administrator ▪ City Planning and Development Coordinator signs the Certificate of Site Zoning Classification ▪ Applicant receives Certificate of Site Zoning Classification ▪ CPDO keeps documents and a copy of Certificate	O.R. Signatory		Arch. Juan O. Villegas, Jr. City Government Development Head I		

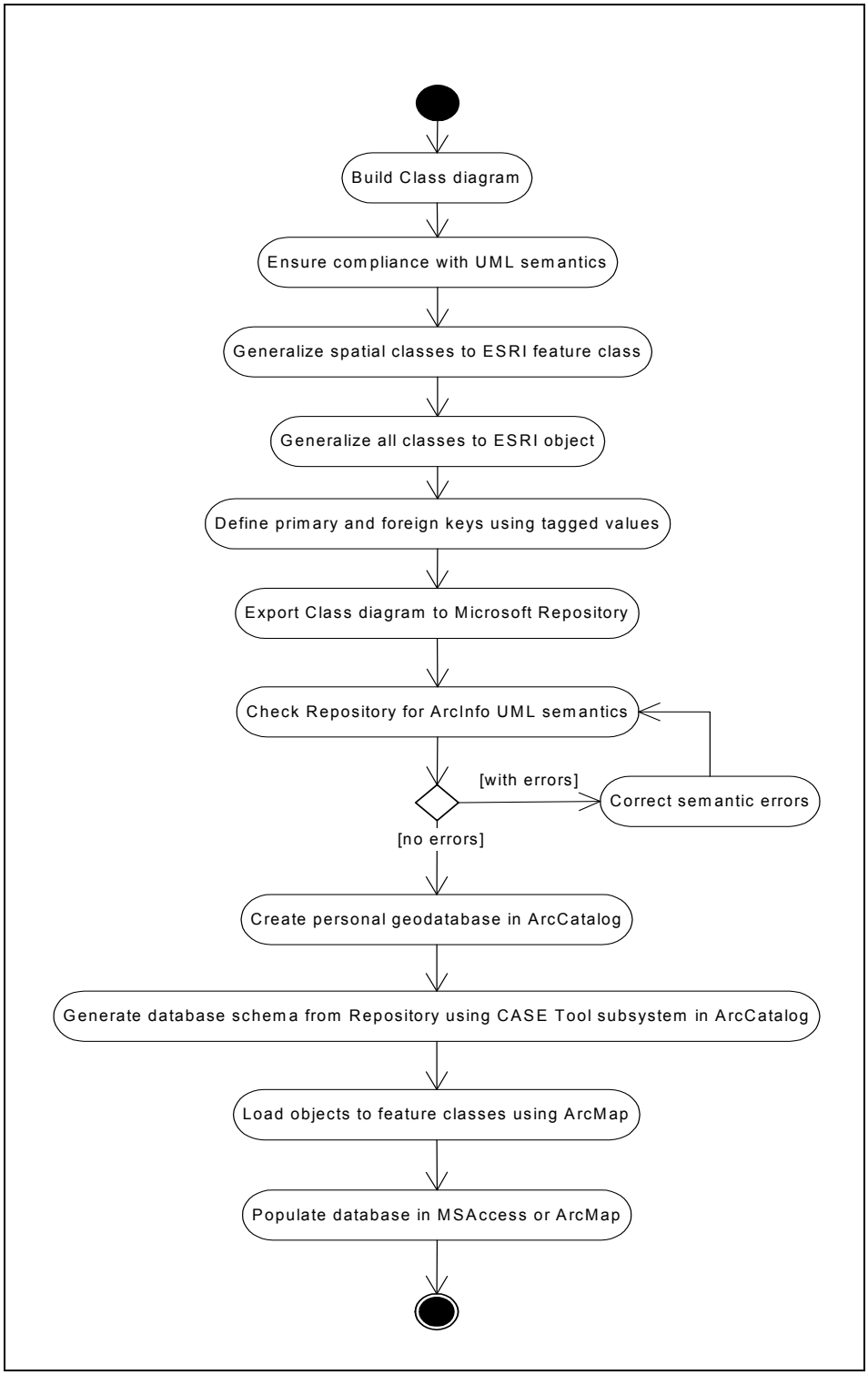
*Based on *The Naga City Citizens Charter: A Guidebook on Key City Government Services*. Naga City. (no date).

Activities and sub-activities were documented based on interviews with Rose Ciudadano on 10 September 2003. Documentation was validated with Job Oliva on 29 September 2003.

APPENDIX H. Overall Activity Diagram for Processing and Deciding on Applications



APPENDIX I. Steps in Implementing the Class Diagram in GIS



APPENDIX J. Sample of Decision Factors Table

Application	Classification/Code	DecisionGuide*	DecisionGuideCode
Type1 (Zoning Clearance for Building Permit	Light materials (1A)		DCode1A-01
	Heavy materials (1B)		DCode1B-01
Type 2 (Zoning Clearance for Business Permit)	General type (2A)	Consider proximity of the development to any public land and the likely impacts	DCode2A-01
		Consider effects on the free movement of pedestrians, cyclists, supply vehicles, waste removal, emergency services and public transport	DCode2A-02
		Consider any likely impacts on the natural physical features and resources of the area, in particular impact caused on the soil or water quality or by the emissions of noise, dust or odors	DCode2A-03
		Ensure availability and provision of utility services	DCode2A-04
		Consider effects of any traffic to be generated by the use or development	DCode2A-05
		Other	DCode2A-06
	Special type (2B)		
	Gasoline filling stations (2B1)	Should be located at least 200-meter distance from the nearest schools, churches, hospitals and other similar buildings/institutions	DCode2B1-01
		Should not constitute safety hazards in a community developed entirely for residential purposes	DCode2B1-02
		Should provide buffer strip and adequate fire fighting equipment	DCode2B1-03
	Night Clubs, pub houses, bars, videokes, discotheques (2B2)		DCode2B2-01
	Vulcanizing shops (2B3)		DCode2B3-01
Type3 (Certificate for Site Zoning Classification)	Certificate for Parcel (3B1) Certificate for Subdivisions (3B2)		

Based on HLURB et al. 2001: 105-108 and *Sangguniang Panlungsod* 2000.

APPENDIX K. Steps in Producing the Suitability Maps