University of Southern Queensland
Faculty of Engineering and Surveying

An Investigation of Land & Property Information (NSW) proposed E-Plan process of digital survey plan lodgement in LandXML format

A dissertation submitted by

Mr. Vaughan Wady

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ABSTRACT

The LPI (NSW) is implementing a new system of lodgement of digital land title plans in NSW known as E-Plan. The E-Plan program will utilise LandXML files for the electronic submission, processing and registration of land title or survey plans. This will be the first system of plan lodgement Australia wide to use electronic examination from submission through to registration. LandXML was created in 2000 by surveyors and engineers for surveyors and engineers and has been tailored to suit the E-Plan process. LandXML is seen as the new emerging format for the transfer of digital data files between different software environments.

The objectives of this dissertation are to identify LandXML files and their origin, to investigate the E-Plan process and to identify the main stakeholders involved in E-Plan. A SWOT analysis will be used to compare the current systems of survey plan lodgement against the new E-Plan process. By doing a pre and post E-Plan analysis it can be shown how the current weaknesses may become strengths and how the current threats to the LPI may be turned into opportunities. The comparison of the two SWOT analyses will also highlight future weaknesses and threats to the LPI upon implementing E-Plan.

The main problem with the current systems of land title plan lodgement from submission through to registration is the manual and multiple handling of the survey plans. Currently plans are submitted in hard or paper copy and are a non-intelligent format so that the survey plan examiners cannot easily enquire information on the plan without having to recreate the plan in the digital environment. E-Plan uses LandXML digital data file format that allows the electronic examination through the use of automated rules engines possible thus reducing the need for multiple and manual handling of plans and reducing the cost and timeframe for the registration of survey plans.

E-Plan will provide a faster and less costly registration process for surveyors through the use of LandXML files. Through using the pre-validation tool available online surveyors can validate their LandXML prior to submission of the land title plan which will reduce requisition rates thus utilising the resources of the LPI more efficiently.

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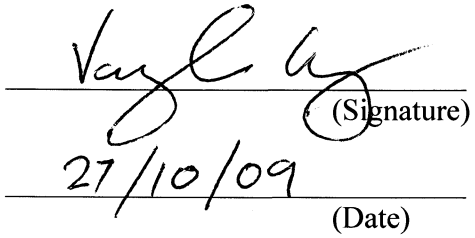
Mr. Vaughan Adam Wady

Student Number: W0050005643



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NOMENCLATURE AND ACRONYMS (OR ABBREVIATIONS)

The following abbreviations have been used throughout the text and bibliography:-

ANZLIC	Spatial Information Council
CAD	Computer Aided Design
CIPP	Continuous Improvement Programme for Plans
DCDB	Digital Cadastre DataBase
ICSM	Intergovernmental Committee on Survey and Mapping
IT	Internet Technologies
LGA	Local Government Area
LINZ	Landonline New Zealand
LPI	Land and Property Information
LTO	Land Tiles Office
PPD	Plan Profile Database
RM	Reference Mark
SIX	Spatial Information eXchange
SWOT	Strength Weakness Opportunity Threat
TIFF	Tagged Image File Format
WWW	World Wide Web
XML	eXtensible Markup Language

Chapter 1

Introduction

1.1 Introduction

The Land and Property Information (LPI) is implementing a new system of lodgement of digital land title plans in NSW known as E-Plan. The E-Plan program will utilise LandXML format for the electronic submission of land title plans. This is a brand new system for handling land title plans and limited research has been done in this area due to the recent creation of LandXML file format and its possible application to land title plan registration.

Historically surveyors have lodged their land title plans either as a hard copy plan, which needed to be lodged manually at the head office of the LPI, or as a TIFF (Tagged Image File Format) image through the e-Plan portal. Hard copy plans are subject to multiple handling and can become damaged in the process.

TIFF image files are subject to image resolution constraints due to file size and hence some of the data produced on TIFF images can and are distorted. Over the last 30 years with the emergence of Computer Aided Design software (CAD), surveyors collect, store and prepare land title plans in a digital environment but the majority still lodge land title plans in hard copy format. The major change for surveyors by using E-Plan is that the process can be done from submission to registration through the World Wide Web (WWW) by utilising LandXML data file formats.

LandXML was created in 2000 and is the new emerging format for transfer of digital data files between different software environments and has been tailored to suit the specific process of E-Plan. However the design of land title plans in this format is an altogether new process for to learn and will affect surveyors as the major stakeholder in the registration of land title plans.

1.2 Outline of the Study

This project aims to investigate the LPI (NSW) new E-Plan process utilising LandXML digital data file format for the registration of land title plans. LandXML is an extension of XML (eXtensible Mark-up Language) files. This investigation can be broken into three parts. The first part is to outline all three processes available to surveyors for

lodging land title plans and to show the advantages and disadvantages for each process. The second part is to identify how LandXML data file formats have evolved, what information a LandXML file contains and to recommend how surveyors may best transition from using CAD software to exporting complete LandXML files suitable for submission into the E-Plan portal. The third part is to identify the major stakeholders involved in any submission of land title plans in NSW, to show their roles in each process of land title registration and measure the advantages and disadvantages that each system represents to each major stakeholder.

1.3 Statement of the Problem

Plan lodgement systems in Australia have stayed static for approximately the part 150 years and survey plans have always been prepared in hard copy format. Technology and software development over the last 20 years has increased to a level that surveyors now capture, store, process and present survey data in an electronic format for all associated aspects of surveying except for land title plans. The Spatial Information Council (ANZLIC) formerly known as the Australia New Zealand Land Information Council has a sub committee under the Intergovernmental Committee on Surveying and Mapping (ICSM) known as the *ePlan* working group who having been working towards the implementation of a National Standard for the electronic lodgement of land title plans Australia wide.

All states and territories have representatives on the ePlan working group but the LPI in the State of NSW will be the first government body nationally to implement the electronic lodgement of survey plans and this system is known as E-Plan. Little if any research has been done on electronic lodgement because it is a new process altogether and is completely different from any other process in Australia to date.

1.4 Significance of the Study

Lodgement of land title plans in Australia has always been hard copy or paper based plans. Below in Figure in 1.3.1 is a simple diagram of the manual lodgement process.

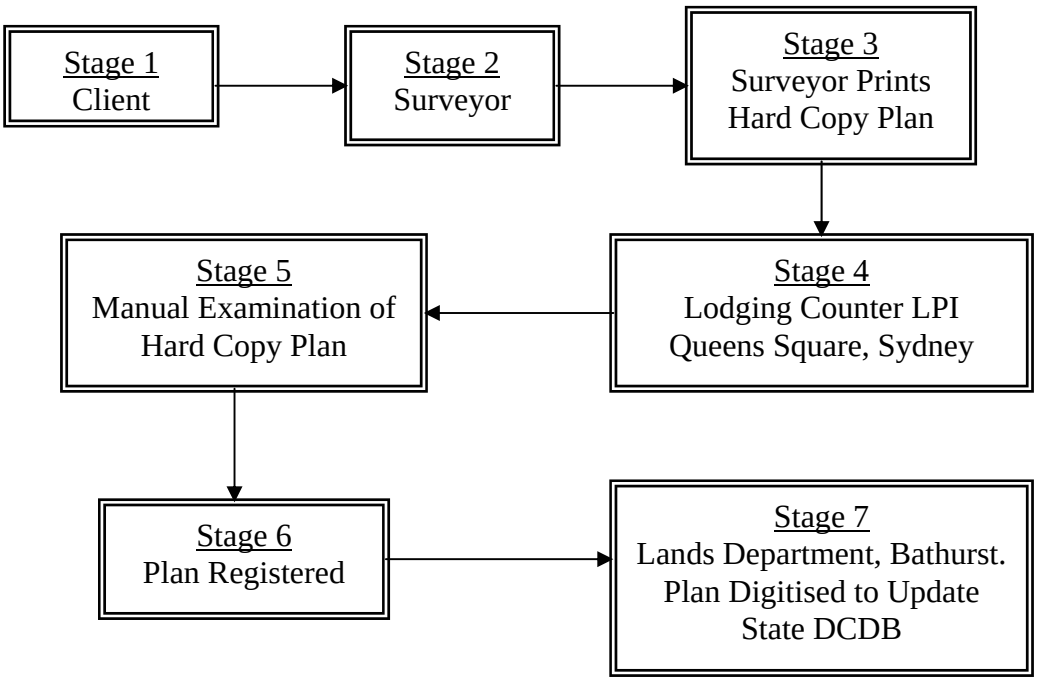

Figure 1.4 Manual Lodgement Process

In Figure 1.4 Manual Lodgement Process it follows that at Stage 1 the client instructs the surveyor to undertake the completion of a land title plan, in Stage 2 the surveyor undertakes the field work and compiles in the plan in CAD software being in an electronic format. In Stage 3 the surveyor prints a hard copy plan and takes the plan physically to the lodging counter of the LPI in Queens Square, Sydney being Stage 4. The LPI in Stages 5 and 6 complete a manual examination of the plan and if the plan is correct and complete register the plan. The LPI then forwards a TIFF of the plan electronically to the Lands Department in Bathurst, NSW where they digitise the plan and update the State's Digital Cadastre Database (DCDB).

The LPI is introducing a new system of digital survey plan lodgement known as E-Plan and this will be the first lodgement process that is completely electronic from submission through to registration. No research has been carried out so far on this digital system of survey plan process and this dissertation aims to do so. Surveyors work in the digital environment for all other aspects of surveying and they will now be able to complete that process by using LandXML files through E-Plan.

1.5 Objectives

This dissertation aims to investigate the LPI new E-Plan process utilising LandXML digital data file format for the registration of land title or survey plans. The three objectives of this dissertation are

- Research and investigation into the E-Plan process
- Identification of LandXML files and
- Identify the role of the main stakeholders in the E-Plan process

The specific objective of researching LandXML is to find out how it was developed and the functionality of the digital files format. Surveyors will need to work with new LandXML data file formats so that the data presented to the LPI will be acceptable for submission into the E-Plan process. As part of this objective it will be necessary to outline how and why LandXML was chosen as the digital file for use in the E-Plan process.

Research and investigation into the E-Plan process will outline the two current systems of survey plan lodgement in the state of NSW as well as outlining the E-Plan process. By drawing simple flow charts like Figure 1.4 of the two remaining processes it can be seen how each lodgement process differs and the role of the main stakeholders in each process.

In identifying the main stakeholders in the E-Plan process it is the aim of this dissertation to see if and how they may be advantaged or disadvantaged by E-Plan.

1.6 The Organisation of the Dissertation

The organisation of this dissertation is structured in the following manner:

Chapter 2 is a literature review that provides background to this topic including the history of plan lodgement processes in NSW and an outline of the current system of survey plan lodgement known as e-Plan. There is also information in chapter 2 on the new process of E-Plan, how it has come about and information of LandXML files which are used in this process. The reviewed literature in chapter two looks at past research completed by university students on the proposed uses of electronic survey data.

Chapter 3 critical analysis defines generic questions for use in a Strengths, Weaknesses Opportunities and Threats (SWOT) analysis that will be used to compare pre and post E-Plan to see if the new system of land title plan lodgement will be of benefit to the users involved. Two sets of generic questions are used for the SWOT analysis, one set of questions is for the strengths versus weaknesses analysis and the other generic questions are used for the Opportunities versus Threats analysis. From these questions a number of criteria are developed for comparison and will be listed in tables.

Chapter 4 results will then use the criteria generated from chapter 3 and assign them as either a strength or weakness and as an opportunity or threat, firstly pre E-Plan and then secondly post E-Plan. The results will be tabulated in tables to show how weaknesses have transitioned to strengths and threats transitioned to opportunities post E-Plan.

Chapter 5 discussion will discuss the results of the SWOT analyses of strengths versus weaknesses and opportunities versus threats. As well as discussing further information that was found during the investigation into E-Plan. This discussion

on further information found from the investigation will talk about attributes and annotation where attributes are the values that will be stored in a LandXML file whereas annotation is the text added to hard copy survey plans. There will be a discussion on how occupation may be shown in E-Plan as well as how the LPI will render land title plans suitable for its' clients needs because LandXML files are solely text based. Lastly under discussion there will information of the cost and timeframe implications of E-Plan and a timeline on the implementation of the E-Plan process.

The last chapter provides the conclusions and recommendations for this dissertation. The conclusion provides a summary of the SWOT analysis from chapter 4 and 5 and possible recommendations for the implementation of E-Plan.

Chapter 2

Literature Review

2.1 Introduction

Due to the new concept of E-Plan in NSW and with the introduction of LandXML there has been little if no published material that has been completed on this topic. Most of the information needed to complete this project will be gathered from the WWW and personal communications. The main source of information for E-Plan and other current lodging systems for land title plans is through the LPI website and similarly the main source of information for LandXML is *LandXML.org* available online. A large part of the research needed for this dissertation will come from personal communications from both LPI staff and industry surveyors.

2.2 Background

> *"The Land Titles Office provides a secure and responsive land title registration and land title information service which each year sees creation of 50,000 titles for new land parcels and 10,000 titles for strata lots, registration of 700,000 land transactions and issue of 6 million electronic and paper copies of land information"*
>
> Azimuth (1999a)

Traditionally in NSW land title plans have been produced in hard copy format which involves the manual lodgement of a plan, the LPI staff then digitally redraw the plan in CAD to validate the plan in the existing NSW cadastre. The chain of events following manual lodgement is as described in Figure 1.4 Manual lodgement process.

Both Falzon (1998) and Polley (1998) found that the Victorian land information registry has been static for 130 years and has not utilised the advances in technology being made in the digital environment. Most of the other associated industries of land information in Victoria were using this technology development to increase production and to increase cost efficiency and the same can be said for NSW. As Falzon (1998), Hobson (2004),

and Polley (1998) noted many other associated industries in land title definition expect that information is provided electronically over the WWW and that CAD systems used by surveyors remove the need for hard copy plans but we still require either hard copy or TIFF images to be produced for land title registration. Surveyors collect, store, calculate and draft land title definition in the digital environment so it should only be a small step for surveyors to produce digital land title plans.

2.3 e-Plan

The LPI e-Plan portal was introduced in January 2000 with the three main differences being that only registered surveyors could lodge plans, plans were lodged as a TIFF image and that land title plan lodgement could be done over the Internet. The chain of events following e-Plan lodgement is that the surveyor liaised with his client and government bodies to make sure the plan has their approval, then the surveyor would lodge the plan with the LPI with the solicitor acting independently in lodging titles. Even with the introduction of e-Plan this still involved manual data entry of land title plans by LPI staff to check for validation within the NSW cadastre.

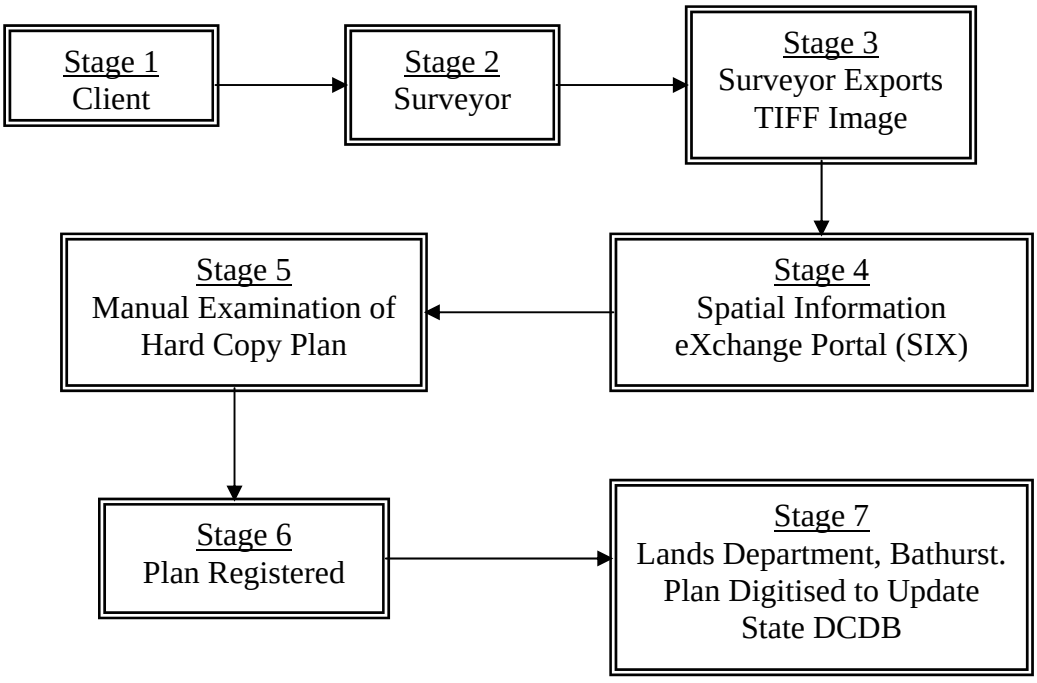

Figure 2.3 e-Plan Lodgement Process

A major problem with the manual nature of hard copy plans is the rising number of requisitions on plans by the LPI staff. In 1997 the Land Titles Office (LTO), which is now the LPI, introduced the Continuous Improvement Programme for Plans (CIPP) to record the details of all plan requisitions in the Plan Profile Database (PPD). The aim of the CIPP programme was to enable the reporting of the type and number of requisitions raised on plans from the PPD and to issue quarterly statements to surveyors and lodging agents about their own personal requisiton rates. (Azimuth 1999b). Since the end of March 1999 to January 2000 plan requisition rates increased from 19% to 42% (Mulcahy 2000). Therefore the LTO enforced the compulsory lodgement of plan checklists for all plans lodged from the 1st February 2000. Furthermore the EPlan Project (2007) found that incorrect or bad plan data was responsible for 50% of requisitions which could be related to the transcribing of errors between CAD software and manual annotation on the plan.

But with the growing number of plans being presented to the LPI with approximately 64,000 lots or titles being created in NSW between 2005-2006 the need to become more cost and time efficient has become a priority. The need to increase efficiency and automation of land title plan creation has become an important factor for the registration of land titles and

> *"Legislative amendments introduced in August 2002, provided the necessary framework to introduce an electronic plan lodgement system"*
>
> EPlan Project (2007).

2.4 E-Plan

The new E-Plan process will allow surveyors to lodge LandXML digital data files at the submission stage. The need for change was identified by the LPI in August 2007 and the key constraints found in the current system of land title creation:

- Collection of administration data
- A high proportion of plans being requisitioned prior to registration
- Plan data is not currently submitted in an intelligent form
- Constraints on existing human resources

- Non-compliance with the proposed national standard
- Security risk of plans

Land and Property Information (2009a)

E-Plan was found to be both financially and economically viable with large cost and time savings in plan processing and significant reductions in plan requisition rates (EPlan Project 2007). One reason for the possible reduction in requisition rates is due to the pre-validation tool in Stage 5 of Figure 2.4 below which will allow surveyors to check completeness of their LandXML file prior to submission into the E-Plan process. Also of major benefit to the E-Plan system will be the two styles of output. The first will be for the general public since E-Plan will generate hard copy plans for the land title in question showing the general lot details such as number, dimensions, area and adjoining parcel details. The second style will enable surveyors to access the full land title definition by exporting the LandXML file, as submitted by the surveyor, in its entirety.

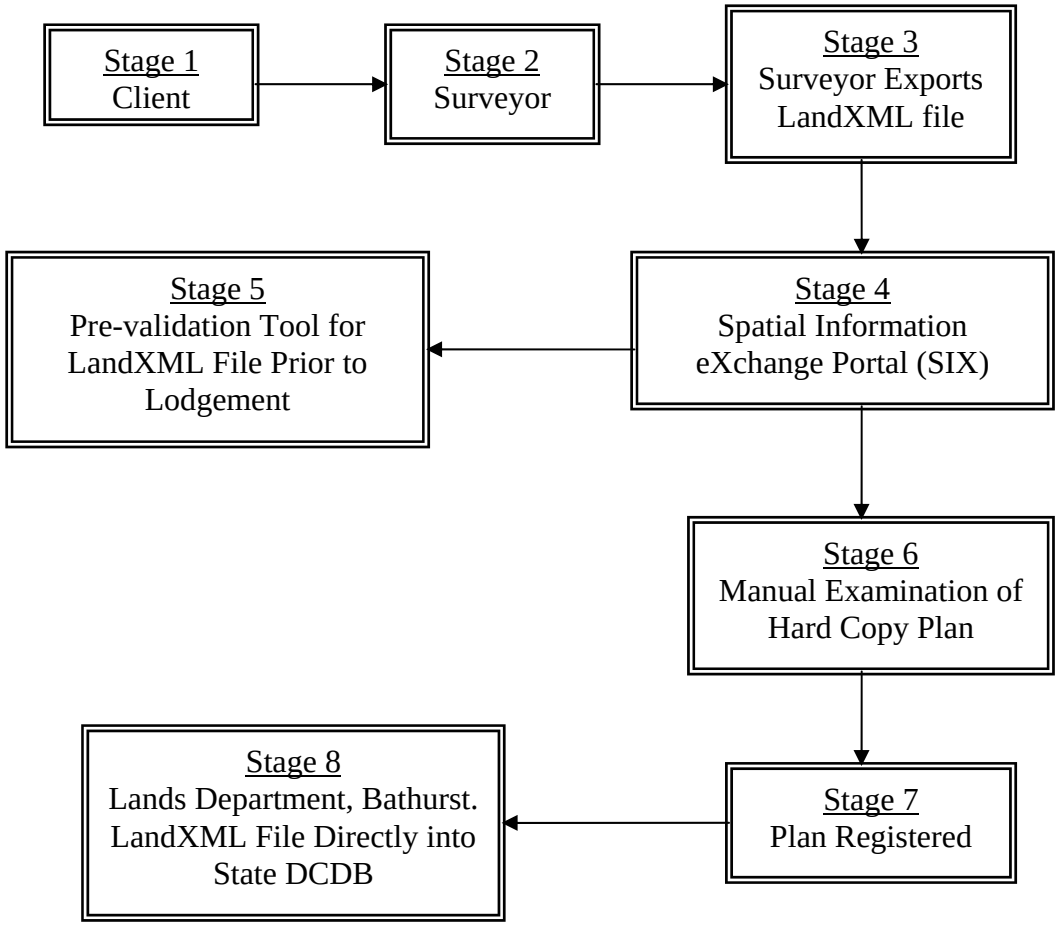

Figure 2.4 E-Plan Lodgement Process

By using LandXML files most of the constraints placed on land title creation can be removed.

> *"Plans prepared as LandXML files are intelligent and will permit pre-lodgement validation by the surveyor and post-lodgement validation by LPI, by running the file through a rules engine"*
>
> EPlan Project (2007).

2.5 LandXML

> *"LandXML is a specialised data file format containing civil engineering and survey measurement data commonly used in the Land Development and Transportation Industries"*
>
> Crews (2006)

LandXML was developed and initiated by Autodesk in December 1999 and its aim was to address the need for a new digital data file that could be exchanged between different software environments efficiently and without any data loss as well as being able to be archived for the long term. An example of part of a LandXML file is given below and the full version can be found in Appendix B.

```
<?xml version="1.0" ?>
- <LandXML xmlns="http://www.landxml.org/schema/LandXML-1.0" xmlns:x
    xsi:schemaLocation="http://www.landxml.org/schema/LandXML-1.0 htt
    time="12:42:18" version="1.0" language="English">
  - <Units>
      <Metric areaUnit="squareMeter" linearUnit="meter" volumeUnit="cubicMet
        heightUnit="meter" angularUnit="decimal dd.mm.ss" directionUnit="deci
    </Units>
    <Project name="dp for preso" />
    <Application name="civilcad" manufacturer="topcon" version="6.82" />
  - <CgPoints>
    - <CgPoints name="SSM">
        <CgPoint name="1" code="PT">6380943.31 346321.91</CgPoint>
        <CgPoint name="2" code="PT">6381110.81 346840.88</CgPoint>
        <CgPoint name="3" code="PT">6381440.38 346302.75</CgPoint>
      </CgPoints>
    + <CgPoints name="CONNECTIONS">
    + <CgPoints name="EASEMENT">
    + <CgPoints name="BOUNDARY LINES">
    </CgPoints>
  - <PlanFeatures>
    - <PlanFeature name="SSM">
      - <CoordGeom>
        - <Line dir="357.4733" length="497.43913246">
            <Start>6380943.31 346321.91</Start>
```

Figure 2.5.1 Example Part of a LandXML File

In the example LandXML given in Figure 2.5.1 it can be seen that a lot of information is show. LandXML files show what version of the LandXML schema it used to generate the file, what software generated the file, the drawings units used in creation of the file and also includes a time and date stamp of when the file was produced. Importantly in this example those characters shown within brackets and containing red text is the attribute and the text in between the inverted commas is what has been added by the surveyor to that attribute.

Hobson (2004) saw LandXML as the ideal data file for use in land title creation in NSW due to it being specifically developed by the survey industry and its ability to store a wide range of cadastral related data.

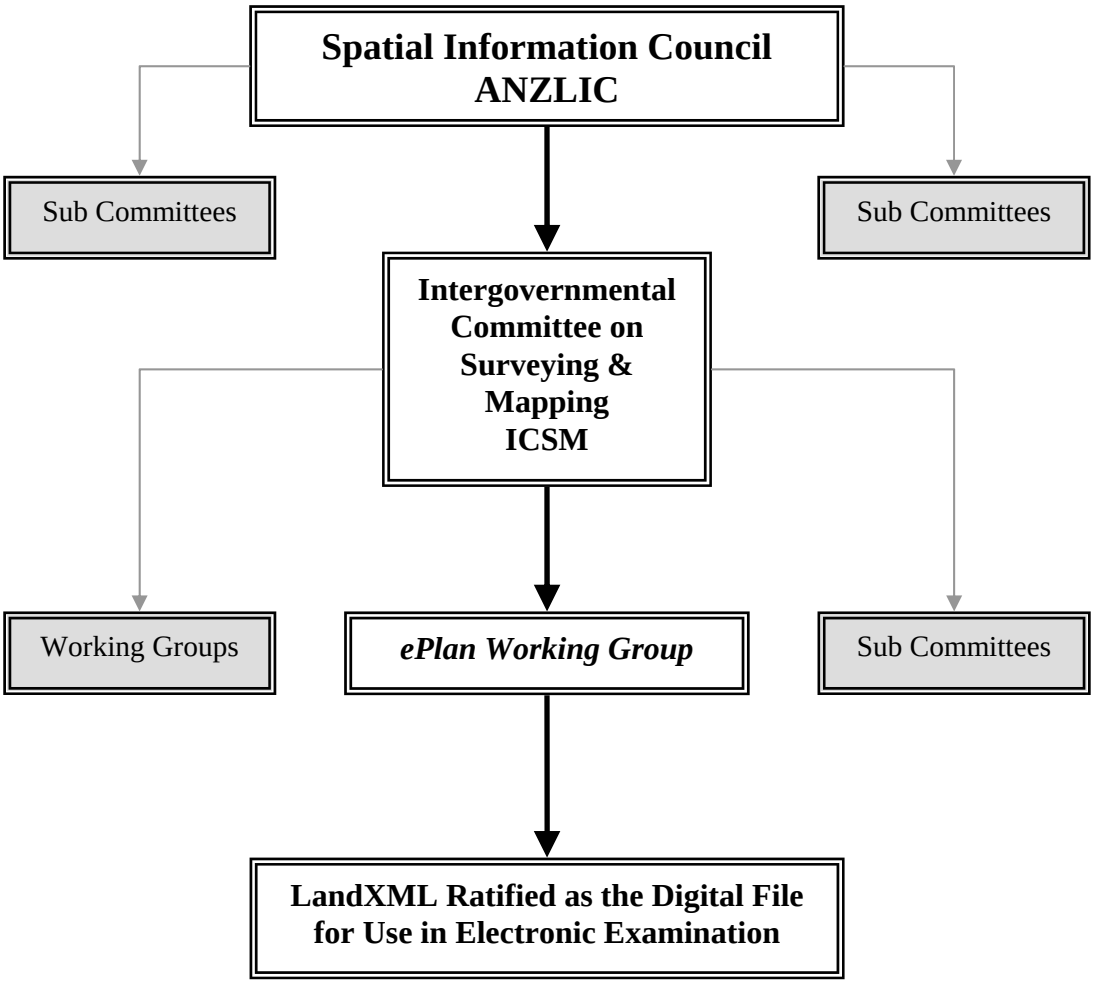

Figure 2.5.2 E-Plan Implementation Model

For E-Plan to be implemented a number of processes needed to take place. ANZLIC has a number of committees and their responsibility is "*ANZLIC – the Spatial Information Council is the peak intergovernmental organisation providing leadership in the collection, management and use of spatial information in Australia and New Zealand"* and their "*role is to facilitate easy and cost effective access to the wealth of spatial data and services provided by a wide range of organisations in the public and private sectors"* (ANZLIC 2009). One of these committees of ANZLIC is the ICSM who's *"role is to provide leadership and coordination to surveying, mapping/charting and national datasets"* (ICSM 2009) and one of the sub committees is the ePlan Working group. The role of the ePlan working group is establish a national model suitable for electronic land title plan registration across all Australian states and territories and they ratified LandXML as the digital data file for use in electronic lodgement processes.

2.6 Landonline New Zealand (LINZ)

LINZ is the only operational online service currently in place in the Australia-New Zealand region which allows surveyors to lodge title dealings and survey data digitally in LandXML format. LINZ has participated with LandXML.org in the creation of a LandXML data structure to ensure compatibility between LandXML and their system of online lodgement known as e-survey. The e-survey portal is the only available option for land title creation in NZ, as hard copy lodgement ended in September 2007. Some of the benefits found by LINZ in using e-survey are its ease of use, it saves time and resources both for surveyors and LINZ staff and its ability of real time updating of land title records.

A surveyor registered as an authorised agent for lodging land title plans logs into e-survey and firstly enters the data pertaining to the land title being created. They then import a survey dataset that allows them to add or delete specific survey information relating to the land title definition. The e-survey portal then pre-validates the LandXML dataset to check for compliance with government regulations and relevant statutory authorities. If the dataset is seen as complete, digital survey plans suitable to be printed in hard copy format are issued and the relevant land title records automatically updated. (Landonline New Zealand 2009a).

The main value of this system is that surveyors doing land title definition can extract out of e-survey the digital dataset relevant to the land being defined and can interrogate the file intelligently as to how and why the plan has been created. This a major advantage to surveyors using the LINZ e-survey system as it removes the need for surveyors to redraw and decipher just how the land title has been created saving time and money. The e-survey process is a similar process that LPI through E-Plan is trying to implement.

2.7 Conclusions

This chapter provided an overview of the available literature on the background of electronic survey data focusing on land title plan lodgement systems in NSW. There are three systems of survey plan lodgement in NSW with two of these procedures being manual lodgement and e-Plan which do have their respective advantages and disadvantages and the new system of survey plan lodgement known as E-Plan.. This chapter also provided the background information on how E-Plan has come about as well as including information on LandXML files and showing an example of a LandXML file.

Chapter 3

Critical Analysis

3.1 Introduction

This Chapter will detail the LPI methods of registration of survey plans both pre and post E-Plan by using a SWOT (Strengths Weaknesses Opportunities Threats) analysis. This is an important analysis tool that can be applied to survey plan lodgement to see if the new system of E-Plan has addressed the weaknesses and threats of the current system of survey plan lodgement

The aim of Chapter 3 is to define what a SWOT analysis is and what criteria will be used to compare the strengths against the weaknesses and the opportunities against the threats that are relevant to any survey plan lodgement system that is to be implemented.

3.2 The Study Area

The LPI in NSW are the sole providers of examination and registration of survey plans, strata plans and certificate of title creation. They have never allowed private examiners to enter the industry. Although the E-Plan business case does look at private examiners it was found that it would be both cost and time prohibitive to set up and implement such a system.

Upon investigating who the main stakeholders for the E-Plan process were, the original idea was that they are the client, surveyor and LPI acting together. But on discovering that the LPI are the only examiners and registration agents of survey plans in NSW both the surveyor and client must comply with whatever stipulations, cost and timeframe the LPI impose upon them. Therefore this dissertation will do a SWOT analyses on the LPI because what affects the LPI affects the client and surveyor.

The questions, criteria and answers for the SWOT analysis are a combination of my investigation into the land title lodgement processes and with personal communications with Mr Mark Deal, Program Manager, E-Plan program, Land and Property Information.

3.3 SWOT Analysis

SWOT stands for Strengths, Weaknesses, Opportunities and Threats and is an important analysis tool for identifying the internal and external factors that are either supportive or unfavourable to a project or business such as E-Plan and the LPI. The strengths and weaknesses are the internal capability of an organisation whereas the opportunities and threats are the external factors that affect the operation of an organisations internal proceeding.

This dissertation will complete two SWOT analyses on the LPI. The first analysis will be completed on the current systems of plan lodgement available to surveyors being manual lodgement and e-Plan. The second analysis will be completed on E-Plan. By comparing the two SWOT analyses both pre and post E-Plan it can be seen how E-Plan has advanced on survey plan lodgement, examination and registration procedures.

3.4 Strengths and Weaknesses.

The strengths and weaknesses analysis is an internal examination of the LPI that is focused on performance, strategy, resources and capabilities including the people, equipment, processes and products. The questions that will be asked and defined to build a list of criteria for strengths and weaknesses are as follows

1. What advantages does the LPI have?
2. What could they improve?
3. What resources, assets do the LPI have?
4. What experience, knowledge does the LPI workforce have?
5. What are the price, value and quality of data?
6. What are the advantages and disadvantages of the current lodgement systems?

In the following 6 figures there will be three text boxes. The first text box will list the question number, the second text box will define the question and this will lead to the third text box that will hold the criteria.

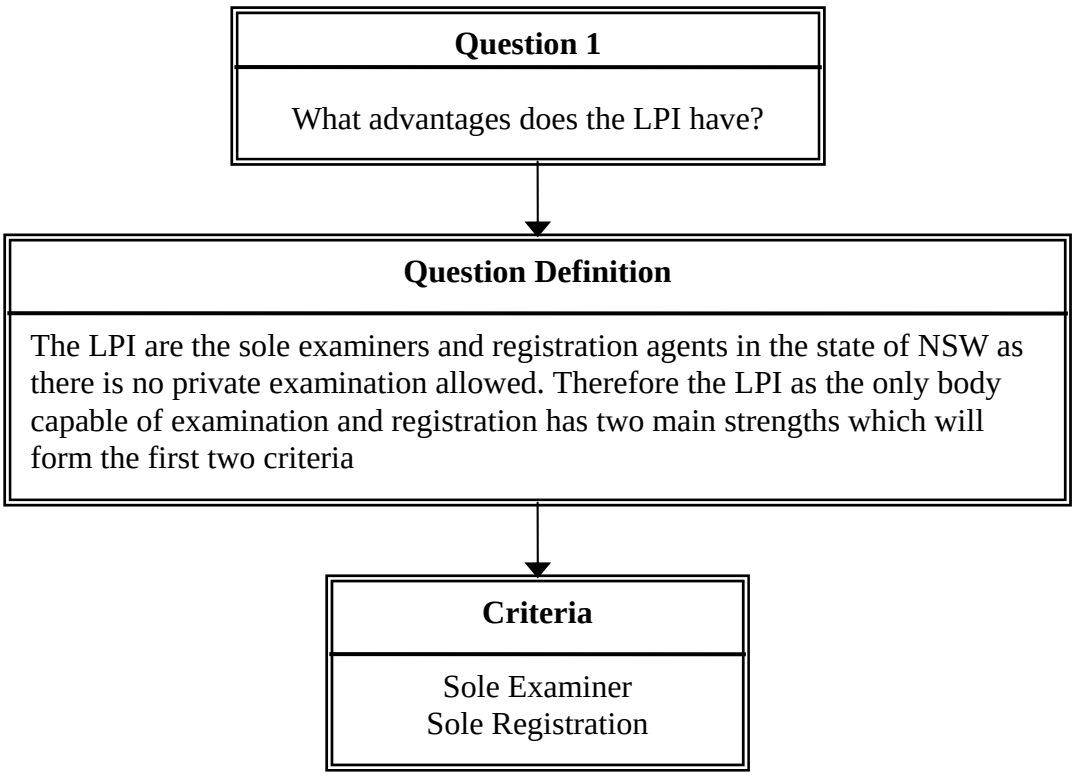

Figure 3.4.1 Question 1 for Strengths and Weaknesses Criteria

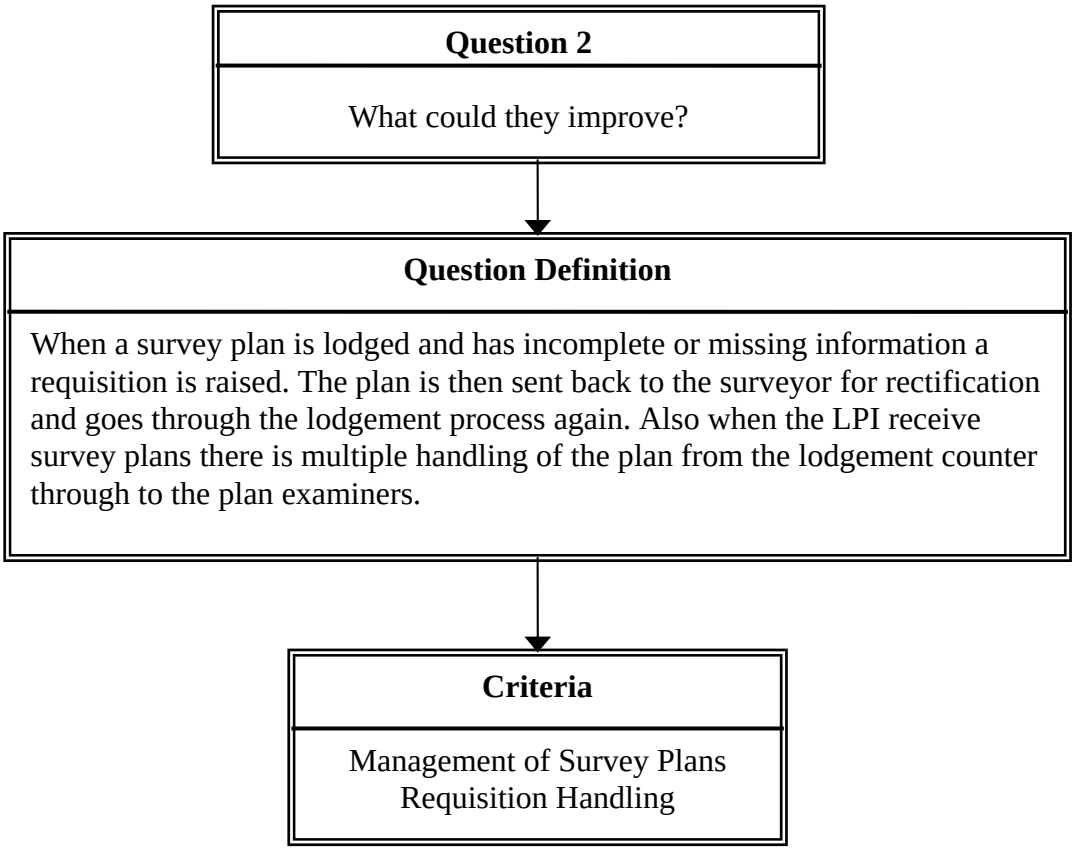

Figure 3.4.2 Questions for Strengths and Weaknesses Criteria

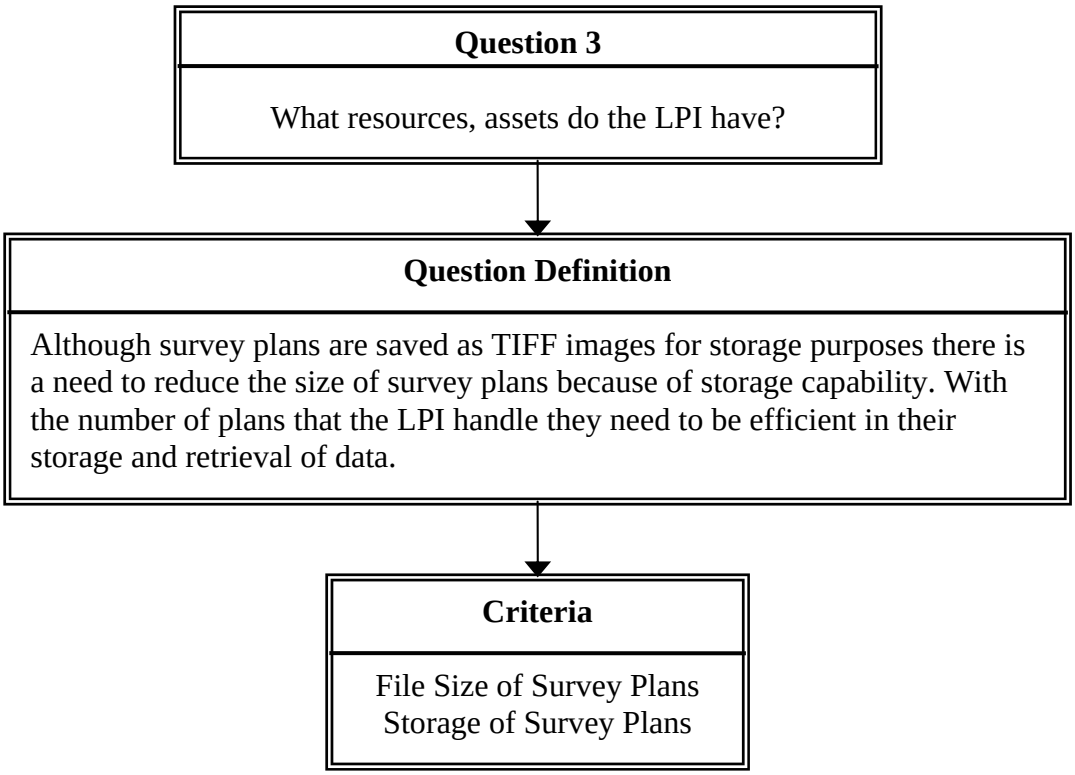

Figure 3.4.3 Questions 3 for Strengths and Weaknesses Criteria

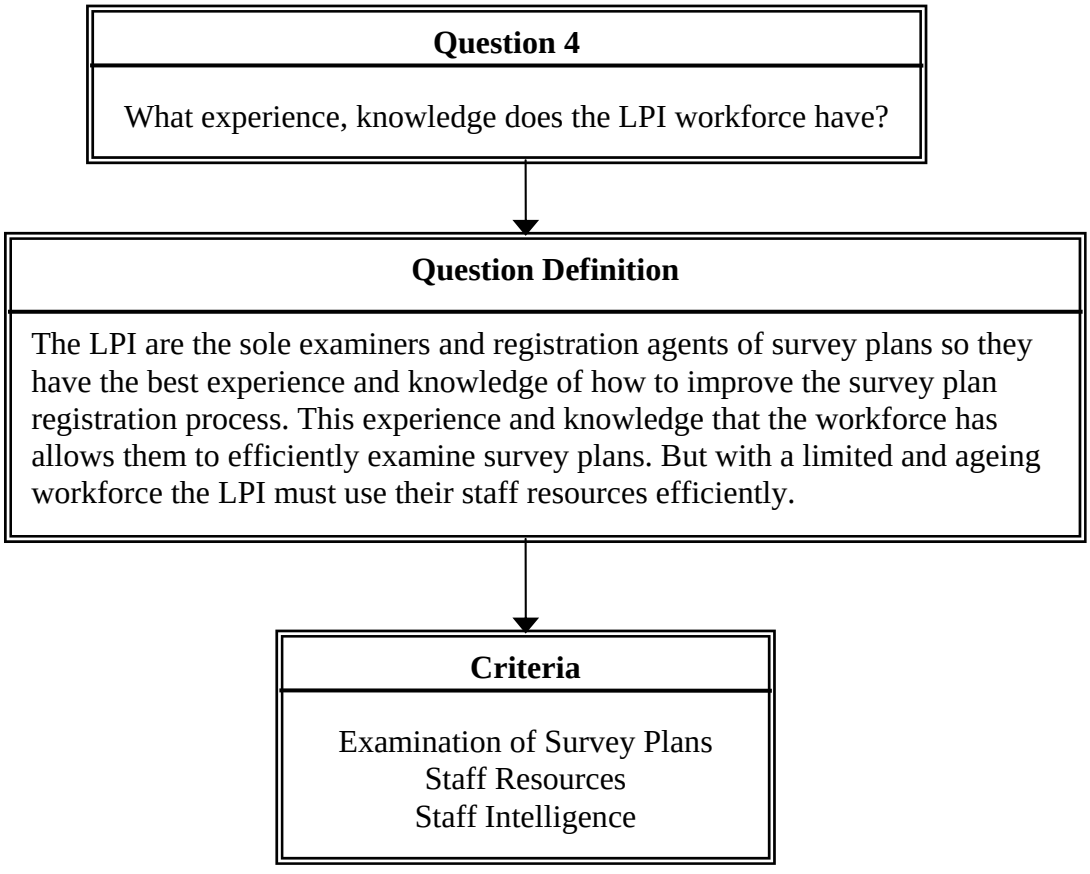

Figure 3.4.4 Questions 4 for Strengths and Weaknesses Criteria

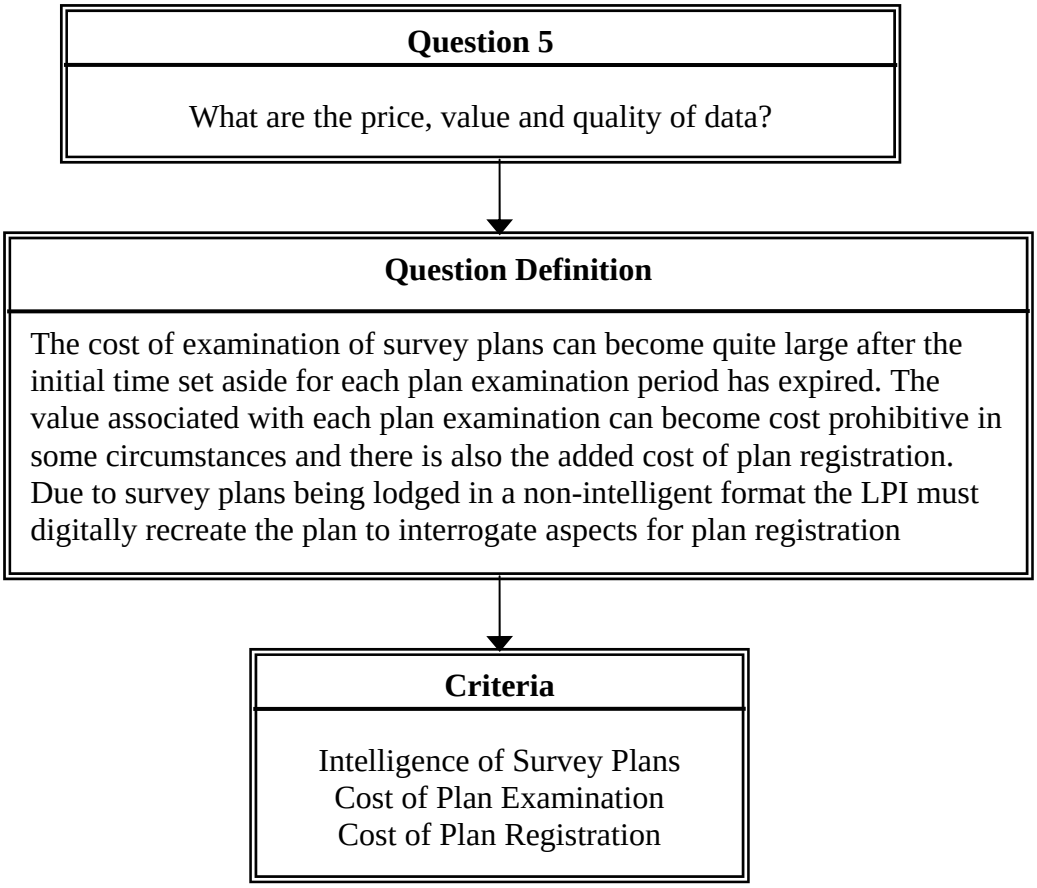

Figure 3.4.5 Questions 5 for Strengths and Weaknesses Criteria

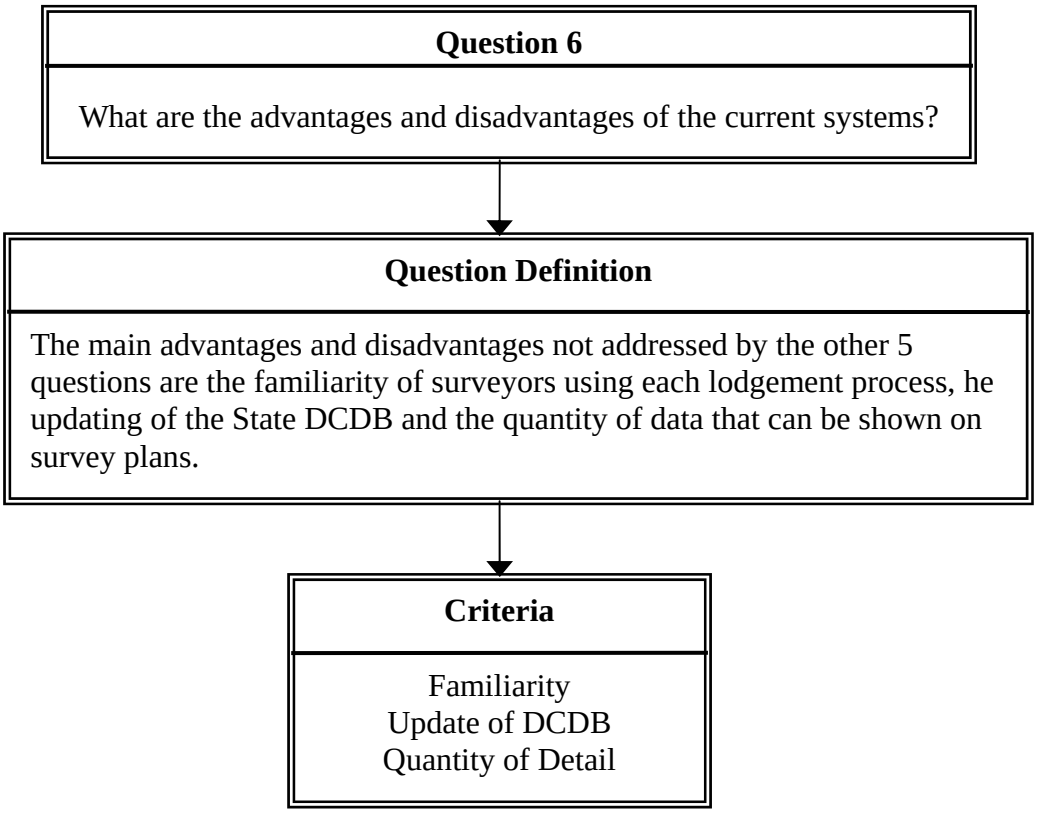

Figure 3.4.6 Question 6 for Strengths and Weaknesses Criteria

The fifteen criteria identified from the question flow charts for the strengths and weaknesses SWOT analysis for pre and post E-Plan are as tabulated in the following table.

Question	Criteria
Question 1	Sole Examination Sole Registration
Question 2	Management of Survey Plans Registration Handling
Question 3	File Size of Survey Plans Storage of Survey Plans
Question 4	Examination of Survey Plans Staff Resources Staff Intelligence
Question 5	Intelligence of Survey Plans Cost of Plan Examination Cost of Plan Registration
Question 6	Familiarity Update of DCDB Quantity of Detail

Table 3.4.7 Strengths & Weaknesses Question and Criteria

3.5 Opportunities and Threats

The opportunities and threats analysis is an examination focusing on the external factors that affect the LPI's business. By asking a number of generic questions a suitable list of criteria can be established and the questions asked to establish the criteria list are as follows:

1. Are there changes in technology?
2. Are there changes in government policy?
3. Are there possible joint ventures?
4. What are the environmental effects?
5. Is the business sustainable?
6. Is there Internet Technology (IT) developments?

In the following 6 figures there will be three text boxes. The first text box will list the question number, the second text box will define the question and this will lead to the third text box that will hold the criteria.

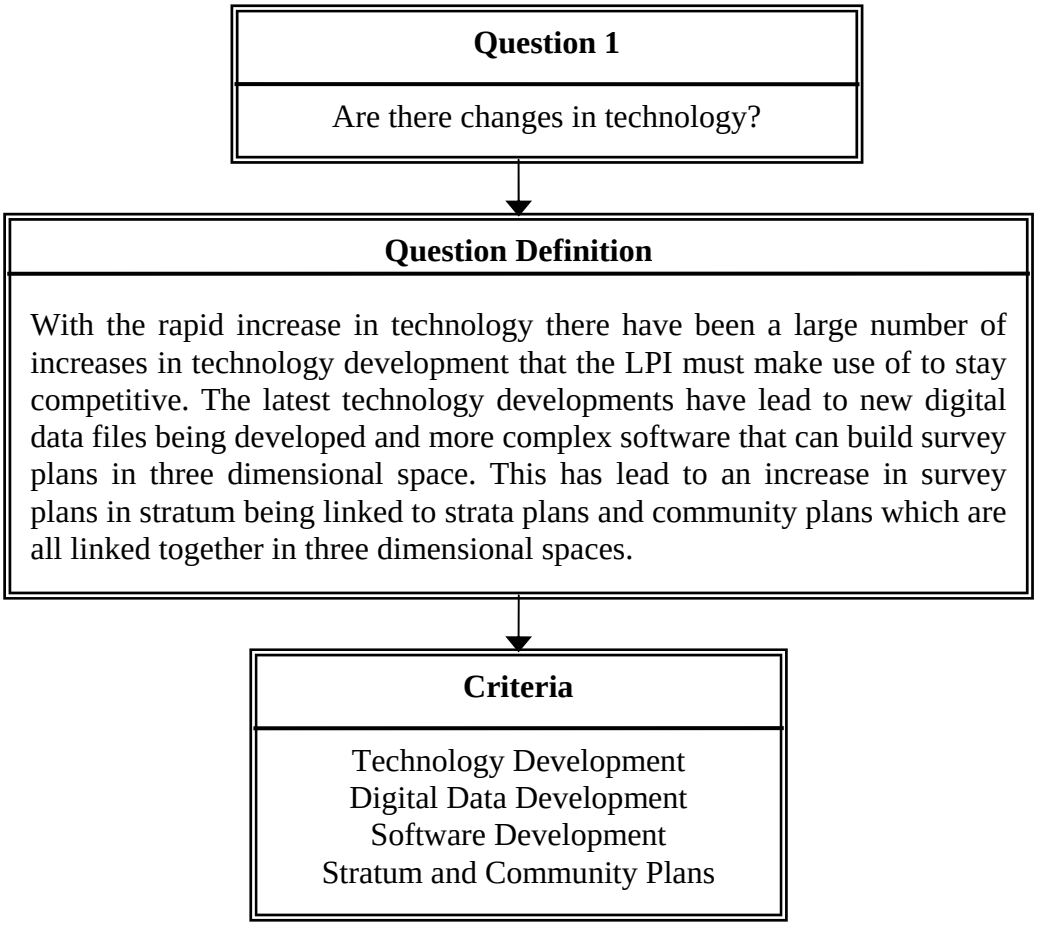

Figure 3.5.1 Question 1 for Opportunities and Threats Criteria

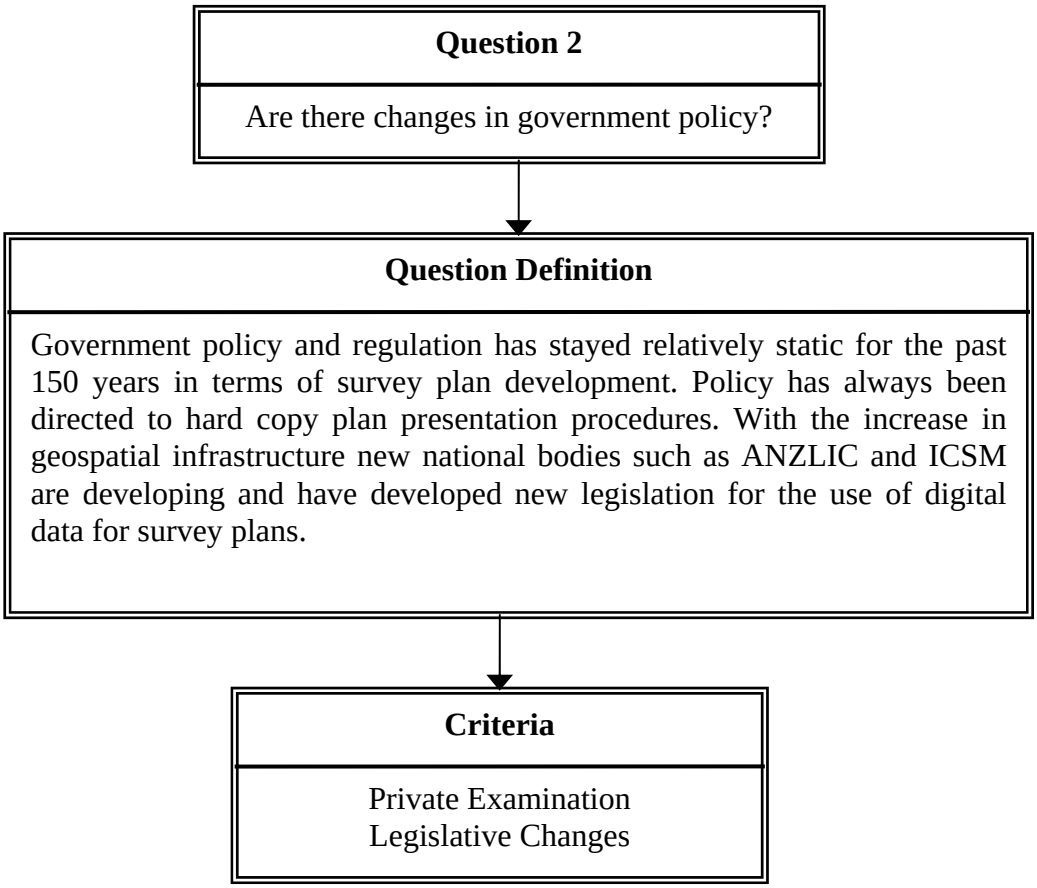

Figure 3.5.2 Question 2 for Opportunities and Threats Criteria

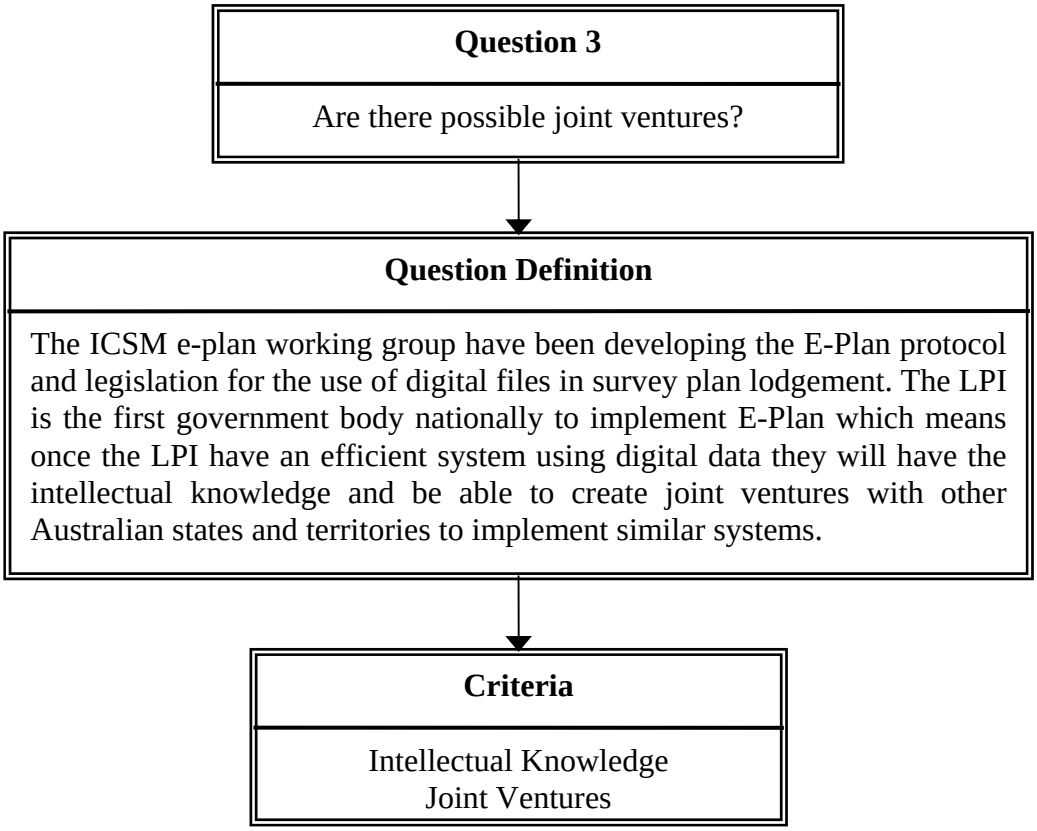

Figure 3.5.3 Question 3 for Opportunities and Threats Criteria

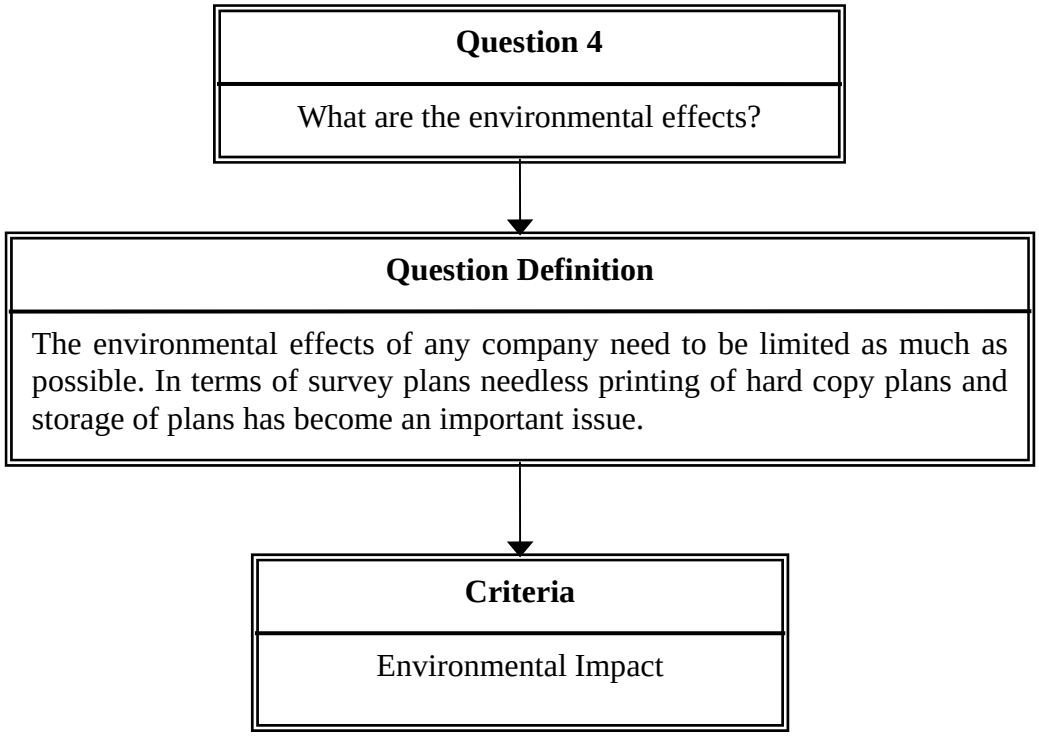

Figure 3.5.4 Question 4 for Opportunities and Threats Criteria

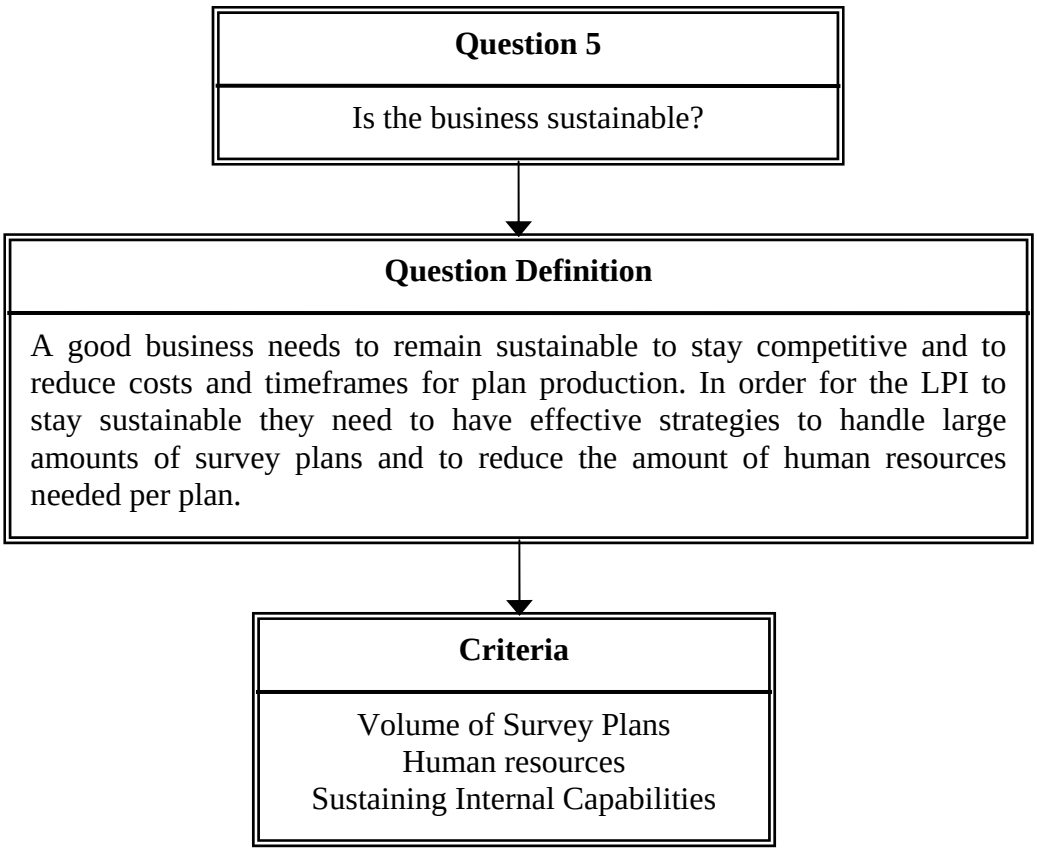

Figure 3.5.5 Question 5 for Opportunities and Threats Criteria

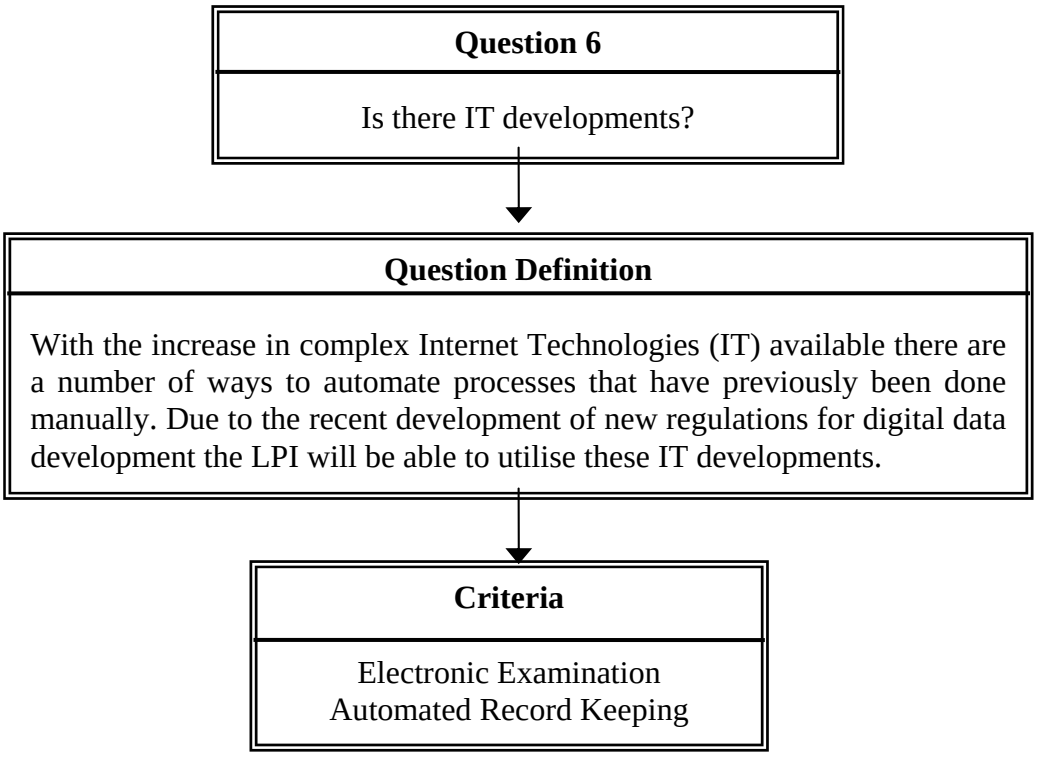

Figure 3.5.6 Question 6 for Opportunities and Threats Criteria

The fifteen criteria identified from the question flow charts for the opportunities and threats SWOT analysis for pre and post E-Plan are as tabulated in the following table.

Question	Criteria
Question 1	Technology Development Digital Data Development Software Development Stratum and Community Plans
Question 2	Private Examination Legislative Changes
Question 3	Intellectual Knowledge Joint Ventures
Question 4	Environmental Impact
Question 5	Volume of Survey Plans Human Resources Sustaining Internal Capabilities
Question 6	Electronic Examination Automated Record Keeping

Table 3.5.7 Opportunities & Threats Question and Criteria

3.6 SWOT Comparison

In order to see why the LPI are dramatically changing survey plan lodgement in NSW to the new digital lodgement system known as E-Plan it is necessary to analyse the LPI's structure both pre and post E-Plan. Now that the criteria for the strengths, weaknesses, opportunities and threats have been developed they can be assigned their respective values and drawn in a simple table for both pre and post E-Plan. These two tables will then be compared to see how many weaknesses become strengths and how many threats become opportunities and vice versa.

3.7 Conclusion

This chapter provided a description of the SWOT analysis and how it will be used to compare pre and post E-Plan. The criteria to be used for comparison has been generated from generic questions on the internal capabilities of the LPI being there strengths and weaknesses and on there external capabilities being there opportunities and threats.
The next chapter will assign each criteria both pre and post E-plan whether they be strengths weaknesses opportunities or threats and then comparison tables will be drawn to show these changes.

Chapter 4

Results

4.1 Introduction

This chapter will firstly define what criteria are strengths and weaknesses for pre and post E-Plan and a strengths and weaknesses table drawn for both results. The two tables for each will be compared to one another and a combined table will then be shown that will highlight where weaknesses have become strengths and strengths have become weaknesses. This process will be repeated for the opportunities and threats analysis.

4.2 Pre E-Plan Strengths and Weaknesses

4.2.1 Pre E-Plan Strengths

The LPI are the only certifying and registration authority in NSW so the first two criteria that become strengths will be Sole Certifier and Sole Registration. Because they are the sole certifier for survey plans it follows that their workforce has the advantage of having the Staff Intelligence for plan examination.

Survey plan registration has not really changed in the past 150 years so that its users have strong Familiarity of using plan lodgement systems. Because plans are generally hard copy diagrams or pictures of boundary definition the Quantity of Detail that can be shown can include a lot of annotative based comments that surveyors use for there accounting purposes. The strengths identified pre E-Plan are as set out in Table 4.2.1

Criteria	Pre E-Plan Strengths
Sole Examination	Sole Examination
Sole Registration	Sole Registration
Management of Survey Plans	
Requisition Handling	
File Size of Survey Plans	
Storage of Survey Plans	
Examination of Survey Plans	
Staff Resources	
Staff Intelligence	Staff Intelligence
Intelligence of Survey Plans	
Cost of Plan Examination	
Cost of Plan Registration	
Familiarity	Familiarity
Update of DCDB	
Quantity of Detail	Quantity of Detail

Table 4.2.1 Pre E-Plan Strengths

4.2.2 Pre E-Plan Weaknesses

When a survey plan is lodged at the LPI it can be handled by multiple users and manually lodged plans are converted to TIFF images. When the plans are converted to TIFF images the resolution becomes a constraint on the quality of data and the file size of these plans also becomes an issue.

Due to the nature of hard copy plans they cannot be interrogated for information easily which is also a reason for the multiple handling and this uses up staff resources. Staff also spend a lot of time in undertaking the manual examination of non intelligent plans.

Requisitions can be raised at a number of steps in the manual and e-plan registration process including after registration of the plans. They can be raised after registration because the Lands Department in Bathurst digitally recreate the lot for the State DCDB

and the LPI do not check miscloses of the created lots. Due to the manual and multiple handling whilst processing survey plans this increases the cost of both plan examination and plan registration. The weaknesses identified pre E-Plan are as set out in Table 4.2.2

Criteria	Pre E-Plan Weaknesses
Sole Examination	
Sole Registration	
Management of Survey Plans	Management of Survey Plans
Requisition Handling	Requisition Handling
File Size of Survey Plans	File Size of Survey Plans
Storage of Survey Plans	Storage of Survey Plans
Examination of Survey Plans	Examination of Survey Plans
Staff Resources	Staff Resources
Staff Intelligence	
Intelligence of Survey Plans	Intelligence of Survey Plans
Cost of Plan Examination	Cost of Plan Examination
Cost of Plan Registration	Cost of Plan Registration
Familiarity	
Update of DCDB	Update of DCDB
Quantity of Detail	

Table 4.2.2 Pre E-Plan Weaknesses

From Tables 4.2.1 and 4.2.2 we now have the criteria labelled as either a strength or weakness pre E-Plan. The summation of these criteria has been tabulated in Table 4.2.3.

Pre E-Plan Strength	Pre E-Plan Weakness
Sole Examination	Management of Survey Plans
Sole Registration	Storage of Survey Plans
Staff Intelligence	Intelligence of Survey Plans
Familiarity	File Size of Survey Plans
Quantity of Detail	Staff Resources
	Examination of Survey Plans
	Requisition Handling
	Update of DCDB
	Cost Of Examination
	Cost of Registration

Table 4.2.3 Pre E-Plan Strengths and Weaknesses

4.3 Post E-Plan Strengths and Weaknesses

4.3.1 Post E-plan Strengths

The LPI as sole certifiers and registration agents makes this one of the main strengths. This also gives the LPI more staff resources due to the reduction in handling as well as the intelligence of staff to use E-Plan as they will be the first in Australia and this will also allow them to be more prescriptive in setting up the underlying basis of the national ePlan initiative.

LandXML files are 30~50% smaller than TIFF images and have built in intelligence as they can be opened, viewed and edited in Internet Explorer and data and attributes can be queried. As LandXML is a digital data file the LPI can generate automated rules engines replacing manual examination techniques hence reducing the workload of staff.

The system will also generate requisitions through automatically generated emails but being a rules engine based examination there will be greater accuracy and consistency in to requisitions raised.

The reduced time frame for plan production, by using automated rules engines, for plan certification and registration means a reduced cost of plan checking and registration. The Lands Department will update the state DCDB using the digital LandXML file and in the LandXML file they will receive the digital Lot boundaries that the LPI previously didn't check for accuracy or completeness saving them time on the manual inputting of the Lot boundaries, creating a more accurate state DCDB and halting plan requisition after the plan has been registered. The strengths identified post E-Plan are as set out in Table 4.3.1

Criteria	Post E-Plan Strength
Sole Examination	Sole Examination
Sole Registration	Sole Registration
Management of Survey Plans	Management of Survey Plans
Requisition Handling	Requisition Handling
File Size of Survey Plans	File Size of Survey Plans
Storage of Survey Plans	Storage of Survey Plans
Examination of Survey Plans	Examination of Survey Plans
Staff Resources	Staff Resources
Staff Intelligence	Staff Intelligence
Intelligence of Survey Plans	Intelligence of Survey Plans
Cost of Plan Examination	Cost of Plan Examination
Cost of Plan Registration	Cost of Plan Registration
Familiarity	
Update of DCDB	Update of DCDB
Quantity of Detail	

Table 4.3.1 Post E-Plan Strengths

4.3.2 Post E-Plan Weaknesses

The two weaknesses of using E-Plan are the familiarity of using this new lodgement system and the quantity of detail shown. Most surveyors, by using the previous lodgement systems continuously over a long period of time have become familiar with all aspects of that lodgement system. Plan lodgement systems have stayed static until now and without proper education of the new E-Plan system and its ease of use surveyors may not use the E-Plan lodgement process.

It seems that the LandXML file is limited in the amount of annotative text that can be shown as must if not all of the information must be contained within attributes attached so features on the survey plan. The weaknesses identified post E-Plan are as set out in Table 4.3.2

Criteria	Post E-Plan Weakness
Sole Examination	
Sole Registration	
Management of Survey Plans	
Requisition Handling	
File Size of Survey Plans	
Storage of Survey Plans	
Examination of Survey Plans	
Staff Resources	
Staff Intelligence	
Intelligence of Survey Plans	
Cost of Plan Examination	
Cost of Plan Registration	
Familiarity →	Familiarity
Update of DCDB	
Quantity of Detail →	Quantity of Detail

Table 4.3.2 Post E-Plan Weaknesses

From Tables 4.3.1 and 4.3.2 we now have the criteria labelled as either a strength or weakness post E-Plan. The summation of these criteria has been tabulated in Table 4.3.3.

Post E-Plan Strengths	Post E-Plan Weakness
Sole Examination	Familiarity
Sole Registration	Quantity of Detail
Management of Survey Plans	
Storage of Survey Plans	
Intelligence of Survey Plans	
File Size of Survey Plans	
Staff Resources	
Staff Intelligence	
Requisition Handling	
Examination of Survey Plans	
Cost of Checking	
Cost of Registration	
Update of DCDB	

Table 4.3.3 Post E-Plan Strengths and Weaknesses

To show how weaknesses have become strengths and strengths have become weaknesses Table 4.3.4 Changes from Pre to Post E-Plan has been tabulated.

Post E-Plan Strength	Post E-Plan Weakness
Sole Examination	
Sole Registration	
Management of Survey Plans ←	→ Management of Survey Plans
Storage of Survey Plans ←	→ Storage of Survey Plans
Intelligence of Survey Plans ←	→ Intelligence of Survey Plans
File Size of Survey Plans ←	→ File Size of Survey Plans
Staff Resources ←	→ Staff Resources
Staff Intelligence	
Familiarity →	← Familiarity
Quantity of Detail →	← Quantity of Detail
Examination of Survey Plans ←	→ Examination of Survey Plans
Requisition Handling ←	→ Requisition Handling
Update of DCDB ←	→ Update of DCDB
Cost of Examination ←	→ Cost of Examination
Cost of Registration ←	→ Cost of Registration

Table 4.3.4 Changes from Pre to Post E-Plan Strengths and Weaknesses

4.4 Pre E-Plan Opportunities and Threats

4.4.1 Pre E-Plan Opportunities

The LPI have the intellectual knowledge on plan registration and are always looking at how to improve current lodgement systems. Due to the recent creation of ANZLIC and ICSM the legislation has been amended to include digital lodgement where previously this was unavailable and the LPI have representatives on these council bodies. The LPI have been looking internally for ways to increase plan registration numbers by using

electronic lodgement. Therefore the opportunities identified pre E-Plan are set out in Table 4.4.1

Criteria	Pre E-Plan Opportunities
Technology Development	
Digital Data Development	
Software Development	
Stratum and Community Plans	
Private Examination	
Legislative Changes →	Legislative Changes
Intellectual Knowledge →	Intellectual Knowledge
Joint Ventures →	Joint Ventures
Environmental Impact	
Volume of Survey Plans	
Human Resources	
Sustaining Internal Capabilities	
Electronic Examination →	Electronic Examination
Automated Record Keeping	

Table 4.4.1 Pre E-Plan Opportunities

4.4.2 Pre E-Plan Threats

The LPI have stayed static in its plan lodgement processes whereas with technology, digital data and software development always increasing and becoming more complex and efficient. This in turn has increased the volume of survey plans being lodged due to the increase in population and more high density mixed residential/commercial developments taking place that are producing complex plans like stratum and strata plans. By staying static the LPI have put a lot of strain on internal capabilities by not being able to automatically update associated electronic databases, There is always the threat, due to the high volume and increasing complexity of survey plans being

produced, that surveyors may ask for private examiners to be introduced for plan lodgement processes to make the processing faster and more accessible. Also of significant importance in today's climate is the environmental impact of hard copy plan production and creating large storage areas for these survey plans. Therefore the threats identified pre E-Plan are set out in Table 4.4.2

Criteria	Pre E-Plan Threats
Technology Development	Technology Development
Digital Data Development	Digital Data Development
Software Development	Software Development
Stratum and Community Plans	Stratum and Community Plans
Private Examination	Private Examination
Legislative Changes	
Intellectual Knowledge	
Joint Ventures	
Environmental Impact	Environmental Impact
Volume of Survey Plans	Volume of Survey Plans
Human Resources	Human Resources
Sustaining Internal Capabilities	Sustaining Internal Capabilities
Electronic Examination	
Automated Record Keeping	Automated Record Keeping

Table 4.4.2 Pre E-Plan Threats

From Tables 4.4.1 and 4.4.2 we now have the criteria labelled as either an opportunity or threat pre E-Plan. The summation of these criteria has been tabulated in Table 4.4.3

Pre E-Plan Opportunity	Pre E-Plan Threat
Legislative Changes	Technology Development
Intellectual Knowledge	Digital Data Development
Joint Ventures	Software Development
Electronic Examination	Stratum and Community Plans
	Private Examination
	Environmental Impact
	Volume of Survey Plans
	Human Resources
	Sustaining Internal Capabilities
	Automated Record Keeping

Table 4.4.3 Pre E-Plan Opportunities and Threats

4.5 Post E-Plan Opportunities and Threats

4.5.1 Post E-Plan Opportunities

The intellectual knowledge of plan lodgement is the main opportunity available to the LPI because they have always been the sole providers of plan examination. Using the new digital data developments the LPI will be able to process large volumes of survey plans which will lower the workload and increase productivity on the human resources and it will also reduce the amount of paper generated lowering the environmental impacts. The legislative changes made by ANZLIC and ICSM with the LPI having representatives on these councils has created an excellent opportunity for the LPI as well as being the first government body to implement a digital plan lodgement in Australia. The new lodgement system E-Plan will sustain their internal capability by reducing workloads thorough electronic examination and automatic updating of relevant databases. Therefore the opportunities identified post E-Plan are as set out in Table 4.5.1

Criteria	Post E-Plan Opportunity
Technology Development	
Digital Data Development	
Software Development	
Stratum and Community Plans →	Stratum and Community Plans
Private Examination	
Legislative Changes →	Legislative Changes
Intellectual Knowledge →	Intellectual Knowledge
Joint Ventures →	Joint Ventures
Environmental Impact →	Environmental Impact
Volume of Survey Plans →	Volume of Survey Plans
Human Resources →	Human Resources
Sustaining Internal Capabilities →	Sustaining Internal Capabilities
Electronic Examination →	
Automated Record Keeping →	Automated Record Keeping

Table 4.5.1 Post E-Plan Opportunities

4.5.2 Post E-Plan Threats

With the rapid increase in digital technology, digital data and software development it is hard for any company to keep up with the changes. The LPI have invested large sums of money to focus on LandXML files for use in their survey plan lodgement system. Although the ICSM e-plan working group have ratified LandXML as the digital data for use Australia wide new technology may appear. This technology may be adopted by industry as the file to use, and may outdate LandXML as a suitable file type meaning that the LPI may have to change their processing techniques. If this does happen or the workload for the LPI becomes to high the surveying industry and associated professionals may call for private examiners to be used. Therefore the threats identified post E-Plan has been set out in Table 4.5.2

Criteria	Post E-Plan Threat
Technology Development →	Technology Development
Digital Data Development →	Digital Data Development
Software Development →	Software Development
Stratum and Community Plans	
Private Examination →	Private Examination
Legislative Changes	
Intellectual Knowledge	
Joint Ventures	
Environmental Impact	
Volume of Survey Plans	
Human Resources	
Sustaining Internal Capabilities	
Electronic Examination	
Automated Record Keeping	

Table 4.5.2 Post E-Plan Threats

From Tables 4.5.1 and 4.5.2 we now have the criteria labelled as either an opportunity or as a threat post E-Plan. The summation of these criteria has been tabulated in Table 4.5.3

Post E-Plan Opportunity	Post E-Plan Threat
Legislative Changes	Technology Development
Intellectual Knowledge	Digital Data Development
Joint Ventures	Software Development
Electronic Examination	Private Examination
Stratum and Community Plans	
Environmental Impact	
Volume of Survey Plans	
Human Resources	
Sustaining Internal Capabilities	
Automated Record Keeping	

Table 4.5.3 Post E-Plan Opportunities and Threats

Table 4.3.4 Changes from Pre to Post E-Plan has been tabulated to show how weaknesses have become strengths and strengths have become weaknesses. Those criteria that haven't changed from a threat to an opportunity or vice versa will be labelled as static.

E-Plan Opportunity	E-Plan Threat
	Technology Development (Static)
	Digital Data Development (Static)
	Software Development (Static)
Stratum and Community Plans ⟵	Stratum and Community Plans
	Private Examination (Static)
Legislative Changes (Static)	
Intellectual Knowledge (Static)	
Joint Ventures (Static)	
Environmental Impact ⟵	Environmental Impact
Volume of Survey Plans ⟵	Volume of Survey Plans
Human Resources ⟵	Human Resources
Sustaining Internal Capabilities ⟵	Sustaining Internal Capabilities
Electronic Examination ⟵	Electronic Examination
Automated Record Keeping ⟵	Automated Record Keeping

Table 4.5.4 Changes from Pre to Post E-Plan Opportunities and Threats

4.6 SWOT Analysis Tables

As a final part to the SWOT analysis two tables will be drawn to show the complete picture. The first table will have all of the strengths, weaknesses, opportunities and threats for pre E-Plan and the second Table will be for post E-Plan. As Table 4.6.2 will demonstrate the E-Plan model has more strengths than weaknesses and more opportunities than threats.

Pre E-Plan Strength	Pre E-Plan Weakness
Sole Examination	Management of Survey Plans
Sole Registration	Storage of Survey Plans
Staff Intelligence	Intelligence of Survey Plans
Familiarity	File Size of Survey Plans
Quantity of Detail	Staff Resources
	Examination of Survey Plans
	Requisition Handling
	Update of DCDB
	Cost of Examination
	Cost Of Registration
Pre E-Plan Opportunity	**Pre E-Plan Threat**
Legislative Changes	Technology Development
Intellectual Knowledge	Digital Data Development
Joint Ventures	Software Development
Electronic Examination	Stratum & Community Plans
	Private Examination
	Environmental Impact
	Volume of Survey Plans
	Human Resources
	Sustaining Internal Capabilities
	Automated Record Keeping

Table 4.6.1 Pre E-Plan SWOT Analysis

Post E-Plan Strength	Post E-Plan Weakness
Sole Examination	Familiarity
Sole Registration	Quantity of Detail
Management of Survey Plans	
Storage of Survey Plans	
Intelligence of Survey Plans	
File Size of Survey Plans	
Staff Resources	
Staff Intelligence	
Requisition Handling	
Examination of Survey Plans	
Cost of Examination	
Cost of Registration	
Update of DCDB	
Post E-Plan Opportunity	**Post E-Plan Threat**
Legislative Changes	Technology Development
Intellectual Knowledge	Digital Data Development
Joint Ventures	Software Development
Electronic Examination	Private Examination
Stratum and Community Plans	
Environmental Impact	
Volume of Survey Plans	
Human Resources	
Sustaining Internal Capabilities	
Automated Record Keeping	

Table 4.6.1 Post E-Plan SWOT Analysis

4.7 Conclusion

This chapter provided the results of the SWOT analysis for the comparison of pre and post E-Plan. The criteria were assigned as a strength, weakness, opportunity or threat pre E-Plan and then post E-Plan and the results were tabulated in tables firstly for the strengths and weaknesses and then secondly as opportunities and threats. At the end of the strengths and weaknesses analysis a table was drawn for post E-Plan that shows how weaknesses became strengths and vice versa. This process was also completed for the opportunities and threats. Lastly in this chapter the completed SWOT analysis tables were drawn for pre and post E-Plan showing all of the criteria as a strength, weakness, opportunity or threat.

The next chapter will complete a discussion on the results of the SWOT analysis as well as detailing further information found through the investigation into the E-Plan land title plan lodgement process.

Chapter 5

Discussion

5.1 Introduction

The previous chapter gave the results for the SWOT analysis for both pre and post E-Plan and also showed the strengths and weaknesses, opportunities and threats, where the changes have occurred.

The aim of this chapter is to discuss why these changes have occurred and to also provide more information that was found through the investigation. To the value of attributes instead of annotation and the effects of E-Plan on cost and timeframe reductions that may be made and to also provide timeframe for the implementation of E-Plan.

5.2 Strengths and Weaknesses

There are significant changes to the strengths and weaknesses tables which are highlighted in Table 5.2. The main group of weaknesses that have become strengths are related to the handling of survey plans of which the majority of processes will be handled electronically through the E-Plan process.

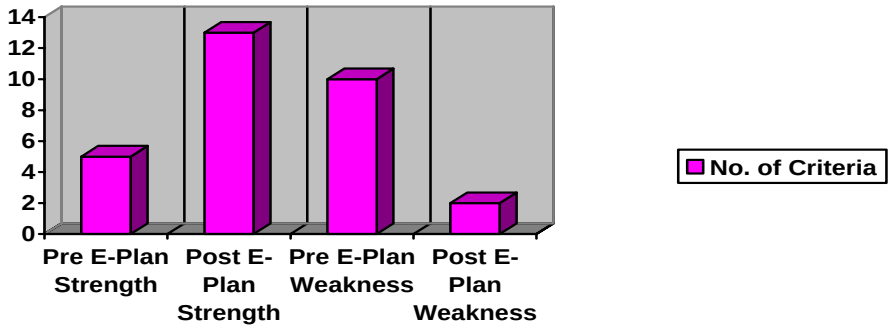

Figure 5.2 Pre versus Post E-Plan Strengths and Weaknesses

As shown in Figure 5.2 which is as described by M Deal (2009, *pers. comms.*, 18 August) the process is mostly electronic with no paper or manual handling required and every part of the process can be completed within the computer environment. This

electronic processing greatly reduces the multiple and manual handling previously used and reduces the timeframe of each step of the registration process.

The two weaknesses that were strengths pre E-Plan may become strengths in time. Surveyors have had little change in the processing of survey plans and are very familiar with the lodgement process. As long as surveyors use and interact with the LPI on improving the E-Plan process these two weaknesses over time may become strengths.

5.3 Opportunities and Threats

There are significant changes to the opportunities and threats which are highlighted in Figure 5.3.

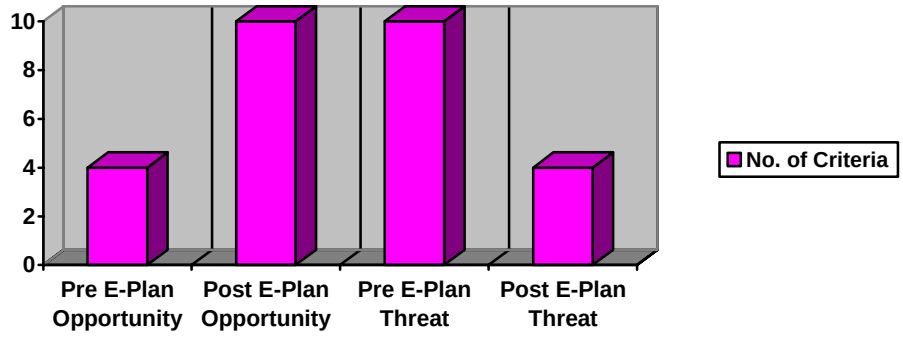

Figure 5.3 Pre versus Post E-Plan Opportunities and Threats

The main opportunity available for implementing E-Plan will be that the LPI will be the first land title authority in Australia to use the electronic E-Plan system. This will give the other states and territories in Australia the ability to monitor how E-Plan is implemented and used and the advantages of using a completely electronic lodgement system. The LPI will therefore become the leading authority in Australia on electronic processing of land title plans making E-Plan the intellectual property of NSW and joint ventures with other state and territories possible.

Through electronic examination as previously shown in Figure 5.3 the human resources requirement for plan examination will be reduced. This will allow staff to increase production of their other services as well as increasing the volume of survey plans being produced.

With the ever increasing awareness of human impact on our environment the old systems of plan lodgement involved very large amounts of hard copy plans being produced as this was the only media available to view these plans. But with electronic processing, CAD software and the WWW the need to print large volumes of hard copy plans has become seemingly redundant. Some hard copy plans will still need to be produced but this can be limited to only a few copies.

There was also the storage issue of keeping the original hard copy plans in humidified controlled storage areas. Now that we have seemingly limitless storage ability on external hard disk or tape drives the area needed for storage will go from large office size storage areas to slim portable hard disk drives the equivalent size of a small shoe box. All these new processes reduce the impact on our environment considerably as this should be the case.

The main threat to the LPI is technology whether it is through new digital data types being developed and used or with software development making LandXML an inferior file. This would mean that the money spent on implementing the new E-Plan system is not so much as wasted but that more money will need to be spent to utilise newer technologies but only if LandXML becomes an inferior or outdated file type in the near future.

5.4 Attribute and Annotation

Attributes, in LandXML, is the information that will be attached to either the polygon, line or point that will describe what the polygon line or point intention is. In land title plans the polygon described will be the shape of the lot. The attributes attached to the lot could be such things as lot number, area, locality or Local Government Area (LGA).

All of this information will be attached to the polygon via attributes where the attribute must be predefined and therefore transcription errors will not occur. The LPI will supply a list of all predefined attributes available for selection when adding these attributes to the polygon, line or point.

Lines in a LandXML file have a bearing and distance described from one end of the line to the other and each line has a purpose. That purpose maybe a connection line, boundary line or easement line and its purpose will be attached to the line as an attribute.

Points are located at each end of a line and a Reference Mark (RM) is one example of a point at the end of a line. An RM in surveying is a feature left behind by surveyors to identify and describe positions of boundaries. On survey plans a RM has a type, a state in which it is found, a connection to the nearest boundary corner and an origin all of which are added to the point as an attribute.

All of this attributed information was previously annotated on a survey plan by the surveyor as descriptive text or annotation. The process for adding this information as annotation is usually that the surveyor drafts a survey plan on paper whilst adding the relevant information to the paper plan as it becomes available. The surveyor will then forward this draft paper copy to the survey drafter who prepares a CAD model of the plan in computer software. The plan needs to be cropped that is it needs to be reduced from a real world scale of 1:1 to fit onto the LPI A2 Plan Format. This is where requisitions are usually raised due to transcription errors or missing information that occur between the surveyor drafting the plan and the survey drafter drawing the plan. The plan produced by the survey drafter or surveyor now becomes a picture of boundary definition rather than accurate real world scale model of the boundary being defined.

An example of annotation that is no longer required on a survey plan but is added to the polygon, line or point is shown below in Figure 5.4.1 All that annotation highlighted in red will be added to the CAD model as attributes and diagrams of specific areas will no longer be necessary.

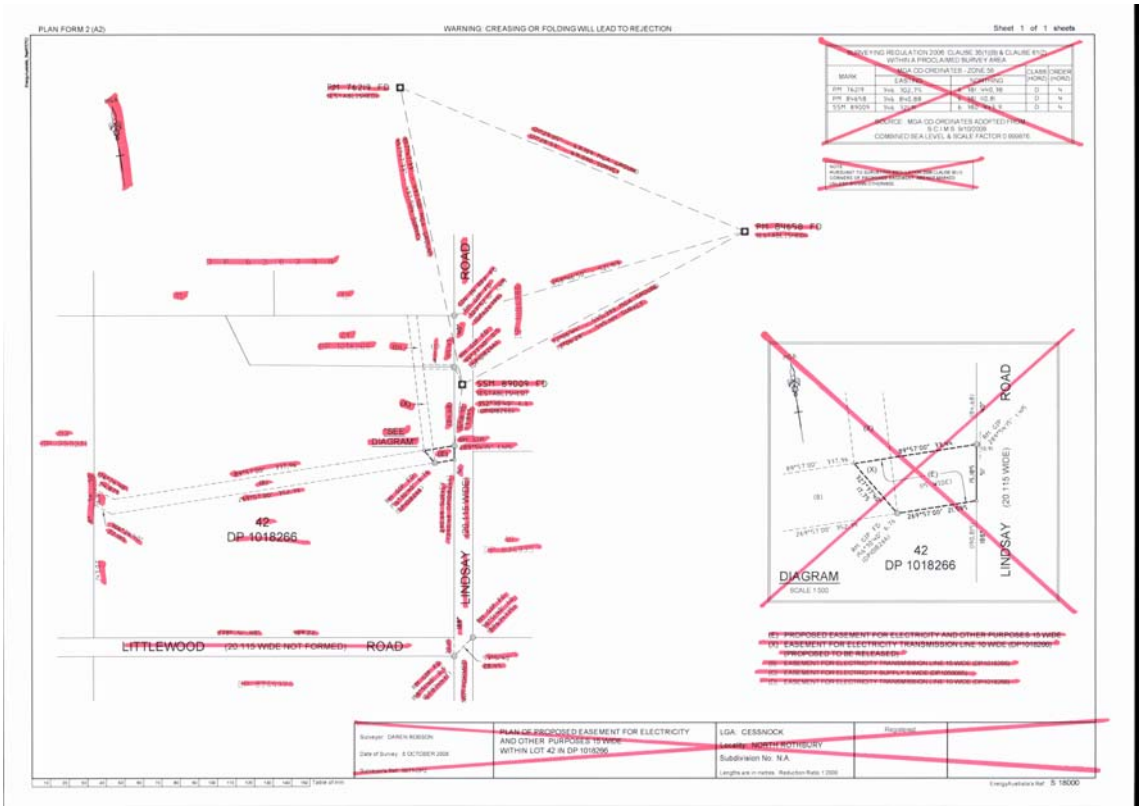

Figure 5.4.1 Annotation That Will Become Attributes.

With the example below the RM can be found at the Eastern intersection of Littlewood and Lindsay Roads in Figure 5.4.1 The LandXML format requires the information be added to the point from drop down menus thus reducing transcription errors.

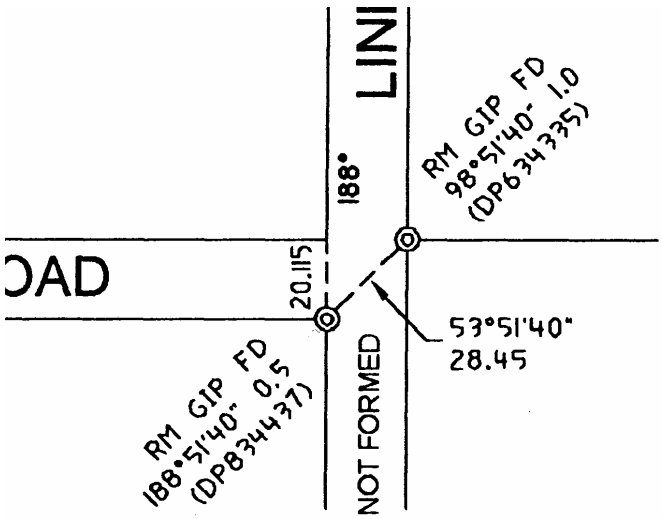

Figure 5.4.2 RM Example with Annotation

The RM on the top right hand side of the picture, as previously stated, has a number of annotations that will now become attributes under E-Plan. The RM has a type Galvanised Iron Pipe (GIP), a state (Found), an origin (DP634335) and a connection to the boundary corner which is 98° 51’ 40” for a distance of 1.0 metres.

Attributes	
PtNumber	80
Easting	346125.125
Northing	6380754.321
Category	Connection
MkPurpose	Reference
MkType	GIP
MkState	Found
MkOrigin	DP634335

Figure 5.4.3 Attributes Added to the Properties of the RM

The Values in the left hand column of Figure 5.4.3 are the attribute description from the LandXML schema. Where the Category, MkPurpose, MkType and MkState are selected from drop down menus in the right hand column from a select list and the MkOrigin is manually inputted.

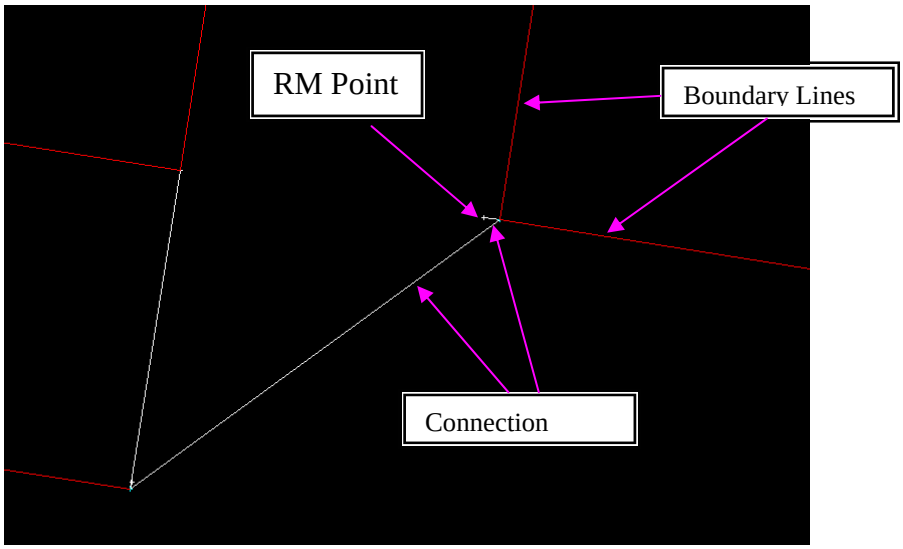

Figure 5.4.4 CAD Model of RM Corner

Figure 5.4.4 is a representation of the CAD model that would be produced to generate the LandXML file. There is no annotation shown on screen, rather the attribute information is added to the properties of the polygon, line or point as indicated in Figure 5.4.3.

Some surveyors do use annotation on plans for their own descriptive purposes that are not related directly to the survey plan. This annotation may not be able to be added to a LandXML file as yet as the annotation is not attached to polygon, line or point but rather to an area of the plan in general.

5.5 Occupation

One of the main areas of concern after discussion with other surveyors and the E-Plan program manager is how to address the issue of occupation. Occupation is shown on survey plans as fences or buildings and their position relative to boundaries and can form a major part of boundary definition on land title plans. The problem is in two parts. The first part of the problem is the scale of the information shown on hard copy

plans and how much of that information that is diagrammatic in nature only. The second part of the problem is how much information for occupation the surveyor locates in the field. These two issues can be overcome for the most part by the surveyor in the field collecting more survey data by way of radiations so that the true position of all corners and the shape of the occupation can be plotted.

An example of fence occupation is shown in Figure 5.5.1 below.

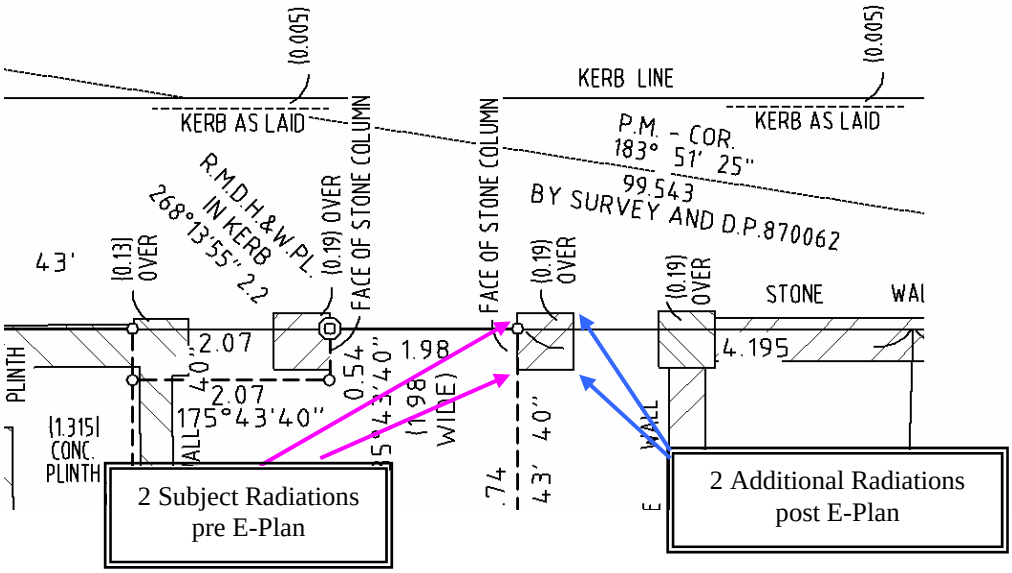

Figure 5.5.1 Fence Occupation Example

In Figure 5.5.1 above the surveyor has located a number of stone columns along the front boundary and shown distances relative to the subject boundary. Previously the surveyor would have only needed to radiate a minimal number of corners for each stone pillar being the 2 subject radiations pre E-Plan. This would give the surveyor the depth of the pillar and the relationship of that pillar to the two subject boundaries then with a tape measure the length of the pillar along the street frontage is measured but only for plotting purposes. But with E-Plan the surveyor will need to radiate all four corners of the pillar so that each point can have its true attributes being occupation and the line joining the points will have an attribute of occupation as well as each corner of the pillar having its position relative to all boundaries in their true positions.

Another example of occupation is a surveyor having located a building in respect to the subject boundary. As in figure 5.5.2 the surveyor has located the two corners of the building relative to the boundary line. But with E-Plan the surveyor will need to radiate two more points so that the return of the walls or the position of the side walls can be shown. This may require an extra traverse station for surveyors to make these radiations to the wall returns but it will be necessary so that the buildings true shape can be shown.

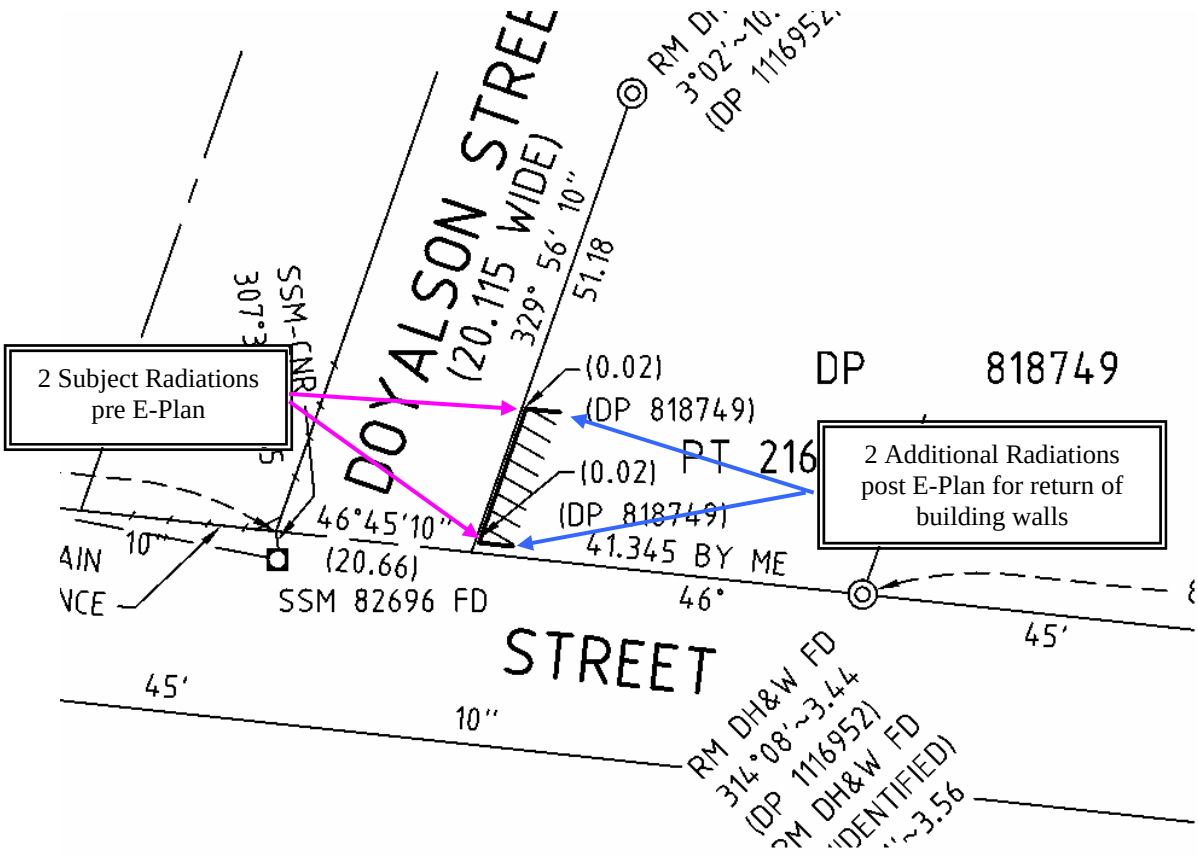

Figure 5.5.2 Building Occupation Example

5.6 Land Title Plan Rendering

When E-Plan is introduced surveyors will be lodging a text based LandXML file and will no longer supply the LPI with a picture or diagram of the land title. The LPI will render an image of the land title plan applicable to the clients' purpose.

Other than the surveyor, when asking the LPI for a land title plan, will receive a picture of their land title with the relevant information they need. Currently clients other than the surveyor receive the same plan as the surveyor yet a lot of the information contained on the survey plan is superfluous to their needs. The plan will show the usual jurisdictional data such as locality, LGA, parish and county and also a simple diagram annotated with the lot number, area of the land title, adjoining streets and the adjoining lot information. (Deal, M 2009, *pers. comms.,* 18 August)

The surveyor will receive not only the original LandXML file but a survey plan similar in appearance with previous land title plans. All survey information such as survey marks, reference marks, bearing and distances etc will be shown in a coordinated schedule.

It will be the responsibility of the LPI to produce or render diagrams of land title plans relevant to their clients needs and each plan will appear identical in rendering across all land title plans. (Deal, M 2009, *pers. comms.,* 18 August)

5.7 Cost and Time

The costs associated with land title plans can be directly related to the timeframe of land title plan production. As the timeframe is reduced so also do the costs but only to a point where it will reach the base cost. With the manual and current ePlan processes the timeframe for registration of a land title plan from submission is on average about 3 to 4 weeks. (Deal, M 2009, *pers. comms.,* 18 August)

The LPI currently have around 10 assembly staff who gathers the associated records for the plan examination to give to the examination staff. There are 20 plan examiners who do manual plan examination and there are another 8 staff creating the title folio's after the plan has been registered. The average lodgement rate over time is the registration of 40 land title plans and 10 strata plans a day but yearly this equates to around 1.1 plans per day per person. As of September 2009 there are 380 land title plans waiting examination. (Deal, M 2009, *pers. comms.,* 18 August)

The LPI currently allow 4 hours for the manual examination of a plan. An additional fee of $50 for each quarter hour or part of a quarter is charged until the plan has been fully examined. (Deal, M 2009, *pers. comms.,* 18 August) Complex stratum land title plans which is a three dimensional subdivision of land can take weeks to manually examine with costs exceeding $10,000 due to the examiner having to recreate the plan in the digital environment.

The LPI are currently undertaking a pilot study with 3 examiners using the E-Plan process from lodgement through to registration utilising LandXML files and software known as Cadastral Editor XML. Other staff compiles hard copy plans into LandXML file format. The 3 examiners are completing around 2.5 plans per person per day. Being a pilot study the process is not fully automated and a degree of manual control is used to test the accuracy of the automated rules engine.
(Deal, M 2009, *pers. comms.,* 18 August)

This dissertation cannot give actual examples of cost or time savings at this time as E-Plan is still in the testing phase and is not available to the public. But the timeframe established by the LPI so far (Deal, M 2009, *pers. comms.,* 18 August) is for registration of a plan 1 to 2 weeks from lodgement through to the issue of title folios instead of the current 3 to 4 weeks. Initially encouragement for surveyors to migrate to the LandXML platform will be given by the LPI offering monetary incentives to surveyors for using the E-Plan portal.

5.8 E-Plan Implementation Timeframe

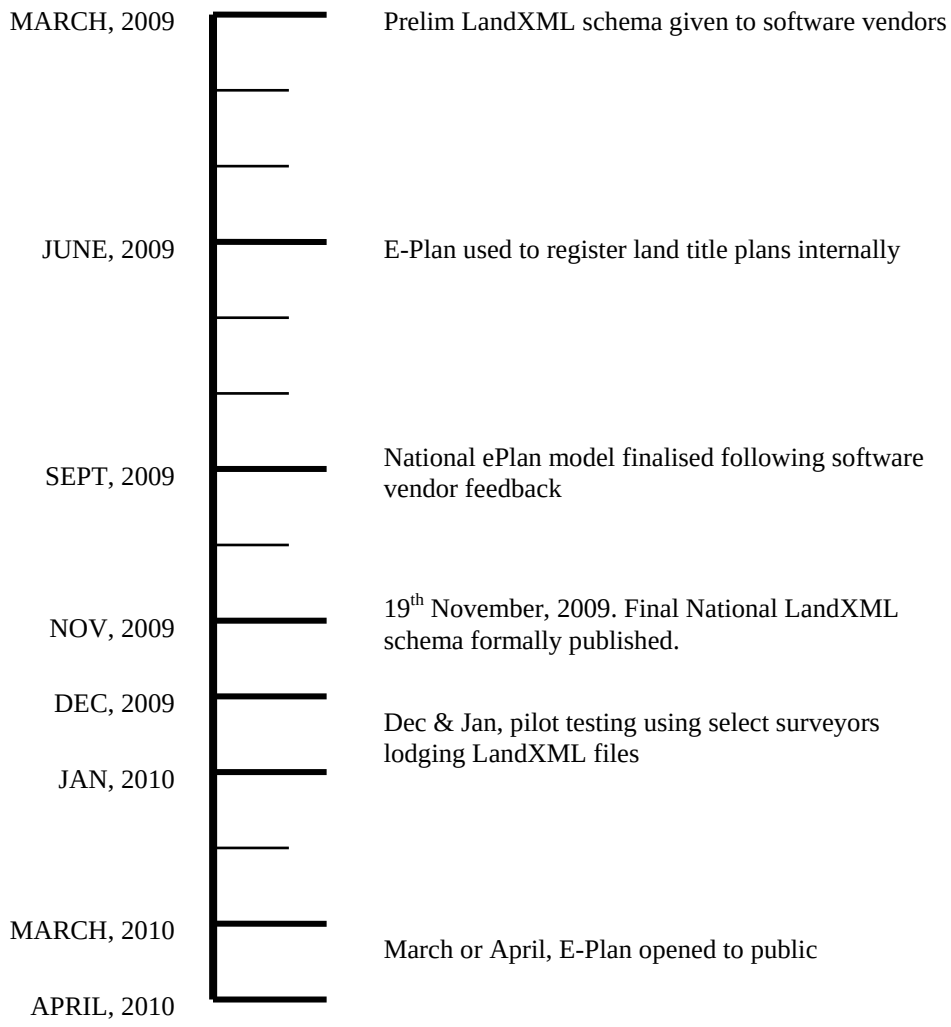

Figure 5.8 E-Plan Implementation Timeframe
Deal (M 2009, pers comms., 14th October)

The ICSM ePlan working group has representatives from all Australian states and territories involved in the implementation of E-Plan. In March 2009 the software vendors were given a preliminary copy of the LandXML schema so that they could start developing the software to produce applicable LandXML files suitable for lodgement in each State and Territory.

In June 2009 the LPI had started using E-Plan for the electronic processing of land title plans in SW. Then on the 29th September, 2009 the National ePlan model for

LandXML was finalised following feedback from the software vendors on the draft version they received in March. The draft model remained virtually unchanged to the final LandXML model that the vendors used to create their software. The final version of the LandXML schema will be ratified by the ICSM on November 19th, 2009 and they will then formally publish the model.

Through December 2009 and January 2010 the LPI will run a pilot program of E-Plan by inviting a number of selected surveyors to lodge both a LandXML file and a TIFF image of the land title plan, using the TIFF image as a backup in case of problems. In March or April of 2010 the E-Plan lodgement facility will be available to the public for use online through the LPI SIX portal.

5.9 Conclusion.

This chapter provided a discussion on the results of the SWOT analysis and also on some aspects of the investigation into the E-Plan process. The strengths outweigh the weaknesses and the opportunities are more abundant than the threats post E-Plan. Attributed information rather than annotation may have short comings at the initial implementation of E-Plan but these things can be resolved over time. Also the cost and timeframe benefits of using E-Plan become apparent.

Chapter 6 will comment on possible recommendations and draw final conclusions on the investigation into E-Plan for the results discussed in this chapter.

Chapter 6

Conclusions and Recommendations

6.1 Introduction

The previous chapter gave a discussion on the results of the SWOT analysis as well some more information that was found during the investigation into the E-Plan process. This discussion included information about attributes that will be added to E-Plan instead of annotation, occupation, land title plan rendering, cost and time and lastly gave the approximate timeframe for the implementation for E-Plan

The aim of this chapter is to provide recommendations that have come from the research and to provide final conclusions on the E-Plan process.

6.2 Conclusions

All of the objectives set out in chapter one has been successfully completed during this dissertation. The SWOT analyses that were completed both pre and post E-Plan showed a shift from weaknesses to strengths and from threats to opportunities.

The main reason behind weaknesses becoming strengths is that past lodgement systems have always been manually based. Using the manually based lodgement process there is multiple handling between staff at the LPI making their internal proceedings inefficient. Moving to a complete electronic system allows the LPI to minimise multiple staff interactions as well as being able to create electronically automated systems that are much more efficient and accurate. The two weaknesses that have been identified post E-Plan being the familiarity and quantity of detail can be resolved over time as long as surveyors are willing to learn the new process.

The change from having more threats than opportunities to having more opportunities than threats is due to the LPI being the first government authority in Australia to implement E-Plan. This will give the LPI the intellectual knowledge to form joint ventures with other states and territories Australia wide for implementing nationally the E-Plan program. The electronic processing of plans will produce an automated record keeping system which will in turn reduce the workload of individual staff giving the

staff more time to work on the other facets of the LPI. The only threat to the LPI is the development of new digital data file types which in turn produce more complex software and technologies that could become the industry standard. The LPI will the have to modify existing infrastructure to accommodate this costing more time and resources to transition to the new system. This threat can be removed if the LPI act fast enough to implement the new E-Plan lodgement process before this digital technology is developed.

Attributes that will be added to the LandXML file will become a new process for surveyors to learn and it is unsure at this stage just how much information can be attached as an attribute and if any information can be added as annotation without being attached to an existing polygon, line or point. The fieldwork for surveyors will need to change to reflect the new process of producing LandXML in particular the process of plotting occupation. Through continuing meetings and negotiations with surveyors on the E-Plan process this issue will be resolved over time.

The LPI will be rendering all land title plans under the new E-Plan system as a LandXML is purely text based as can be seen in Appendix B. This rendering process will be tailored to suit the LPI individual client needs and is one more process the LPI needs to set up. But having the LPI produce the plans suitable for each of its client's needs means that each plan will become identical in its appearance.

As a whole the E-Plan process is a necessary step for the processing of land title or survey plans. The electronic processing of these plans will be more cost and time efficient and will complete the picture for surveyors to work completely in the digital environment allowing more accurate and up to date spatial data

6.3 Recommendations

This dissertation cannot make any definitive recommendations at this stage as the E-Plan process will not be available to the public until April 2010.

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Appendices

Appendix A

University of Southern Queensland

FACULTY OF ENGINEERING AND SURVEYING

ENG4111/4112 Research Project
PROJECT SPECIFICATION

FOR:	**Vaughan Adam WADY**
TOPIC:	INVESTIGATION OF LAND & PROPERTY INFORMATION (N.S.W.) PROPOSED ***EPlan*** PROCESS OF DIGITAL SURVEY PLAN LODGEMENT IN LandXML FORMAT
SUPERVISORS:	Mr. Glenn Campbell Mr. Matthew Riddell, Registered Surveyor, *EnergyAustralia*
PROJECT AIM:	To investigate the proposed *EPlan* system of digital survey plan lodgement in LandXML format and analyse the benefits and impediments for the key stakeholders concerned.

PROGRAMME:

1. Research existing literature with respect to electronic lodgement survey data.
2. Research the existing *ePlan* and proposed *EPlan* system of registration of survey plans.
3. Research LandXML file structure and identify its advantages and disadvantages with respect to cadastral plans.
4. Identify the needs of key stakeholders who utilise cadastral information.
5. Analyse the benefits and impediments of *EPlan* registration including Deposited Plans in Stratum.
6. Make recommendations on changes to the proposed *EPlan* system if required.
7. Submit an academic dissertation on the research.

As Time Permits

8. Research how the LandXML data will be incorporated into the Digital Cadastre Database.

AGREED:

(Student) (Supervisors)

Date: 11/3/09 11/3/09 __/__/__

31/03/09

Appendix B


```
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