THE SURVEYING ACTIVITIES AT THE AUSTRIAN FEDERAL OFFICE FOR METROLOGY AND SURVEYING: AN ECONOMIC ANALYSIS

(*VOKSWIRTSCHAFTLICHE STUDIE ZU DEN LEISTUNGEN DES BUNDESAMTES FÜR EICH- UND VERMESSUNGSWESEN IM VERMESSUNGSWESEN*)

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ABSTRACT

This study analyzes the surveying activities followed by the Austrian Federal Office for Metrology and Surveying (BEV). The BEV, a subordinate agency of the Austrian Federal Ministry of Economics and Labour, accomplishes two main categories of activities within the surveying area. One activity is concerned with the Fiscal Cadastre, which deals with the storage and administration of parcel boundaries at the national level and maintenance at the regional level. The second activity is the Topographic and Mapping Survey, which deals with the production and maintenance of topographic data with national coverage.

The study concludes that the Austrian Cadastre, namely the fiscal and ownership cadastre, is cost effective. The contributions of the users to the maintenance of the cadastre, via property and transfer tax, fees for registration of ownership change and mortgage, and revenues from cadastral data sale, seem to be adequate according to the nature and purpose of the cadastral system, i.e. the security and protection of the land owners' property rights. The Topographic Survey covers broader and diverse data needs, from the public to the private sector, having defence a central role in the production of topographic data. The free access to topographic data seems to be appropriate, given that 75% of the users belong to the public sector. Additionally, topographic data access can contribute to the economic growth in terms of job creation, business opportunities, R&D growth, etc. The biggest impact of this recommended change will be at the level of the SME and the citizens, ending up with the confinement of these data to big business and government. This method of making public data available free of charge is believed to have contributed in the U.S. at the beginning of the 90s to the growth of the American economy, which has affected, in last instance, the tax revenues.

EXECUTIVE SUMMARY

The aim of this study was to analyze the surveying activities of the Austrian Federal Office for Metrology and Surveying (BEV). The BEV is a subordinate agency of the Austrian Federal Ministry of Economics and Labour, and is considered to be moving from a purely governmental department towards a public corporation.

The BEV accomplishes three main activities within the surveying area:

- Fiscal cadastre (*Kataster*): deals with the storage and administration of parcel boundaries at national level and maintenance at regional level. The main goal of this activity is to secure the land property rights.
- Topographic and Mapping Survey: deals with the production and maintenance of topographic data with national coverage. The main goal is to cover the topographic data needs at national level.
- Record and determination of land use and classification attributes: the costs of this activity are included in the fiscal cadastre.

After analyzing these types of activities the main results found are:

- The surveying activities accomplished at the BEV employ more than 82% of the labour resources.
- The Cadastre Service at the BEV concentrated more than 65% of the surveying activities' labour resources at the BEV.
- The costs of maintaining the Austrian Cadastre amount to ATS 684.7 million (€ 49.7 million). These costs include the costs associated to the ownership cadastre (Department of Land Registry, *Grundbuch*) and to the fiscal cadastre (BEV, Cadastre Service).
- The benefits associated with the Cadastre amount to ATS 15,824.3 million (€ 1,150.0 million). The benefits are quantified in terms of revenues from taxes and fees associated to the Cadastre, which include: Property tax (*Grundsteuer*), Transfer tax (*Grunderwerbssteuer*), fees levied on the registration of ownership and mortgage in the Ownership Cadastre (*Grundbuch*), and revenues from cadastral data sales. This is a low estimate of the benefits since it does not include non-monetary benefits like the incentives to market transactions, reduction of asymmetric information and uncertainty about land property that can provoke land disputes, and reduction of uncertainty and moral hazard problems for creditors in the use of land as collateral.
- The Austrian Cadastre is 100% cost recovery. The revenues induced by the Cadastre are more than twenty three times the costs of the Cadastre.
- The users of the Cadastre are to a large extent private, approximately 60%. The Cadastre contributes in first instance to the benefit of private individuals, by the protection of ownership rights. Therefore, it seems reasonable that the owners or potential owners of land shall contribute to the maintenance of the system through the taxes and fees imposed upon the use of the service.
- The Topographic Survey at the BEV concentrates around 35% of the surveying activities' labour resources at the BEV.
- The base topographic dataset produced by the BEV are the 1:50.000 scale topographic maps, which are the main source of the production costs at the Topographic Survey Service. In the year 2000 the National Topographic Survey (NTS) contributed 5.9–12.6% of Austrian gross value added[1]. In real terms this amounts to ATS 167.1 billion–ATS 356.3 billion (€ 12,143.9 billion/€ 25,893.9 billion). This figure is a low estimate since the contribution

[1] Austrian GDP at market prices (2000) is ATS 2,839.9 billion/€ 205,952 million

is calculated through the use of topographic data as a primary input into production by several key private sectors in the economy (namely: utilities, architects, engineers, survey and construction, real estate, transport, farming and forestry, mining, drilling and quarrying). This estimate leaves out important users of topographic data like the public sector and some users within the service sector. It does not include the positive economic externalities the production and availability of topographic data generate and which are difficult to quantify.

- The nature of topographic data users is very diverse, including federal and regional government, business users (large corporations and SME), academia and research institutions, and citizens at large. Additionally, the production of other geodata goods and services involves the use of topographic data to a large extent. The wide use of topographic data at all levels gives an intuitive idea of the important contribution of topographic data to the Austrian economy. We assess the contribution of topographic data to the Austrian economy by estimating the value-added tax (VAT) revenues levied on the GVA assumed to be topographic data dependent. In the year 2000, the National Topographic Survey produced VAT revenues equal to 1.18–2.51% in GDP terms (ATS 33.4 billion–ATS 71.3 billion/€ 5,178.8 million–€ 2,428.8 million).
- Since the free release of topographic data in the U.S. (TIGER files) at the beginning of the 90s the market has grown significantly. It is reasonable to estimate that a free release of topographic data in Austria could easily produce a growth of the GDP by more than 0.1% (€ 205 million). This growth in the GDP will increase the VAT revenues by more than € 20 million, which is high enough to cover the costs of the Topographic Survey (ATS 254.7 million/€ 18.5 million).
- The access of topographic data via the Internet is the way to overcome institutional failures that might hamper the accessibility, giving an equal status to every potential user of the data and avoiding situations of unfair competition. The biggest impact of this change will be at the level of the SME and the citizens, ending up with the confinement of these data to big business and government. Furthermore, this mechanism will also eliminate the costs of data dissemination that are related to data distribution (media and reproduction), marketing, fee collection, sales support, and a portion of overhead expenses.
- The BEV incurs administration costs for charging fees associated to the distribution of geodata. The collection of fees entails a number of activities within departments associated with calculating, preparing, and sending invoices and receiving payment. Administration costs have incurred already before fees are collected, which in this case are not compensated by the amount of the fees.
- The free release of topographic data is supported by principles of welfare economics that point at the inefficiencies derived from the pricing of goods for which the marginal costs of provision are zero, due to the welfare loss produced by preventing the usage of the goods as a result of charging for the topographic data.

INTRODUCTION

The goal of this study is to analyze the surveying activities followed by the Austrian Federal Office for Metrology and Surveying (BEV), the economic consequences derived from the access to the data collected and maintained by the BEV, and how these economic consequences can be enhanced. Therefore it is necessary to analyze the types of activities and service provision the BEV is enrolled in, the types of users these activities reach, the economic nature of the users and the costs and benefits derived from these activities.

The BEV is involved in three major activities[2]:

- Production and maintenance of the topographic data: the National Topographic Survey;
- Recording of parcel boundaries: Fiscal Cadastre. Storage and administration at the national level and maintenance at the regional level;
- Record and determination of land use and classification attributes[3].

The methodology used to analyze the topographic and cadastral surveying activities, being the two major activities, are different due to the different economic nature of the two types of data each of the activities produce and the nature of the users of the data:

- **Cadastral Survey.** We study the costs of production and maintenance of the Austrian Cadastre and the revenue in terms of fees and taxes levied on this type of data. This analysis considers the whole cadastre, namely the ownership cadastre and the fiscal cadastre (*Grundbuch* and *Kataster*). The established funding system, via taxes and fees, seems to be justified by the economic nature of the users of the cadastral data, which are mainly private users with direct benefits in terms of protection of their ownership rights.
- **National Topographic Survey.** We analyze the contribution of topographic data to the Austrian GVA (Gross Value Added[4]). From that contribution we estimate the VAT (Value-Added Tax) revenues assumed to be topographic data dependent. We limit the analysis to the monetary contributions of the private economic sectors that use topographic data as an input in their production activities. Our estimates are therefore low, taking into account the great contribution of topographic data to public sector activities and the positive economic externalities topographic data production produces[5], economic externalities being quite difficult to quantify.

STRUCTURE OF THE STUDY

The study is structured as follows. Chapter one gives an overview of the activities the BEV carries on. Then we focus on the surveying service. We identify three major activities: Topographic Survey, Cadastral Survey, and record and determination of land use and classification attributes. Then we define the output of these activities, i.e. cadastre and topographic data, and the main users of these data.

Chapter two deals with the Cadastral Survey or fiscal cadastre. We provide a cost and benefit analysis of the Austrian Cadastre. This analysis includes the whole Austrian Cadastre, namely the fiscal and the ownership cadastre.

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2 As mentioned before, we are focusing on the BEV’s surveying activities. For the sake of simplification and unless specified otherwise, we mean surveying activities when referring to BEV’s activities

3 The costs are included in the cadastre

4 *Bruttowertschöpfung*

5 For a description of the positive externalities produced by topographic data production see Section 4.3.4.

In Chapter three we deal with the economic and legal aspects of topographic data collection and access. This section is important in order to understand why topographic data is produced and maintained by the public sector, i.e. the BEV, instead of the private sector, and how the structure of public institutions influences the access to the data. The topics discussed include the economic properties of topographic data that make the production by the public sector necessary, the importance of institutional structures that ease or hamper the access to the data, the positive consequences of topographic data digitization and the decisive role of the Internet as the mean to provide effective and immediate access to topographic data by any potential user.

Chapter four deals with the second main surveying activity at the BEV, the National Topographic Survey (NTS). To understand the costs and benefits of the NTS, it is crucial to analyze the production process and the resulting products and services. The BEV offers many different products under the general heading: topographic goods and services, but it produces the 1:50.000 scale map as the base dataset. The production of this primary dataset generates most of the cost at this department. Most of the other surveying products commercialized by the BEV are generalizations or enlargements of that data set (i.e. 1:200.000, 1:500.000, 1:25.000 scale maps), whose costs are negligible compared to that of the base data set. The cost-benefit analysis of the Topographic Survey is provided in Sections 4.2. and 4.3.

In Chapter five we analyze the North American case. The U.S. is a good example of the positive effect on economic growth of non-cost recovery policies for topographic data. The free dissemination of topographic maps (1:64.000 scale), which occurred at the end of the 90s, is believed to have contributed to the high growth the American geographic market has experienced in the last years. We survey several examples of the U.S. geomarket size in contrast to the EU geomarket.

In Chapter six we give an overview of the situation of National Mapping Agencies (NMAs) in Europe and the reason why they are experiencing an institutional reform process that is transforming them from government departments into public corporations.

In Chapter seven we give some concluding remarks and recommendations.

We enclose an annex at the end of the paper. The annex is complementing the study report. Therefore all data, tables, figures and calculations that are very detailed are included in the annex to let the reader follow the thread and the main arguments of the study, without distracting his attention.

DATA SOURCES

We use official sources for the economic variables referred to in the report and necesssary for the estimations, e.g. GDP, costs by public department, exchange rates, tax revenues, etc. The main sources are the Ministry of Finance (Budget), the National Statistic Office, the Ministry of Economics and Labour and the Austrian Federal Office for Metrology and Surveying (BEV). In any case, the sources and references are specified where used.

We take the latest year available for each variable. We obviously use, for the computations at a certain point of time, the value of the variables referring to the same time period. Nevertheless, this is sometimes impossible due to the lack of published data for some variables, namely: revenues from public commercial activities, costs breakdown by public departments, etc. In this case we are forced to compare variables of different years. Nevertheless, the analysis does not suffer much from this fact, since these variables typically do not change abruptly from year to year.

1. THE AUSTRIAN FEDERAL OFFICE FOR METROLOGY AND SURVEYING (BEV)

The Austrian Federal Office for Metrology and Surveying (BEV) is a subordinate agency of the Federal Ministry of Economics and Labour (MoE). The BEV is at present considered to be moving from a purely governmental department towards a public corporation (BEV 2000). That means they are given more responsibility for their own finances and planning, and more freedom to develop new initiatives, being basically a publicly owned agency, which operates like a commercial company.

The activities of the BEV, as its name indicates, are related to metrology and surveying. In this chapter, we start by briefly describing the main activities of the BEV and the resources, in terms of labour, that each of the activities concentrates. This will provide with a schematic overview of the BEV's cost structure in terms of employees by department, identifying the areas that centralize more resources. Next we focus on the surveying activities, given the scope of this study, namely the analysis of the surveying activities at the BEV.

The surveying activities employ more than 82% of the human resources of the organization[6] (BEV 2000). We describe the activities within the surveying section: the types of goods and services that are produced, a description of the users of the data and their economic relevance, and the currency of the data.

1.1 The Main Activities at the BEV

The BEV, according to its legal mandate, is in charge of Metrology and Surveying. This mandate refers to three main differentiated activities: The Metrology activities, the Cadastral Survey and the National Topographic Survey.

In order to assess the weight and importance of each main activity at the BEV, we quantify each of them in terms of the labour resources they concentrate. We take the organizational structure of the BEV and assign the labour costs of each department to one of the three main activities. The organization of the BEV is divided in the following departments: Management department, Administration department, Metrology Service, Local Offices of Metrology and Cadastre and the Surveying Service (see Figure 1.1.). Each of these departments deals with one or more of the three activities: metrology, cadastre or topographic mapping. The Management and Administration departments contribute to all three activities; therefore, we divide and proportionally assign their labour costs to each of the three activities (according to the weight each of the three activities has among the total number of employees at the BEV). The sources available provide a breakdown for the Local Offices of Metrology and Cadastre, assigning 600 employees to the Cadastral Offices (600 employees), and the remaining 300 employees to the Verification Offices and Tele-working Centres. We divide these 300 employees equally between both departments (Verification Offices and Tele-working Centres). A detailed description of the calculation and share of employees by department is enclosed in Annex B.

[6] A description of the number of employees at the BEV by department, and the distribution of the employees at the personnel department among the main activities at the BEV is enclosed in Annex B

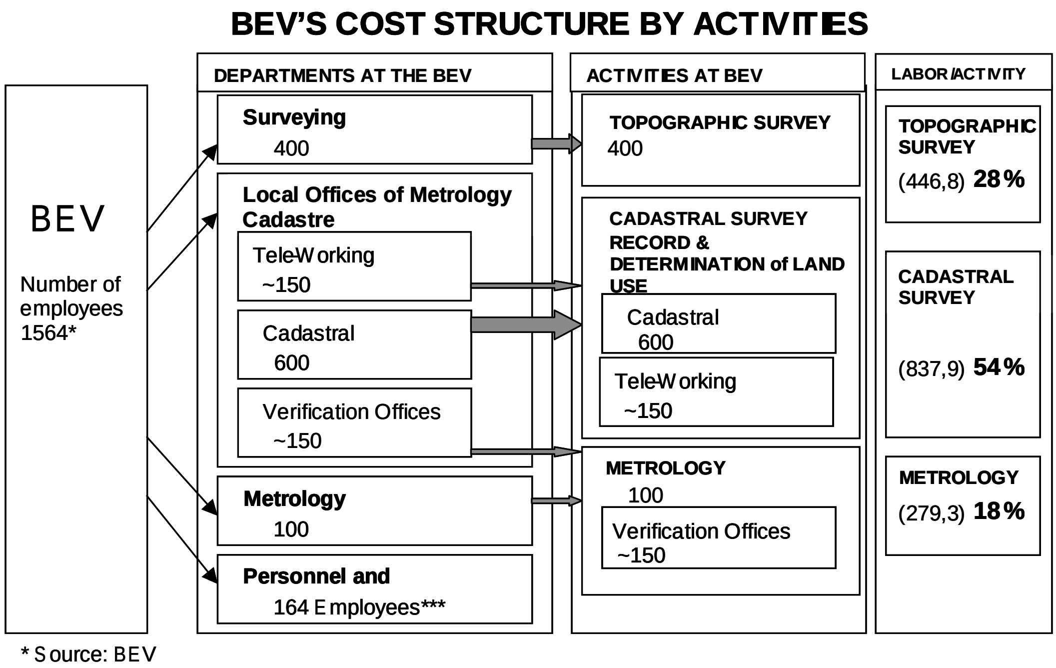

Figure 1.1. Activities at the BEV

We conclude that the Metrology Service concentrates 18% of the labour cost, the Topographic Survey 28% and the Cadastral Survey 54%. Therefore the surveying activities at the BEV concentrate 82% of the total labour costs. From now on we focus on the surveying activities at the BEV, being that the purpose of this study.

The surveying activities at the BEV comprise:

- The Cadastral Survey (fiscal cadastre): storage and administration of the fiscal cadastre of the whole territory of the Republic and maintenance at the regional level;
- The National Topographic Survey: production and maintenance of the topographic data at the national level;
- The record and determination of land use and classification attributes: this activity is included in the cadastral survey activities.

Therefore the surveying activities of the BEV can be divided in two main categories: the Cadastral Survey and the Topographic Survey.

It is important to identify the users of each type of data in order to assess the economic consequences that access and dissemination of the data can produce.

1.2 Cadastral Survey. Users of Cadastral Data

1.2.1 Definition of Cadastre

A Cadastre is a parcel-based and up-to-date land information system containing a record of interest in land (e.g., rights, restrictions and responsibilities). It includes a geometric description of land parcels linked to other records describing the nature of the interests, the ownership or control of these interests, and often the value of the parcel and its improvements. It may be established for fiscal purposes (e.g., valuation and equitable taxation), legal purposes (conveyance), to assist in the management of land and land use (e.g., for planning and other administrative purposes), and enables sustainable development and environmental protection (FIG 2001).

1.2.2 The Cadastre in Austria

In Austria there is a strict separation between the fiscal cadastre (*Kataster*) and the ownership cadastre (*Grundbuch*) (Navratil G. 1998). The fiscal cadastre deals with the geometric properties[7] and assignments directly related to it, e.g., administration of the coordinate database, creation of parcel number, registration of the land use. The ownership cadastre administers the legal situation, e.g., ownership, encumbrances, etc. There is also a separation in:

- The administrative authorities: Ministry of Economics and Labour for the fiscal cadastre and Ministry of Justice for the ownership cadastre, and
- The legal classification: Administrative right applies for the fiscal cadastre and civil right for the ownership cadastre.

In Austria, the access to cadastral data is granted to everybody but with restrictions in the level of access.

1.2.3 Users of Cadastral Data

There are two types of users of cadastral data, the public administration and the private users. Hoeflinger (1998) provides figures of cadastral data users based on data of access to the land administration. In 1997 there were 3.000 public institutions and 4.000 private offices directly connected with the database on real estate. That makes 43% public users and 57% private users.

The categories of users in the public and private user groups are as follow. From the public or internal access the main users are: justice 68%, cadastre 18%, finance 7%, municipalities 2% and others 5%. From the private or external access, the main users are: banks 31%, lawyers 21%, notaries 10%, surveyors 9%, public bodies 6% and others 23%.

Public administration use cadastral data for taxation purposes and as a basis for planning assignments, like the planning of future land use (Navratil G. 1998). The main users in the private sector are banks and financial institutions with 61% of the total usage; dealing with the credit markets and the use of real estate as collateral, also including the change of ownership registration.

A cadastral system is part of the institutional framework for the protection of ownership rights. The protection of the ownership rights has significant consequences for resource allocation and economic efficiency. The cadastre has important social benefits, such as the gains in land and credit markets' efficiency. But the cadastre produces, in first instance, private benefits. Therefore it seems reasonable that individuals have to contribute to the maintenance of the system through the taxes and fees imposed upon the use of the service. The level of taxes and user charges in Austria seems to be appropriate. They seem to match the individuals' willingness to support policy measures to improve ownership security.

1.3 Topographic Survey. Users of Topographic Data

1.3.1 Definition of Topographic Maps

Topographic maps are the most widely used of all maps (USGS 2001). The feature that most distinguishes topographic maps from maps of other types is the use of contour lines to portray the shape and elevation of the land. They render the three-dimensional ups und downs of the terrain on a two-dimensional surface.

[7] The cadastral map

Topographic maps usually portray both natural and man-made features. They show and name works of nature including mountains, valleys, plains, lakes, rivers, and vegetation. They also identify the principal works of man, such as roads, boundaries, transmission lines, and major buildings.

The wide range of information provided by topographic maps make them extremely useful to professional and recreational map users alike. Topographic maps are used for engineering, energy exploration, natural resource conservation, environmental management, public works design, commercial and residential planning, and outdoors activities like hiking, camping, skiing, and fishing.

Topographic maps are also used as the basic layer for most other maps: road, geology, hydrography, transportation, ground water, hiking, human impacts on the land, rescue, fire fighting, forest studies, teaching, hunting, wildlife areas, caving activities, sews, etc. **(so kann man das sicher nicht sagen)**

Large-scale topographic maps like the 1:50.000 map depict considerable detail. Such large-scale maps of developed areas show features like schools, churches, cemeteries, campgrounds, ski lifts, and even fence lines. Many of these features are generalized or omitted in smaller scale topographic maps (USGS 2001).

1.3.2 The Topographic Survey at the BEV: The1:50.000 Map as the Base Dataset

In most cases NMAs produce a base or reference geographic dataset. This dataset contains different features that typically include: shape and elevation of the land, roads and transport routes, hydrographic and geological details, etc. To date NMAs have produced topographic maps as base datasets.

In the case of Austria, the BEV produces the 1:50.000 scale topographic map as the base dataset. The 1:50.000 scale map is the base or reference dataset, which is the fundamental geographical reference for all other thematic application data.[8]

The production of the 1:50.000 scale map is the main source of cost at the surveying service. To analyze the cost structure of the surveying service we suggest to look at the departments comprised by the Surveying Service and the outputs of each of the departments. The Surveying Service is divided in the following sub-departments: Control Survey, Remote Sensing, Landscape Information, Cartographic, Thematic Cadastre and Publishing of Geoinformation. One can observe how these outputs are inputs for the production of the 1:50.000 scale map.

Furthermore, the BEV’s Surveying Service offers a number of products that are either generalizations or enlargements of the 1:50.000 scale map or products that have been used in the production or update process of the 1:50.000 scale dataset. In the first category we find:

- All topographic maps at scales different from 1:50.000, which are generalizations and enlargements of the 1:50.000 scale

In the second category we find:

- The Control Survey: the control and reference points, i.e. the geodetic network;
- Data acquisition resulting from Remote Sensing[9] techniques (e.g., aerial photography, multi-spectral scanning, imaging spectroscopy, laser scanning and synthetic aperture radar), i.e. aerial photographs and orthoimagery, satellite imagery, DEM (Digital Elevation Models) and DLM (Digital Landscape Models);
- The cartographic models.

Cartographic models, control and reference points, aerial photographs and orthophotos are directly used to produce the base dataset. Satellite imagery is typically used to update the topographic map.

[8] A definition of base or reference data is provided in Annex A.

[9] Remote sensing is a technique for the acquisition of different types of geometric and thematic data.

Most of the surveying products commercialized by the BEV have intervened in or are related to the production process of the topographic maps 1:50.000[10]. We can say that the users of topographic data offered by the BEV are explicitly or implicitly using data based on the 1:50.000 scale map.

1.3.3 Users of Topographic Data

The public users of topographic data amount to 75% of the total users. Private users amount to the rest of 25%. Public users include the federal, state and local government. One significant user of topographic data in the public sector is the Federal Ministry of National Defence.

Historically, topographic data has been produced for defence purposes. The production of topographic data with national coverage would be hardly economically justified but for defence purposes.

Users of topographic data include federal government, regional government, business (SME and large companies), individuals, academia and research institutions, and association users (USGS 1997). The wide variety of users is remarkable and – what is more important – also the high usage of this type of data by many individuals and citizens. The dissemination of topographic data would affect positively SME and citizens that normally have less means to access these data, and given the fact that topographic data is collected for defence purposes with public money, welfare arguments suggest that the free provision is a better policy than the pricing of data.

1.4 Currency of the Data at the Surveying Service

The data in the surveying service at the BEV is updated as follows:

- Cadastral data is permanently updated
- Topographic data is updated with a 6–8 years' periodicity (BEV 2001)
- Determination of land use and classification attributes are not updated in Austria

1.5 Interaction between the Cadastral and National Surveying Activities

The cadastral data and the geodata satisfy different needs and seem to have different economic properties. Cadastral data contribute to the protection of ownership rights, which have consequences on economic growth and stability. Geodata is mainly produced for defence purposes and is widely used by public and private users; the pricing policies of geodata seem to affect significantly the potential economic growth of a country. But the production processes of both types of data are interrelated and the greater the interaction between the national surveying and mapping, and the cadastre organizations, the better. For example, Williamson (1997) points to the following reasons that make desirable the interaction of the national surveying and mapping organizations with the cadastre organizations:

- Pressure for increased efficiency and productivity
- Pressure from the information society requiring on-line access to digital data
- National, state, regional and urban spatial data infrastructures
- The increase of spatial information (i.e. GIS, LIS, AM/FM, Spatial IS, Urban Information Systems and digital road networks)
- The need to integrate topographic and cadastral data sets, and
- The need for national large-scale land parcel data sets

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[10] Figure A.1. in Annex A depicts the production process of the base dataset at the BEV.

To analyze the surveying activities at the BEV we have separated both activities, the cadastral and topographic surveys, and have accomplished a cost-benefit analysis for each of the activities, given the different nature of both types of data. However, the coordination of both activities at the BEV has significant advantages in terms of integration and growth of efficiency and productivity, as enumerated above.

1.6 Conclusion

In this chapter we described the main activities at the BEV, namely the Metrology Service, the Cadastral Survey and the National Topographic Survey. Then we focused on the surveying activities.

We have analyzed the main outputs of the cadastral and the topographic surveys. Cadastral and topographic data are not just different types of spatial data; they also cover different needs and influence the economy in different ways. Cadastral data protect the ownership rights of real estate owners, and the cadastre plays a main role in the development and credibility of financial markets.

The topographic survey refers to the 1:50.000 scale topographic map, which is the base data set. Collection of topographic data with national coverage is linked to defence purposes. The users of topographic data are mainly the public sector. The open access policies can benefit citizens and SME that would doubtfully access these data should the prices be high.

2. COST AND BENEFIT ANALYSIS OF THE FEDERAL CADASTRE. METHODOLOGY AND ANALYSIS

The purpose of this chapter is to assess the costs and benefits of the Austrian cadastre. For a coherent assessment we consider the whole Austrian cadastre, and not just the part of the cadastre under BEV's competence, namely the fiscal cadastre. The benefits of the cadastre can be divided in monetary benefits and non-monetary benefits, and require the existence and good coordination of the elements of Land Administration. It should be mentioned that while the source of cost are the budgets of the Ministry of Economics and Labour (MoE, BEV outlays) and the Ministry of Justice (MoJ, Departments of Land Registration), the benefits are canalized through the Ministry of Finance (MoF).

2.1 The Cadastre Organization

The cadastre is part of the Land Administration system. A Land Administration typically comprises:

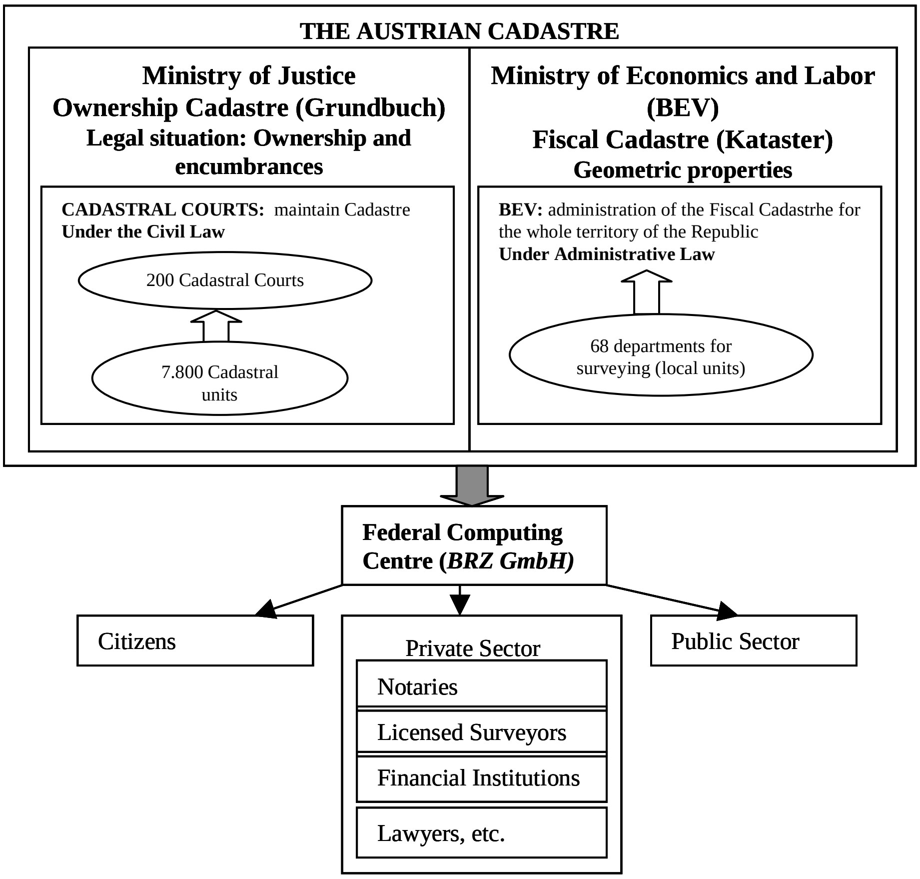
- Land Registry: *Grundbuch* in Austria
- Cadastre: *Kataster* in Austria, and
- Land Valuation: for taxation purposes, made by the Ministry of Finance in Austria

The positive influence of the cadastre on economic growth and development requires a coordination of the three elements of the Land Administration; a perfect technical cadastre map alone without the proper tax rates and fees will not contribute to the development of the land credit markets (Feder G. 1991).

The BEV stores and administers the cadastre of real estate of the whole territory of the Republic of Austria and maintains it at the regional level. But in order to assess the benefits and costs of the cadastre we have to consider the fiscal cadastre (*Kataster*) and the ownership cadastre (*Grundbuch*).

The Austrian Cadastre consists of two separate organizations: the fiscal cadastre and the ownership cadastre. Figure 2.1 depicts the structure of the cadastre, and the governmental authorities responsible for each of the organizations. We would like to point out that there is an important element that connects the Austrian Cadastre to any potential user, which is the Federal Computing Centre (*Bundesrechenzentrum*)[11].

[11] http://www.brz.gv.at/dt/fr1.htm. For a description of the Federal Computing Centre see Annex B.



Source: BEV (2000), Navratil (1998)

Figure 2.1. The Organization of the Austrian Cadastre

2.2 Cost Analysis of the Austrian Cadastre

To calculate the costs of the Austrian Cadastre, we have considered the two parts of the Cadastre, i.e. the fiscal and the ownership cadastre. We estimate the costs associated to the cadastre activities in the two institutions concerned: the BEV (Ministry of Economics and Labour) and in the Departments for Land Registration (Ministry of Justice).

The cost of each department (BEV and Departments for Land Registration) is taken from the Austrian Budget 2002.

For the costs of the fiscal cadastre we had figures from two sources: the BEV[12] and the Austrian Budget[13]. There are some discrepancies in the figures, which we could not reconcile. For our calculations we use the Austrian Budget's figures, in order to calculate the costs of the fiscal and ownership cadastre using the same source. In any case the difference does not influence the results and the conclusions of the analysis.

The Cadastre Service of the BEV employs around 837.9 employees[14] and the Departments for Land Registration (*Grundbuch*) approximately 400 employees (Auer H. 1992). The costs per employee are calculated for each part of the cadastre based on the cost of personnel by department specified in the Austrian budget.

12 Costs at the BEV per activity: Topographic Survey ATS 201 million (€ 14.6 million), Fiscal Cadastre ATS 638 million (€ 46.4 million) and Metrology ATS 167 million (€ 12.1 million)

13 Total Costs of the BEV: ATS 888.9 million (€ 64.6 million)

14 Source: BEV (2000) and own calculations (figure 1.1. and Annex B)

The table below shows the estimated costs breakdown by ownership and fiscal cadastre. The total costs of the Cadastre are ATS 684.7 million[15].

	Total number of employees			Cost per employee (Mio Euros)	Total Cost of the department	
	Number of employees at the Cadastral Survey Service	Personnel department employees ascribed at the Cadastral Survey Service	Total number of employees (including the proportion of the Personnel Department)		Mio Euros	Mio ATS
FISCAL CADASTRE (BEV: Local offices of metrology and Cadastre)	750	87.9	837.9	0.04	34.61	476.23
OWNERSHIP CADASTRE (Department for Land Registration)	400	*	400	0.04	15.15	208.48
Total	1,150		1,237.9	0.08	49.76	684.71

* We lack of statistics about the number of employees at the Personnel Department in the Ministry of Justice
Source: Austrian Budget 2001, BEV

Table 2.2. The Costs of the Austrian Cadastre

2.3 Benefit Analysis of the Austrian Cadastre

2.3.1 The Benefits of the Austrian Cadastre

The Austrian Cadastre produces benefits of different nature. In this study we distinguish among non-monetary and monetary economic benefits. Non-monetary benefits refer to the economic benefits derived from the protection of ownership rights that contributes to secure the rule of law; they are difficult to quantify, but have a great impact on economic growth and stability, according to recent empirical results from economic growth research. Monetary economic and fiscal benefits include the fees and revenues collected through the access or use of the cadastre and the tax revenues related to the land and real estate, namely the property and transfer tax.

2.3.1.1 Non-Monetary Economic Benefits

A cadastre system is a land right system or a system that protects the ownership property rights. This protection of rights has profound effects on incentives and on the scope of

[15] Total Costs of the Cadastre: ATS 684.71 million = 476.23 (BEV, *Kataster*) + 208.48 (Department for Land Registration, *Grundbuch*)

market transactions in land and credit, where land is often used as collateral (Feder G. 1991). A summary of the nature of these effects is provided below.

Incentives

Property rights provide agents with the incentives to use land efficiently and to invest in land conservation and improvement.

Reduction of Asymmetric Information and Uncertainty

Developed economies imply a more increased mobility of individuals and entrepreneurs in the economy and frequent land transactions among individuals who are not members of the same community. A cadastral system reduces the inefficiencies arising from uncertainty or asymmetric information about land property, which can provoke land disputes.

The cadastre is nevertheless only one of the institutions designed to reduce uncertainty. A functioning legal system and effective enforcement mechanisms are necessary as well (Feder G. 1991).

Land Rights and Credit Transactions

The business of lending is inherently risky. The use of collateral on loans reduces uncertainty and moral hazard problems[16] for creditors. Collateral is more valuable the more immobile and immune to damage it is, and land has traditionally been an ideal collateral asset in areas where land is scarce (Binswanger H. P. 1986).

The usefulness of land as collateral is dependent on the absence of uncertainty and asymmetric information with regard to the rights (in particular, transfer rights) of the operator-occupier. The availability of land as collateral, and documentation of land rights that make such collateral credible, affect the willingness of creditors to make loans, facilitating more efficient credit markets (Feder G. 1991).

An efficient trusted cadastre (land registration system) is part of land markets and part of the national investment system of a state (Holstein L. 1996). “The legal basis for a mortgage granted for the long term and securely is a functioning land registration system. Without such a land registration system, construction of a market economy-based investment system is scarcely possible” (Stocker, 1992).

The Credit Market in Germany, U.S.A. and Austria

Stocker (1992) provides figures about the significance of the mortgages in the financial markets (Holstein L. 1996). In Germany there were 25 private banks in 1992 that had issued mortgage bonds[17] (*Pfandbriefe*) for a total of DEM 460 billion[18] (€ 235.2 billion) and together with the public banks there are mortgage bonds in circulation for about DEM 800 billion (€ 409 billion), representing over 25% of GDP (1992).

In the U.S., the real estate industry[19] totals about 16.5% of the GDP (1988). The basis of much of this activity depends on the operation of a reliable real estate transaction recording system (Jeffress G. 1993). Collateral loan is also important in the U.S., with 70% of all loans made using some form of collateral as security for the loan (Holstein L. 1996).

In Austria (ÖBA 1991) 30–40 % of the capital market is based on real estate funds (ATS 500 billion/€ 36.3 billion).

Primary and secondary mortgage markets depend critically on efficient land recording systems, quite apart from title and mortgage insurance industry.

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16 Moral hazard refers to the incentive to cheat in the absence of penalties for cheating. This term, used in the insurance world, is often associated with adverse selection, the incentive to conceal information about one's true nature.

17 Mortgage Bond: Bond in which a debt is secured by a real asset

18 DEM 1 = € 0.5113

19 The “real estate industry” is defined as services involved in transferring, financing, and valuing real property: construction of residential and business-related buildings; investment in real property; and services related to renting, leasing and managing buildings and real property.

The non-monetary benefits are difficult to quantify but are significant, the cadastre ensures the security of land tenure, which encourages investment, facilitates land transactions, reduces litigation with respect to real estate disputes, facilitates the planning, design, construction and maintenance of infrastructure and public utilities, and contributes to the development of the financial markets by enabling real estate owners to mortgage their properties.

2.3.1.2 Monetary Economic Benefits

The cadastre produces monetary benefits to the state. The revenues materialize in terms of taxes related to the property of land or real estate, and the fees charged for changes in the rights attached to the property, namely ownership and mortgages registration. Finally the third source of monetary revenue is the sale of cadastral data.

The tax and fees revenues end up in the public treasury at the Ministry of Finance. Nevertheless, the Land Registry Office, the notaries, surveyors and financial and real estate services, the BEV and the Federal Computing Centre (*Bundesrechenzentrum*) collect most of the fees from ownership and mortgages registration, and revenues from data sale. Then, these institutions transfer the fees and revenues to the Ministry of Finance.

Tax revenues: Property and Transfer Tax

Historically the cadastre has enabled a tax system on real estate. In the past, real estate was one of the main sources of state income, since it was the most reliable way to tax individuals.

In Austria there are today two types of taxes related to land and real estate, namely the property tax (*Grundsteuer*) and the transfer tax (*Grunderwerbssteue*r). The efficiency of such a tax system greatly depends on a proper and well functioning land administration.

The property tax is based on the value of property owned by a taxpayer. In Austria the property tax is a municipal tax and is charged on the value of a property, as defined by a series of value bands, which depend on the region of Austria in which the property is situated. For rural areas main determinants for the tax rates are the quality of soil and the climate. For urban areas the main determinant for the tax rates is the value of the parcel, the building or flat.

The transfer tax is a tax imposed on the buyer upon the purchase of real property, as well as on an heir. In Austria the transfer tax is a federal tax and the rate is between 2–3.5% of the purchase price.

The tax revenues related to real estate, as a percentage of all tax revenues in Austria, is a small figure. The main tax revenues are social security tax 33.8% (percentage of total tax revenues), income tax 29.3%, services tax 28.2%, services tax 6.1%, property tax 1.3% and other taxes 1.3%. Total tax revenues amount to 44% in GDP terms.

Fees: Registration of Mortgages and Ownership Rights

The public sector collects fees for the registration of ownership rights and mortgage inscription. The collectors of these fees are notaries, surveyors and banks, financial institutions and real estate services. The fees are then passed to the Ministry of Finance. There are two public institutions that collect the fees, namely, the BEV (MoE) and the Department of Land Registry (*Grundbuch*, MoJ):

- The BEV collects fees for sale of data.
- The Department of Land Registry collects fees for:
  - Sale of data
  - Ownership registration and
  - Mortgage registration

Main private institutions collecting fees are: Notaries, surveyors and banks, financial institutions and real estate services.

- The Notaries collect fees for:

- Transfer of ownership rights
- Inscription of mortgages

Cadastral Data Sale

The sale of cadastral data is done by:

- The Federal Computing Centre (*BRZ GmbH*), a publicly owned company: the major provider of cadastral data
- The BEV
- The Land Registry Office

2.3.2 Calculation of the Benefits

The previous section enumerated the benefits derived by the Austrian Cadastre. In this section we calculate or quantify these benefits. For this purpose we will only include part of the benefits enumerated. The intangible benefits, i.e. the protection of ownership rights are not included. The reason is the difficulty to quantify the benefits derived from the protection and warranty of these rights. The rest of the benefits of the Austrian Cadastre specified above are quantified and added: Tax revenues, fees from services and sale of data. The fees charged by notaries, surveyors and real estate agencies are not included since they are considered to be private benefits. The benefits of the Austrian Cadastre result from adding the following concepts:

- Property Tax[20] (Municipality)
- Transaction Tax (Federal Ministry of Finance)
- Ownership Registration Fees (Land Registry Office, Notaries, Surveyors)
- Mortgage Registration Fees (Land Registry Office, Notaries)
- Sale of data (Land Registry Office, BEV and Federal Computing Centre)

The institutions specified in parentheses collect the taxes and fees, but these revenues are transferred to the Ministry of Finance.

[20] More information about the Austrian Cadastre and the costs of land transfer in Austria is enclosed in Annex B. It is interesting to notice that the property tax revenues are in Austria less than 1% of total governmental revenue, which is one of the smallest from a sample of European countries: the property tax in the U.S. is the highest with 14.2% of total governmental revenue; in Denmark, France and the Netherlands it is only about 2.1% (UNECE 1998)

	Mio Euro	Mio ATS
Property Tax Revenue	450	6,192
Transaction Tax Revenue	450	6,192
Registration Fee (Ownership and Mortgage)	250	3,440
Sale of Cadastral Data	10	138
TOTAL	1,150	15,824

Table 2.3.2. The Benefits of the Austrian Cadastre. Source: (Twaroch Ch. 1999)

2.4 Conclusion

In this chapter we estimated the costs and benefits of the Austrian Cadastre. On the cost side we have taken the part of the expenditures registered in the budget for the BEV (fiscal Cadastre section) and the Departments of Land Registry. We divide the benefits in two categories: non-monetary benefits, which we do not quantify, and monetary benefits.

The costs are borne by the Ministry of Economics and Labour (BEV, cadastre section) and the Ministry of Justice (Departments of Land Registry). The Ministry of Finance canalizes the benefits.

The costs of the Austrian Cadastre amount to ATS 684.7 million. The revenues, or monetary benefits, induced by the Cadastre are ATS 15,824.3 million, (ATS 6,192.1 million from the Property Tax revenues, ATS 6,192.1 million from Transaction Tax revenues, ATS 3,440 million from registration fees (ownership and mortgage) and ATS 138 million from the sale of cadastre data). Therefore, the Cadastre is 100% cost recovery.

Given that the cadastre produces in first instance private benefits, by protecting the ownership rights, it is reasonable that the cadastre is 100% cost recovery.

The revenues induced by the Austrian Cadastre, i.e. Property tax (*Grundsteuer*) and Transaction tax (*Grunderwerbssteuer*), fees levied from registration of ownership and mortgage in the Ownership Cadastre (*Grundbuch*), and revenues coming from the sale of cadastre data, are more than twenty three times the cost of the cadastre. The cadastre is funded by the revenues it generates.

3. ECONOMIC AND LEGAL ASPECTS OF TOPOGRAPHIC DATA COLLECTION AND ACCESS

In this chapter we study the economic rationale for the public sector, namely the BEV, producing the topographic data. Topographic data is produced for defence purposes, with national coverage. National coverage is determinant for the economics of topographic data collection and production. The production of topographic data at national coverage makes the production process lead to a natural monopoly. It is a situation in which one firm alone supplies the market better and the reason why competitive markets fail in allocating the resources optimally. We analyze the economic properties of topographic data and the production process. Then we move on to analyze the problems that public production brings about in terms of economic efficiency. Public departments show problems in producing with maximum, and sometimes even acceptable, efficiency. The lack of incentives and the public accountancy rules are the main problems in the performance of public departments. Public departments' organization will also influence the accessibility of topographic data.

Topographic data, as compared with cadastral data, seem to have different economics. The main reason seems to be the better definition and allocation of the benefits of the cadastre; the real estate owners have direct benefits from a well functioning cadastre, and the fees and taxes charged seem to match their willingness to pay for the service they get. In the case of topographic data the main users are the public sector, and welfare principles and economic growth theory point at higher benefits derived from a wider access to topographic data. The definition of pricing policies for topographic data will be crucial to reap all the benefits of topographic data production and availability.

The chapter is organized as follows: first we start by briefly reviewing the main uses of topographic data and the important role of topographic data for national defence and the public sector in general. Then we provide an explanation of why the public sector intervenes in economic activities, namely the production of topographic data. Next we deal with the failure of public departments in producing the data and providing access, and the consequences. We finish discussing the pricing policies for topographic data and the welfare effects the different pricing policies can produce.

3.1 Uses of Topographic data: What is Topographic Data Used for?

Topographic data is used as an important input in the public and private sector activities. Topographic data is essential for the public sector in order to carry on activities related to National Defence, emergency measures and services, e.g. fire fighting, floods, snow avalanches, etc., planning, decision-making and resource allocation, transport coordination, public utilities, (Ordnance Survey 1996) and for legislative and policy development (Groot R. 2001). Among all these public users, topographic data has an important role in National Defence activities. National Defence needs topographic data at a national scale. Such large-scale production needs, namely at national level, result in economies of scale in the production activities, which are responsible for natural monopoly production structures.

The private sector needs topographic data in the following sectors: telecommunication, engineering and consultancy companies, geomarketing, transportation, utilities, health, education and entertainment, tourism, research, etc. Individuals need topographic data for leisure activities, education, etc.

3.2 Why Does the Public Sector Produce the Topographic Data? Economic Rationale for Government Economic Activities

Even when the public sector needs topographic data to carry on a number of activities, it does not justify that they have to collect and produce it, i.e. that NMAs are publicly owned and managed. In this section we will outline the economic rationale for the public sector intervention in the collection and production of topographic data.

3.2.1 Market Failures

There are no pure market economies, i.e. economies in which all economic activities are carried out by the private sector. Most of today's economies are mixed economies; they combine in different proportions private economic activities with government economic activities.

The public sector, the government, intervenes in the economy in situations of market failures, i.e. situations in which competitive markets fail to allocate the resources in an optimal way as well as for redistribution and welfare issues. This later issue will not be discussed here.

Market failures arise from production functions that present increasing returns to scale, goods that present "special" economic properties (e.g. public goods and externalities), incomplete markets (i.e., markets that fail to provide a good or service, even though the cost of providing it is less than what individuals are willing to pay, e.g. some types of insurance and loan markets) or information failures (i.e. information asymmetry situations, principal-agent problem, adverse selection and market signalling).

Topographic goods and services have characteristics that make competitive markets fail: topographic data are quasi-public goods; as such they are associated with economic externalities, and the production of topographic data, at the national level, leads to natural monopolies.

3.2.1.1 Public Goods

Topographic data are quasi-public goods: they are non-rival in consumption, i.e. the consumption by one individual does not diminish the amount available for the rest of the individuals. The marginal cost for an additional individual enjoying the good is zero, i.e. the marginal cost of supplying an additional unit is zero.

3.2.1.2 Economic Externalities

Quasi-public goods are also associated with economic externalities. That means the production of geodata has positive effects on other economic activities, e.g. it contributes to the support for the defence of the realm, supports emergency services (civil disaster, floods, etc.), is an input to better business and policy-making decisions, eases the coordination between users (saving time and resources), contributes to developing value-added goods or services, fosters economic growth, etc.

3.2.1.3 Natural Monopolies[21]

Geodata production leads to natural monopolies: geodata production is characterized by increasing returns to scale, i.e. the average costs of production decrease rapidly as production increases. The cost of producing one unit is very high, due to the high cost of data collection, but once the first unit has been produced the cost of producing an additional unit is very low. One producer alone, the monopolist, is able to satisfy the market demand.

High sunk costs intensify natural monopoly structures. Sunk costs are costs incurred due to entering an industry which cannot be recovered when exiting an industry.

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[21] An interesting reading about natural monopolies is provided by Train K. E. (1991). Optimal Regulation, The Economic Theory of Natural Monopoly, The MIT Press.

A monopoly is a market with only one producer. The monopolist can decide to reduce the production to less than the demand level in order to increase the prices and therefore maximize his profits, at a loss of benefits to the economy as a whole.

3.2.2 Public Sector Intervention to Overcome Market Failures

A solution to the market failures produced by topographic data collection and production is a public agency which collects and produces topographic data. The public sector aims to increase welfare by exploiting the non-rivalry property of topographic data goods and services. Nevertheless, some questions remain. Public intervention can be done in different ways:

- Should the public sector produce topographic data?
- Should they just provide topographic data but leave the production to a private firm?
- Should they provide topographic data to everybody, etc?

To know what is the best way to intervene is to analyze the degree of development of the public institutions' structure, the degree of competition and the type of good or service to be provided. Privatization is not the only option and sometimes privatization has negative effects due to the social consequences of the provision of the goods and services.

3.3 Government Failures: Public Intervention alone is not the Answer to Market Failures

Though theoretically the public sector intervention could reallocate the resources optimally, in practice there are "government failures", because the government has limited information, limited control over private market responses, limited control over bureaucracy and limitations imposed by political processes.

Furthermore, the state's intervention has a price that must be paid from the taxes collected, distorts the private sector activities that slow down economic activities, e.g. prevents investment from the private sector, generates administrative and transaction costs, etc. It is very important to analyze the consequences of a particular interventionist economic policy and its suitability.

When the public sector intervenes in economic activities, public and private sphere is difficult to delimitate. In any case, the BEV should take special care not to incur in unfair competition with the private market. When a NMA produces value-added goods, these activities might hinder the development of the value-added market due to inappropriate pricing and publicly subsidized products. Additionally, if the BEV wants to serve the end user properly, they need to use many resources in terms of marketing and market research, feedback from customers, etc., which perhaps could be better covered by the private market.

3.4 Accessibility to Topographic Data: Institutional Failures

Concerning public access, in Austria there is no law that deals in detail with access to public sector information, but in the Constitution there is a paragraph on general access. In addition there is a federal law, the *Auskunftpflichtgesetz,* which gives a general framework on access to information, held by the public sector (Haeck J. 1998).

It is not the purpose of this study to analyze which can be the potential aspects of institutions that make access fail, but the results of poorly functioning institutions give rise to anomalies and confusion, and often, personal biases determine the availability or denial of data to some user, depriving potential users of the information and hampering the development of new products.

Another aspect of data accessibility is referring to situations in which access is also granted *de jure*, but pricing and copyright policies[22] make the *de facto* access practically impossible, especially for citizens and SME that lack the resources of large corporations.

Internet can play an important role to overcome the institutional failures that hamper accessibility, by providing a system for the accessibility to topographic data. This will prevent slow processes of data provision and will give an equal status, in terms of accessibility, to every potential user of the information. The biggest impact of this measure will be at the level of the SME and the citizens, ending up with confinement of these data to big businesses and government (European Union 1996).

It should be noticed that access via Internet, resulting in the concept of a (geospatial data) clearinghouse[23], will also eliminate the costs of data dissemination that are related to data distribution (media and reproduction), marketing, fee collection, sales support, and a portion of overhead expenses (Sears G. 2001).

Furthermore, it is questionable whether it is desirable or fair, to excessively burden the user of the data, who, as a taxpayer, has already contributed to pay for the collection and production of the topographic data.

3.5 Cost Recovery Approach vs. Welfare Effects: Is Pricing Economically Efficient?

Topographic data, as mentioned before, is non-rival in consumption, but can be excludable in consumption as soon as the data is priced. So they are not pure public goods. But it is interesting to notice what Stiglitz (1988) mentions about the inefficiencies derived from the private provision of public goods "…[I]t is possible to charge for many goods for which the marginal cost of an additional person enjoying them is zero. These goods can be provided privately. The argument for public provision is that it is more efficient to have them publicly provided. When there is no marginal cost to an additional individual using the good, then it should not be rationed. But if it is to be privately provided by a firm, the firm must charge for its use; and any charge for its use will discourage individuals from using it. Thus when public goods are privately provided, an underutilization of these goods will result."

As illustrated in Figure 2, pricing these goods will produce a welfare loss, that is, what is not consumed as a consequence of pricing the good at price P_1. We observe that the marginal costs of production of the good are zero along the whole demand function. If no price is charged, that means $P=0$, the quantity demanded is Q_M. When pricing the good at P_1, the quantity demanded will decrease to Q_1, which means the welfare loss equals the striped area.

22 The Austrian law refers to copyright in public information in the Copyright Act: The Copyright Act states that topographic works produced by the Ordnance Survey/Topographic Service (i.e. the BEV) can be subject to copyright (7.2.) This is the case if they are original, destined for publication, and produced by the BEV (i.e. their employees) Haeck J. (1998). Legal Protection of Geographical Information, EUROGI.

23 A clearinghouse is a decentralized system of servers located on the Internet, which contain field-level descriptions of available digital spatial data.

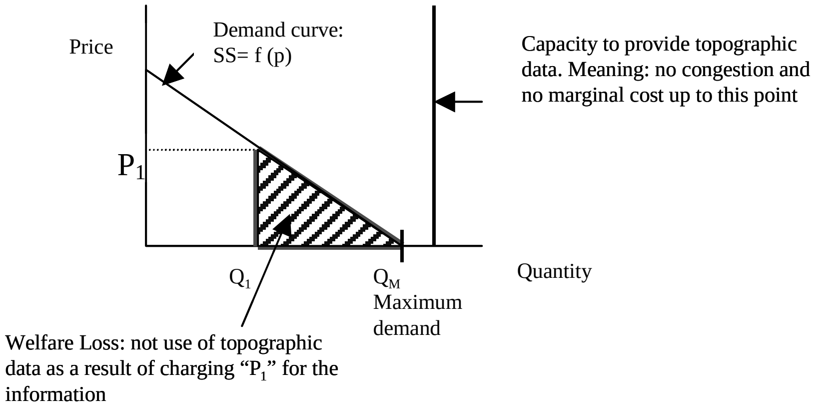


Figure 3.5. Welfare Loss Resulting from Pricing Topographic Data

Topographic data goods also present production functions (aspects **??**) in which the costs of producing an additional unit are zero, the marginal costs of production equal zero, which is the same as saying that the production costs are all fixed; this enhances the non-rivalry property.

3.6 Digital Support of Topographic Data: Improvements in the Benefits of Topographic Data Dissemination

In short, accessibility to the topographic data will lead to a decrease in transaction costs that will have an effect in terms of costs (e.g. transaction, decision costs), prices (e.g. prices of spatial data and value-added goods produced by the geographic information industry) and therefore in terms of social welfare.

The availability of the topographic data as digital support makes this described economic effect bigger than if the data were on paper, since it saves time in transmission, later transformation is easier, the data provided is uniform and consistent in relation to the criteria used for its collection, which will make network economies possible, etc.

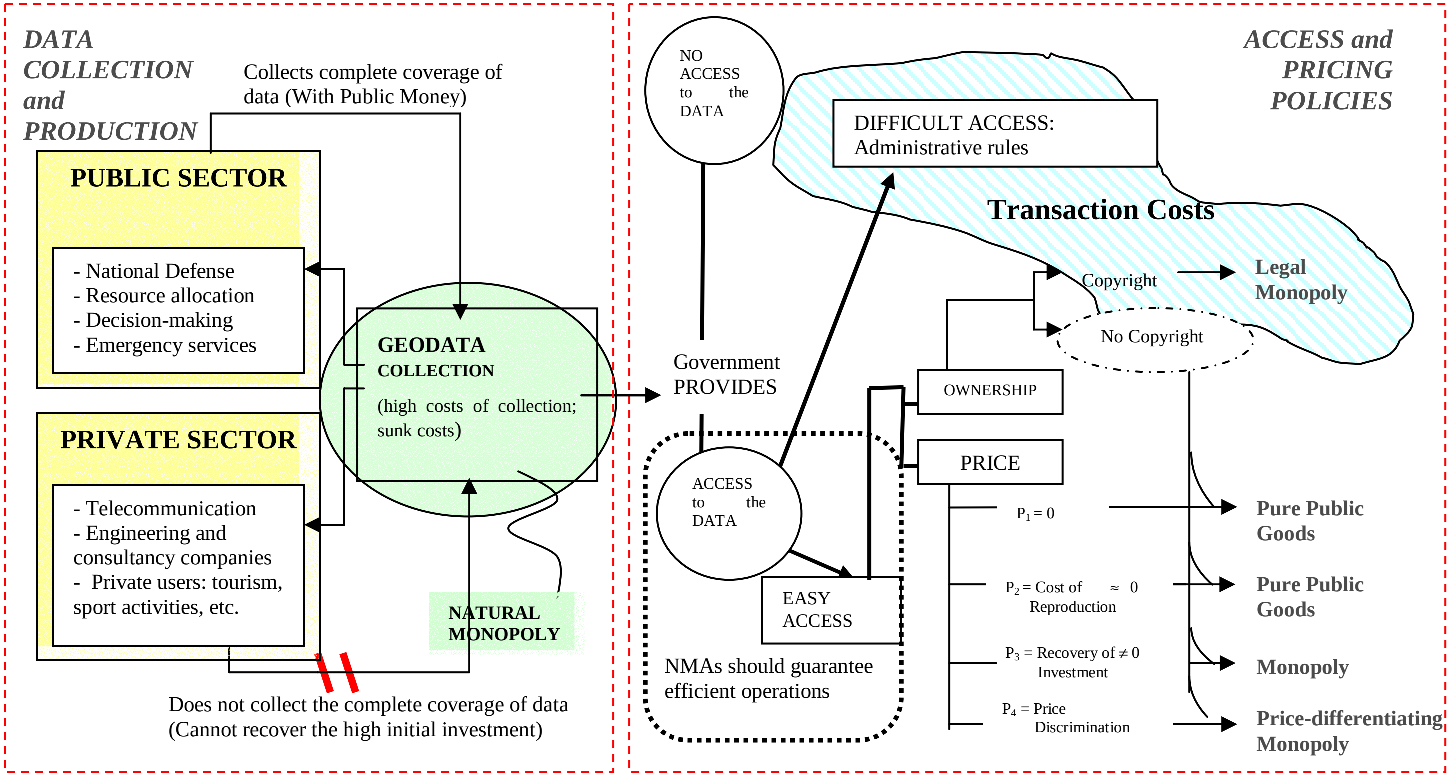
Another consequence of this easier access to spatial digital data are the positive externalities generated: Topographic data are an input to decision making, contribute to the development of business related to topographic data goods and services or value-added goods, improve government decisions, etc.

Additional improvements at each user's level are:

- Government departments: coordination of the public sector at federal, regional and local level avoiding duplication of efforts and unnecessary expenditure, and identification of the users of spatial information in the public administration;
- Citizens: saving of time in allocation of resources and transportation;
- Private sector (firms): saving of time in allocation of resources, transportation, and bureaucracy.

Cost savings, decrease of transaction costs, positive economic externalities and increase of social welfare are immediate effects that can be derived from a *de facto* access to topographic data, improved by the digital support of the data.

Figure 3.6 Economic and Legal Aspects of Topographic Data Collection and Access



3.7 Conclusion

In this chapter we studied the economic and legal aspects of topographic data collection and access. Topographic data production at a national scale is linked to National Defence purposes. Such large-scale production needs result in economies of scale in the production activities, which are responsible for structures of natural monopoly production. We have reviewed the economic rationale for the government intervening in the production of topographic data. Topographic goods and services have characteristics that make competitive markets fail: Topographic data are quasi-public goods; as such they are associated with economic externalities and the production of topographic data, at a national level, leads to natural monopolies.

Main users of topographic data are the public sector, accounting for 75% of usage. Additionally, topographic data access by private users can contribute to economic growth in terms of job creation, business opportunities, R&D growth, etc. The biggest impact will be at the level of the SME and the citizens, ending up with the confinement of these data to the big business and government. Charging users for data that is already available for public purposes means also charging these users twice: once as taxpayers for the production of the data, and once as users of the data when accessing them.

4. COST AND BENEFIT ANALYSIS OF THE TOPOGRAPHIC SURVEY: METHODOLOGY AND ANALYSIS

In this chapter we provide the cost-benefit analysis of the topographic survey, which is one of the two main activities within the surveying service.

The BEV bears the costs of producing the topographic survey. The benefits are somehow more disseminated and not so easily quantifiable. Topographic data, which historically have been produced as a geographic base dataset, is used for many spatial applications. In Austria 75% of the users are from the public sector, which use the information for planning, environmental management, public works design, emergency situations, etc. Special attention deserves the role of topographic data in national defence activities, as the production of data with national coverage is significantly linked to national defence purposes. Defence is a purely public good, whose provision is paid with public money. The question is, therefore, how many times should the tax payer pay for the same good and if the revenues from private users trade off the potential benefits, in terms of economic growth a wider access policy can produce. Among the private users of topographic data account engineering, energy exploration, commercial and residential planning and outdoor activities. The bottom line is that the benefits of topographic data production and availability are difficult to quantify in monetary terms. But an economic figure aiming to quantify the benefits of topographic data is useful to have as a reference for the scale of importance of these data. To overcome this problem, our approach to calculate the benefits of topographic data borrows from Oxera (1999). We attempt to estimate the contribution of topographic data to the Austrian GVA and from there we estimate the VAT assumed to be topographic data dependent.

4.1 The National Topographic Survey

4.1.1 The National Topographic Survey: 1:50.000 Scale Map, the Base Dataset

The BEV base dataset is the 1:50.000 scale topographic map. The base dataset is the data on which most other applications are based for their production. As discussed in the first chapter the production of the base dataset concentrates most of the resources and is the main source of cost at the BEV's surveying department. The BEV commercializes other maps at different scales. These other maps are generalizations or specifications of the 1:50.000 map. The remaining products offered by the BEV are products that have intervened to a greater or smaller extent in the production of the base dataset: cartographic models, control and reference points, aerial photographs, orthophotos are all inputs into the production process of the base data set. Additionally, satellite imagery is used to update topographic maps.

4.1.2 The Scope of Topographic Data

For simplification purposes we assume that the use of any topographic goods and services produced by the BEV is indeed the use of the base dataset produced by the BEV, since all products are based on the base dataset or have intervened in its production.

Therefore, because the scope of the users of topographic data is very wide and includes many individuals, economic sectors and the society as a whole, we choose to quantify the contribution of topographic data to the Austrian economy, in order to evaluate topographic data benefits.

4.1.3 The Pricing Policies of the BEV

Up to now the BEV has followed a cost recovery pricing policy for geodata. The cost recovery pricing policy is considered to be moving to a non-cost recovery pricing policy, which just charges the cost associated to the reproduction of data. One example of this new pricing policy is the Austrian Map (AMAP). The AMAP is a digital product from the BEV, which contains data from the cartographic model, and is released at cost of reproduction.

4.2 Cost Analysis of the Topographic Survey

The costs attributable to the Topographic Survey are the costs of the topographic service department and the part of the personnel department proportional to the topographic survey at the BEV.

The detailed calculation of the costs is provided in Annex C. We use the total outlays of the BEV, which are specified in the Austrian Budget 2001. The budget provides the total public expenditures breakdown by ministries and public departments. The budget provides also the number of employees at the BEV, and the BEV (BEV 2000) supplies the breakdown of employees by department[24]. From the total expenditures we calculate the costs of the topographic service by dividing the total costs by the total number of employees and reassigning the employees at the administration department to the three main activities.

The resulting costs of the Topographic Survey Service are ATS 254.7 million (€ 18.5 million). The number of employees at the topographic department is 400. The cost at the Topographic Survey is ATS 228 million (€ 16.56 million). The costs of the personnel department attributable to the Topographic Survey department are ATS 26.7 million (€ 1.9 million).

A table containing detailed calculations of the costs at the Topographic Survey Service is enclosed in Annex C.

Total Costs of the Topographic Survey	
Total number of employees at the Topographic Survey	446.8
Cost per employee	ATS 0.57 million
Total Costs (ATS)	**ATS 254.68 million**
Total Costs (€)	**€ 18.51 million**

Table 4.2 Total Costs of the Topographic Survey

4.3 Benefit Analysis of the Topographic Survey

4.3.1 Methodology

The methodology used to assess the contribution of topographic data to the Austrian economy is taken from a similar study made by Oxera on behalf of the Ordnance Survey (Oxera 1999). In any case, the monetary values provided are just broad indicators of the contribution of topographic data to the Austrian economy.

Oxera’s methodology is appropriate for two main reasons. One reason are the similarities found between the British and Austrian case. The OS produces and maintains a base dataset, the National Topographic Database (NTD), which is the main asset and source of cost and is used as base dataset or foundation data for the rest of their production; other datasets are generated from this base dataset. In comparison, the BEV produces a base data set, the 1:50.000 scale topographic map, which is the dataset used to produce the remaining surveying products and services the BEV offers[25]. Second, there is a lack of similar studies applied to the topographic data industry. Furthermore, the British and Austrian economic structures correspond to that of a developed country, being the tertiary sector the one that contributes more significantly to the national production[26].

Our goal is to estimate how much VAT revenue is levied by the proportion of gross value added in the economy assumed to be dependent on topographic data. For this, we follow a Gross Value Added (GVA) approach. In each economic sector, value added is equal to the value of output produced less the value of goods bought to produce that output.

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24 There is an imbalance in the total number of employees at the BEV: Austrian budget 2001 reports 1.535 and BEV reports 1.564. The difference is not significant and does not affect the results significantly.

25 See Annex A for a discussion about base dataset and topographic data production at the BEV.

26 See Annex C for a description of the Austrian economic structure by sectors.

Oxera's study estimates the contribution of topographic data to the British economy by calculating the economic contribution of topographic data in terms of Gross Value Added (GVA) dependent on topographic data. We go one step further, and from the resulting figure we estimate the VAT (Value-Added Tax) revenue believed to be induced by topographic data.

The steps followed to calculate the monetary contribution of topographic data to the economy are the following:

- Identify the economic sectors in the economy that depend on topographic data as an input for their production activities;
- Find out the Gross Value Added by industry or economic sector;
- Estimate the proportion of production that is dependent on topographic data;
- Estimate the GVA which can be assumed to be topographic data dependent, based on the resulting proportions of the former step found to be dependent on topographic data;
- Estimate the VAT levied by the proportion of value added dependent on topographic data. In Austria there are two VAT rates (*Umsatzsteuer*): normal rate of 20% and reduced rate of 10%. For our estimations we have taken the 20% rate since it is the most commonly applied.

4.3.2 Monetary Contributions: Assessing the Benefits of Topographic Data Production at the BEV to other Industries and Services.

Identify and Estimate the Proportions of Production dependent on Topographic Data

Oxera estimates the proportions of production dependent on topographic data based on a survey. Oxera uses a sample of existing customers and interviews them in order to assess the importance of topographic data as an input in their production activities. All those interviewed were existing users of topographic data. They were customers of the Ordnance Survey. As existing users of topographic data they cannot be assumed to be statistically representative of all potential topographic data users. However, a wide variety of key user groups were included in the analysis. The qualitative analysis is used to provide an indication of how dependent a particular sector's production is on topographic data. For each sector, the degree of dependence on topographic data as a source of input to the production process is determined by placing it in one rating band. The table describing the rating of each economic sector's dependence on topographic data is enclosed in Annex C.

Given the broad nature of the sectoral analysis and the limited number of interviews, it is clear that the assumptions about a sector's dependence on topographic data are very approximate. They do, however, provide a guide to the contribution of topographic data to production in these sectors, and hence to its contribution to the national economy, in order to place the use of topographic data in context.

Sectors dependent on Topographic Data for their Production

Oxera identifies ten key economic sectors using topographic data as a significant input in their production activities. The sectors are:

- **Utilities (A).** This sector relates to the sectors for gas, electricity, water and sewerage, communications, and oil and pipelines. The main activities in which they use topographic data are: assets and facilities management, customer billing, marketing, radio propagation, network analysis, optimum routing and vehicle tracking.
- **Architects, engineers, survey and construction (D).** Being the main activities for which they use topographic data products: surveying, planning applications, valuations, boundary disputes, building regulations and defects inspections.
- **Real Estate (E)**. This sector includes companies that develop, buy and sell real estate; those that develop and let property; and housing associations.

- **Solicitors and environmental consultancy (E)**. Topographic data are mainly used for land and property transactions.
- **Transport (C)**. Companies involved in road, rail, air and sea transport.
- **Farming and forestry (E)**
- **Mining, drilling and quarrying (E)**. This sector comprises mineral extraction, cement, aggregates, brick making, and oil and gas extraction. Topographic data products are used for planning applications, impact analysis, asset management, and landfill.
- **Central Government (E, B).** The users can be divided into two groups: policy-makers and operational agencies. Operational agencies make a more intensive use of topographic data than policy-maker agencies.
- **Local Government (B).**
- **Computer and related activities (E).** The users are software and application producers.

Each identified sector uses topographic data as input in their production in different proportions, meaning that the degree of significance of topographic data to their production is different. The representative economic sectors and the rates (in parentheses after the sector's name[27]) are estimated based on information from interviews with a sample of customers within these sectors. All those interviewed were existing users of topographic goods and services and, as such, cannot be assumed to be statistically representative of all potential topographic data users. However, the analysis includes a wide variety of key user groups.

The assumptions about a sector's dependence on topographic data are very approximate, and monetary values should be considered just as an approximate value. In any case, they provide a good reference as an attempt to measure quantitatively the contribution of topographic data to the economy.

4.3.3 Adapting the Methodology to the Austrian Study

Our analysis differs from Oxera's. After estimating the contribution of topographic data in terms of GVA we go a step further. We estimate the VAT revenues that can be assumed to be topographic data dependent, based on the proportions of GVA estimated to be topographic data dependent.

For this type of analysis we can just consider the economic sectors that are paying VAT. From the ten key economic sectors identified by Oxera, we just take into account the private economic sectors that have to pay VAT, and we leave out the public sector. The public sector use extensively topographic data for their production activities but are not paying taxes. Therefore in our calculations we leave out the Central and Local Governments. To see the significance of public sector users we enumerate the important users of topographic data within the government:

- Federal Ministry of National Defence/Federal Army
- Federal Ministry of Agriculture, Forestry, Environment and Water Economy
- Federal Ministry of Economics and Labour
- Federal Ministry of Finance
- Federal Ministry of Justice
- Federal Ministry of Transport, Innovation and Technology
- Austrian Broadcasting Corporation (ORF)

Additionally, due to non-availability of data we leave out the "Solicitors and environmental consultancy", "Computer and related activities" and "Architects, engineers and survey" sectors. We exclude them because statistics at the proper level of desegregation were not available.

The results are underestimated, with reference to the methodology used, given the omission of several identified key sectors using topographic data as a significant input for their production activities.

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[27] For a description of the rates please refer to Annex C.

4.3.4 Non-Monetary Economic Contribution of Topographic Data

We assess the economic contribution of topographic data to the Austrian economy following a GVA approach. From the GVA assumed to be topographic data dependent we then estimate the VAT revenue.

Oxera's value-added methodology focuses on ten key business segments that use topographic data as an important input. Therefore, the attempt to show something of the economic value of the topographic data as an input to the production of other goods and services should be viewed as an underestimate, given that topographic data is also a valuable input used in sectors omitted from the analysis.

This approach leaves out non-monetary contributions that are difficult to evaluate and quantify, and also monetary contributions that are not included, as discussed in the previous sections (Sections 4.3.3. and 4.3.4.).

The economic gains from the use of topographic data are not limited to the identified economic sectors, to what we call monetary or pecuniary contributions. There are non-tangible effects in the economy produced by topographic data; we could talk about the social value of topographic data or positive economic externalities[28] of topographic data. Many uses of topographic data involve the public health and social services or other aspects of public provision, e.g., prevention of accidents, environmental protection, etc., which generate significant benefits, perhaps not explicit monetary benefits, though at the end they will result in cost savings: in sanitary and environmental costs, not to say incalculable personal costs. We are also not quantifying the economic contribution in terms of employment that topographic data generate.

The collection and production of topographic data have positive externalities (Ordnance Survey 1999) in:

- The support for the defence of the realm
- The support to the emergency services: civil disaster, floods, etc.
- Input to better business and policy-making decisions
- Ease of coordination between users: saving time and resources
- Education
- Leisure and sports activities

Spillover effects resulting from the availability of topographic data and proper pricing policies are the development of new topographic data goods or products, the creation of new topographic data enterprises, the growth in R&D, etc. These spillover effects contribute to the growth of a region's economy.

4.3.5 Data Sources

The figures for Gross Value Added of the economy by industry are taken from the Austrian National Accounts[29]. The year taken to make the analysis is 2000. This is the most recent year for which *Statistik Austria*[30] data on value added by sector is available.

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28 An externality Mueller D.C. (1989). Public choice II, Cambridge University Press.) occurs when the consumption or production activity of one individual or firm has an unintended impact on the utility or production function of another individual or firm. Externalities can be defined as consequences for welfare or opportunity costs not fully accounted for in the price and market system. There are negative externalities that cause reductions in the social welfare and positive externalities that cause an increase in the social welfare. Defence or other public expenditure on research and development is sometimes justified on the additional grounds that it stimulates the development of new technology that may become freely available to all. They are also called spillover effects, non-pecuniary externalities.

29 Source: Statistical Yearbook, Austrian Statistical Office

30 Austrian Statistical Office

Additional data (government expenditure and revenue, tax revenue by industry, etc.) are taken from official sources: Statistics Austria (Statistics Yearbook, National Accounts from several years), Wifo (Österreichisches Institut für Wirtschaftsforschung) and the Austrian Chamber of Commerce.

4.3.6 Remarks to Oxera's Methodology

As we have already said, any monetary values provided are just broad indicators of the scale of the contribution of topographic data to the Austrian economy. Even if some of the ratings to the economic sectors were overvalued by Oxera's analysis, and the contribution of topographic data to the production activities was lower than the figures obtained, the results are significant enough to provide an idea of the importance of the topographic data to the economic activities.

4.3.7 The Results[31]

The detailed calculations and results are enclosed in Annex C at the end of the study.

Table 1 in Annex C contains the results of the contribution of topographic data to the economy in terms of GVA and the estimation of VAT revenue assumed to come from the GVA dependent on topographic data (using the standard rate of VAT and not taking into account sales at reduced VAT rates). Two scenarios have been defined:

- An optimistic scenario: where the contribution of topographic data to each of the sectors is calculated using the highest rating given to each of the economic sectors[32];
- A pessimistic scenario: where the contribution of topographic data to each of the sectors is calculated using the lowest rating.

For the optimistic scenario, we find that the VAT generated by the topographic data is approximately ATS 71.26 billion (€ 5,178.78 million), which correspond to 2.51% of the Austrian GDP.

For the pessimistic scenario, we find that the VAT assumed to be generated by the topographic data is approximately ATS 33.42 billion (€ 2,428.78 million), which correspond to 1.18% of the Austrian GDP.

Table 2 (Annex C) shows the contribution of topographic data to the Austrian Gross Value Added. The same two scenarios described above are defined. The results are the following:

- Optimistic scenario: topographic data contributed in the year 2000 12.57% of Austrian Gross Value Added
- Pessimistic scenario: topographic data contributed in the year 2000 5.90% of Austrian Gross Value Added

As mentioned before, these are just approximate estimates of the contribution of topographic data to the Austrian economy.

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[31] To put the results into context it is important to look at the Austrian economic structure by economic sector. Look at Annex C for a discussion.

[32] Remember that the ratings indicated the dependency of each sector on topographic data as input for their production activities.

4.4 The Role of the BEV in the Geodata Business

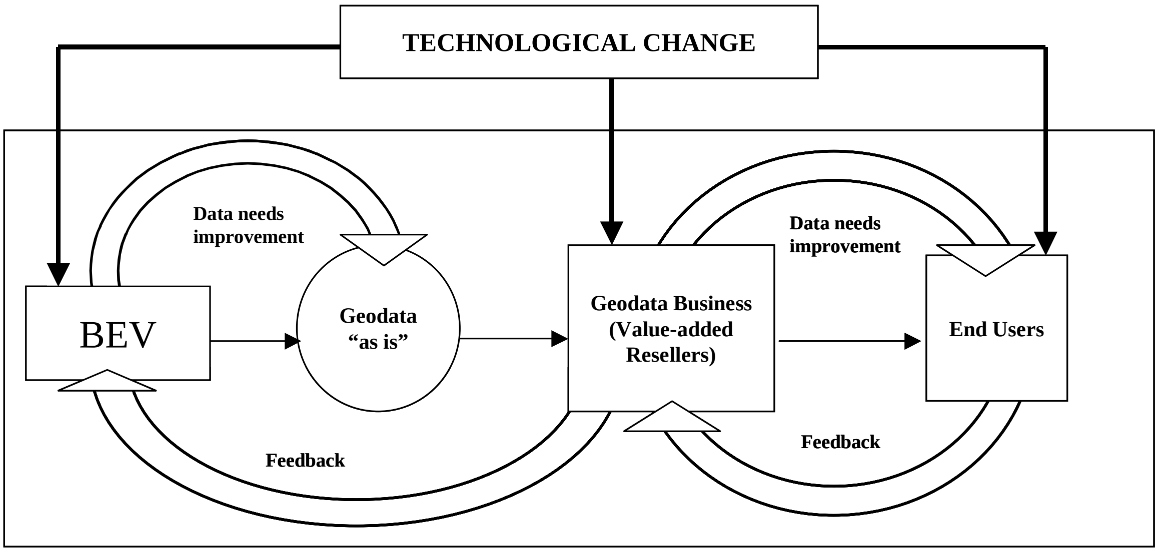

Figure 4.4. Geodata Business: The role of the BEV

The results of this chapter conclude that topographic data have a great influence on the Austrian economy. The picture above outlines how the BEV could contribute to and enhance the economic benefits of topographic data.

The way the BEV can avoid extra costs for improving the quality of the data is by providing access to the data "as is". Everybody could have access to the data, end users or value-added resellers. This makes it necessary to define who is subject to liability in case of data quality problems. The value-added resellers would enjoy access to data for costs of reproduction, therefore they should be responsible to check the data and be subject to liability.

The value-added resellers will produce a wide range of products according to the end users' tastes and needs. The BEV will not have to use their resources in extensive marketing and market research and can use their resources for more strategic purposes. Additionally this will make the geomarket more varied and developed. This approach would also save resources from the BEV, since they will not have to care for particular value-added products.

The BEV will get feedback mainly from value-added resellers who will improve and redesign their data production. Technology change will influence all participants in the geodata business.

4.5 Conclusion

The costs of producing the topographic data are ATS 254.2 million (€ 18.5 million) and the benefits in terms of VAT revenue levied on the GVA that is topographic data dependent are ATS 33.42 billion–ATS 71.26 billion[33].

Topographic data contributed 9.23% (low estimate) or 12.6% (high estimate) of the Austrian gross value added in 2000. These estimates correspond only to the contribution of topographic data to private sector activities and leave out the contribution to the government department's activities and production, and the positive externalities that geographic data collection and production produce create to the economy. Therefore these are low estimates of the contribution of topographic data to the Austrian GDP.

Furthermore topographic data produce revenue equal 1.85% of the GDP (low estimate, and 2.51% high estimate) in terms of VAT.

Taking into account the American case in which the free release of topographic data 1:50.000 (Tiger files) transformed the geodata market in a multi-million dollar revenue industry (Holsmuller F. 1998), it is plausible to assume for the Austrian case that the free release of topographic data could

[33] € 5,178.78 million – € 2,428.78 million

easily produce a growth in the GPD equal to 0.38% (ATS 13.7 million/€ 0.99 million, in real terms). This growth in the GDP will increase the VAT revenue by 0.48 % (ATS 254.7 million), enough to cover the costs of the National Topographic Surveying Service (ATS 254.7 million).

5. THE NORTH AMERICAN CASE: A SUCCESSFUL STORY

In this section we survey the case of the U.S., where large amounts of geographic data and other intellectual resources have been made available as public goods by governments at the local, state and national levels for the general benefit of all citizens through a range of legal and institutional mechanisms (Onsrud H. 1997)[34]. We also discuss the consequences of such open access policies for the geomarket development and the economic growth of the U.S.

5.1 U.S. Information Policy

United States domestic federal information policy is relatively straightforward: a high freedom of information law, no government copyright, fees limited to recouping the cost of dissemination, and no restrictions on reuse. In contrast, European countries vary greatly in their information policies: The Scandinavian countries have strict public access laws, while Germany and Great Britain have none. France’s public access law is weak and subject to significant exceptions.

United States domestic federal information policy is based on the premise that government information is a valuable national resource and that the economic benefits to society are maximized when government information is available in a timely and equitable manner to all (Weiss P. 1996).

Other nations do not necessarily share these values. Although an increasing number are embracing the concept of open and unrestricted access to public information, particularly scientific, environmental, and geographic information of great public benefit, other nations are treating their information as a commodity to be commercialized. Some nations in Europe take advantage of their domestic copyright laws that do permit government copyright to assert monopoly control over certain categories of information in order to generate revenues.

5.2 The United States Interior Department’s Geological Survey (USGS): The American NMA

The United States Geological Survey (USGS) is the national topographic mapping agency. Their base product is the 1:64,000 topographic map. The basic costs of generating and processing information are covered by appropriated funds, and the Geological Survey sets its prices for information products to cover the costs of reproduction, handling, packaging, and distribution. Therefore, the USGS charges only the dissemination cost of supplying data to users.

Its copyright-free and low cost data policy means that the Geological Survey can focus on strategic planning without being distracted by attempting to assert protective copyright and worrying about possible data misuse, although it is certainly not free from the exigencies of budget limitations (Weiss P. 1996).

Topographic maps are not the only cartographic products available from the USGS. The USGS publishes and distributes a variety of special-purpose maps. Some of these are topographic-bathymetric maps, photo image maps, satellite image maps, geologic maps, land use and land cover maps, and hydrologic maps. Each type of map has a distinct purpose and appearance and, like topographic maps, all are available to the public for the cost of reproduction and distribution. USGS maps are not copyrighted (USGS 2001).

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[34] Harald Onsrud (1997, http://www.shef.ac.uk/uni/academic/D-H/gis/onsrud.html)
“Large amounts of geographic data and other intellectual resources have been made available as public goods by governments in the United States for the general benefit of all citizens through a range of legal and institutional mechanisms. The resulting body of geographic information which is freely accessible for use by all constitutes a public commons in information. This information commons has had substantial positive effects on the well-being and growth of the nation”.

5.3 The Cost Recovery vs. the free Dissemination of Data Approaches

Government departments have been facing budget restrictions and the costs of geodata collection have increased with the adoption of new technologies and digitization of the data. This has led to the adoption of government commercialization activities.

The U.S. government is a major creator, collector, user and disseminator of information. During the 80s and 90s, a broad consensus developed in the U.S. that government information is a public asset and a valuable national resource to be managed in accordance with the following principles. The government should make information available to the public on timely and equitable terms. It is also necessary to foster diversity of information sources, in which the private sector, along with state and local governments, libraries and other entities, are significant partners. On the one hand this means that the government should not engage in monopolistic practices, and indeed, should actively encourage the development of a robust private sector. On the other hand, it means that government should actively disseminate its information, particularly the raw content from which value-added products are created, at no more than the cost of dissemination and not attempt to exert copyright or other restrictions (Weiss P. 1996).

The result is that data and information products produced by the government are available to all at the cost of dissemination. This minimizes the financial burden of using information for research and education, and assures that there are no barriers to the entry of additional competitive actors in the value-added arena. The competitive value-added industry results in a high level of services available to specialized users, and the public gets quality information as part of popular, low-cost information products such as newspapers and cable television channels, as well.

5.3.1 Failure of Cost Recovery Policies in the U.S.

The cost-recovery experiences in the U.S. have been unsuccessful. For example, the U.S Geological Survey tried in 1981 to increase its prices for digital data products in order to recover more of the costs of producing the data.

During the early years of computerization, when the cost of transition from paper to digital maps was significantly higher than it is now, USGS made an attempt to move towards more significant cost recovery. In 1981, the USGS increased its prices for digital data products in order to recover more of the primary costs of producing the data. As a result, demand dropped so precipitously that the Survey was forced to quickly reduce its prices to recapture the previous market for digital products. After reducing the charges, sales took three years to return to their previous level.

5.3.2 Cost Recovery Policies in Europe: The Ordnance Survey

In Europe the pricing policies and public information access are different. The government commercialization approach has been adopted by a number of European nations. Essentially, the paradigm is to finance the operations of some government departments (e.g. National Statistical Offices, NMAs, and other departments that produce data) by charging users for services instead of financing their operations through direct appropriations. Since this has in some cases significantly reduced direct cost to the government running the agencies, apparent savings can be claimed by advocates of such policies.

The British NMA is the most representative example of aggressive cost recovery approach. The Ordnance Survey of the United Kingdom is an example of an attempt to take certain government functions off budget by requiring the agencies to recover the costs of operations through commercializing government information. Chartered as a semi-independent Executive Agency in 1990, and as a Trade Fund in 1999, the OS is required to maximize its reliance on revenue from customer entities. However, of the US$ 100 million annual OS revenue, only 32 million comes from actual sales of the products. The remainder comes from other federal, regional and local governments as well as from mandatory usage of large-scale maps by the utility industry. This revenue cannot be called a commercial payment, but rather a shift of taxpayer or ratepayer money. At the same time, the growth of the geographic information industry in the UK is thwarted as compared to the U.S. Another example is the Meteorology service. The British Met[35] gets 50% of its revenue as transfer payment of taxpayer funds from Defence, and recently decided to make significant categories of basic observational ("synoptic") data available for free, due to negligible revenue from data sales and a growing recognition of the benefits of open access policies (Pluijmers Y. 2001).

Focusing in a particular example of geodata, the meteorological service, it is found that the United Kingdom's Meteorological Office gets about 70% of its funding by charging the nation's military for its services. In other words, most of the agency's revenue still comes from tax revenues. Furthermore, despite the economic justification for moving the service "off budget", the provision of this service is still seen as a critical national need, and the United Kingdom has not been willing to simply shift to actual competitive private sector supply of weather information, nor have the other European nations who have adopted the government commercialization approach. Rather, they have tended to grant their national meteorological services what is effectively a monopoly status as the sole supplier of weather information. Such "information monopolies" do not tend to see the unrestricted flow of information as in their best interest.

5.3.3 Non-cost Recovery Policies

United States

In comparison to Europe, the response to budget pressure in the U.S. has been quite different. Given significant streamlining of the federal meteorological workforce, a different type of public/private division of responsibilities has evolved: the government continues to maintain large-scale measurement systems and modelling and analysis activities, and makes its results available to anyone who wants them at the cost of dissemination. In addition, commercial services can pay and then use this information in creating value-added services and products that they price according to the market. For example, the meteorological and weather forecasting market in the U.S., a whole class of value-added local and regional forecasting activities and the delivery of high level information to users has been left to the private sector, creating a significant industry with gross revenues in the range of $200 to $250 million per year and growing. This is a concrete example of the beneficial economic effects of the diversity principle in the context of government information policy.

Canada

Some studies (Sears G. 2001), (The Blair Consulting Group 1999), suggest that the effects of cost recovery policies in Canada had negative consequences on the Canadian economy.

The Blair Report (The Blair Consulting Group 1999) concludes that cost recovery is having the opposite effect to its stated goals. It found the consequences for businesses are higher costs, lower research and development investments and threatened marginal products. The results for consumers are negative: higher prices and reduced products and services. The overall economic consequences, according to this report, are fewer jobs (23,000), reduced economic output by almost $2.6 billion and a lower gross domestic product (GDP) by nearly US$ 1.4 billion.

Additionally, economic growth theorists suggest that the ability of firms to identify and secure low-cost information resources is vital to stimulating economic growth in an information-based economy (Sears G. 2001).

5.4 The Effects of Non-Cost Recovery Policies in the Geomarket

5.4.1 The TIGER files

The TIGER files (Topologically Integrated Geographic Encoding and Referencing Systems) were developed at the Census Bureau originally only to support the mapping and related geographic

35 British Meteorology Office

activities required by the decennial census and sample survey programs. The TIGER/Line files are a digital database of geographic features, such as roads, railroads, rivers, lakes, political boundaries, census statistical boundaries, etc. covering the entire United States. The database contains information about these features, address ranges for most streets, the geographic relationship to other features, and other related information.

With the appropriate software a user can produce maps ranging in detail from a neighbourhood street map to a map of the United States. To date, many local governments have used the TIGER data in applications requiring digital street maps. Software companies have created products for the personal computer that allow consumers to produce their own detailed maps. There are many other possibilities. The availability of TIGER files has made possible low-cost municipal land information systems and most importantly has created a major advance in the field of geographic information systems.

5.4.2 Other Commercial Data Sets and Services

The U.S. pricing policies for geodata, at cost of reproduction, encouraged commercial companies to create end products for consumers (Krek A. 2000). One example are the TIGER files mentioned under the preceding heading. Companies like Claritas, GDT, and ETAK used the TIGER files (updating them, adding more attribute data to them) and developed products, which were much lower in cost than similar products abroad if they were available at all (Holsmuller F. 1998). Other companies like GeoScape International, America Digital Cartographic Inc., and many others use the government products as background for applications ranging from flood plain analysis, e.g. for insurance companies, to business geographics, e.g. site location for new retail outlets, (Holsmuller F. 1998).

Another example mentioned by Holsmuller et al. (1998) refers to the special product created during the early 90s, the Digital Chart of the World (DCW): a worldwide data set (scale 1:1m) based on cartographic data from the CIA. In many countries it is impossible to even look at data produced by the intelligence service; in the U.S., however, this data set was converted into a new special format (VPF format) and released to the public for a very low price. It is now being used for many research projects worldwide and updated by a number of companies, each adding their own value to it.

These examples show that having low-cost government based data sets makes it possible to create a new and exciting, growing niche industry providing jobs for many people. The latest statistics suggest that the geodata market generates a multimillion dollar revenue. This figure also reflects the high percentage of computer users in the U.S. and the large overall market (Holsmuller F. 1998).

5.5 The size of the Geodata Market in the U.S.

The size of the American market for geodata is much bigger than the European one[36]. For example, the yearly revenues of the U.S. commercial meteorology industry exceed $500 million. The annual gross receipt is between $400 million and $700 million, composed of approximately 400 firms with 4000 employees in total. In comparison the EU commercial meteorology market, which amounts to between $30 million and $50 million annually, counts approximately 30 firms and 300 employees in total. Since the size of the U.S. and EU economies are approximately the same, there is no reason for the European market not to grow to the U.S. size with the accompanying revenue generation and job growth (Pluijmers Y. 2001).

5.6 Conclusion

Cost recovery policies have proved unsuccessful and even counterproductive for the development of geomarkets and economic growth. Open access and non-cost recovery policies seem to have great influence on the growth of the American geomarket producing positive effects in the American

36 A discussion about the commercial exploitation of Europe’s public sector information is provided in: Pira International Ltd., University of East Anglia and Knowledge View (2000). Commercial exploitation of Europe's public sector information, European Commission, Directorate-General for the Information Society.

economy in terms of job creation, business opportunities, R&D growth, which affect, in last instance, the tax revenues.

6. NMAs in Europe. Tendencies[37]

In Europe National Mapping Agencies (NMAs) are generally part of the public sector. In Chapter 3 we discussed the economic rationale for public sector intervening in the economic activities. In this chapter we will discuss the transformation processes that NMAs are experiencing in Europe.

6.1 Liberalization Processes in the Economy

The economic liberalization processes started in Europe in the 1980s and continued during the 90s. These processes are taking place at different paces throughout Europe. They intend to open internal markets to competition, and make them able to face the challenge of a global market. The liberalization process consists mainly of deregulation and privatization policies.

Competition is believed to introduce economic efficiency. Economic efficiency means:

- "Technical" efficiency: where the production is made at minimum cost in terms of scarce economic resources (production at the lowest possible cost) and
- "Allocative" efficiency: where resources should be used in order to produce the goods and services that yield maximum utility.

In competitive situations:

- Firms are forced to produce at the minimum cost (technical efficiency) and
- Prices will equal marginal cost of production (allocative efficiency)

Therefore competition will lead to economic efficiency (in the technical and allocative sense), which is the theoretical basis for suggesting that, if privatization leads to a greater level of competition, then privatization can lead to greater economic efficiency.

European governments are following deregulation and privatization processes that intend to make the economy more competitive.

6.2 How Do Liberalization Processes Affect NMAs?

National Mapping Agencies (NMAs) are, in general terms, in charge of surveying and topographic mapping, i.e. collecting and producing base geodata goods and services. They have different mandates according to each country's legislation.

In Europe, the degree of autonomy of NMAs varies, from government departments to Trade Funds (UK) or other forms of public corporations. Public corporations are allowed to operate outside the line of hierarchical control by departments of the central government and are not subject to public accounting standards. These different legal and organizational structures are believed to influence the economic efficiency of the agencies. Government departments have less flexibility to carry on their activities, whereas public corporations follow regular accountancy rules, may use incentive systems and perform evaluations of customers' satisfaction.

The transformation process of NMAs observed in Europe, though at very different paces in different countries, from government departments into public corporations is one of the consequences of the global institutional reform in the public sector. These deregulation and privatization processes intend to make the economy more competitive and efficient. NMAs are becoming corporations in order to improve the efficiency of the public sector activity, by limiting the public sector influence in the decision processes of the NMAs.

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[37] This chapter borrows from Martinez-Asenjo, B., Frank, A.U. (forthcoming). "An Economic Overview of European NMAs' Transformation from Government Departments into Public Corporations." Geoinformatics.

Some examples of the departments or offices that are experiencing transformation into public corporations may include: Statistical services (National Statistical Offices), National Public Insurance services, Mapping and Surveying departments (NMAs), Employment Offices, Stocks Exchange, etc.

The economic reason for these liberalization processes is to make markets more competitive and thus more efficient. But there are also political reasons for economic decisions: the government might want to cash in public assets, to reduce the public deficit or the size of the government expenditures. For example, one can decrease the overall size of the public sector by setting up corporations (independent agencies) and enterprises. There might not be a real difference, in terms of economic funding, whether the NMA is a department of the government or a separate corporation receiving a subsidy from the government. But if it is a department, all of its income and its expenditures will be included in the government budget. If it is a separate enterprise, only the deficit, the difference between its expenditures and income, is recorded. This has become an important aspect under the European Union Stability and Growth Pact.

Currently governments are transforming NMAs into public corporations, as the smoothest way to introduce competition. Other ways to introduce competition are: privatization and deregulation. Public corporations are independent in the sense that they are allowed to operate outside the line of hierarchical control by the departments of central government.

Problems associated to the economic performance of government departments are that they are weak at controlling cost and tend to influence and be influenced by non-commercial pressures. Government departments can be made more efficient by transforming them into public corporations or independent agencies. The public corporations, though still publicly owned, are given more responsibility for their own finances and planning and more freedom to develop new initiatives.

A body is corporatized when the five principles mentioned below are satisfied, when the first four principles are satisfied an entity can be said to be fully commercialized. The five principles are:

- Clear commercial objectives: differentiation among commercial, social, policy, advisory and regulatory functions of the entity
- Appropriate managerial authority and autonomy: Giving boards of directors and management greater responsibility and authority for accomplishing the body’s objectives within the commercial parameters set by the Government as shareholder (that means that key internal operating decisions are made by boards and management)
- Effective performance monitoring
- Rewards and sanctions on performance: in order to effectively promote good commercial performance and to sanction poor performance
- Competitive neutrality in input and output markets: any special advantages or disadvantages applying to corporatized enterprise by virtue of their Government ownership must be removed

The problems a government department faces are therefore: lack of clear commercial objectives, appropriate managerial authority and autonomy, effective performance monitoring, rewards and sanctions on performance and competitive neutrality in input and output markets. By transforming Mapping and Surveying departments into public corporations a bigger efficiency is pursued by limiting the public sector influence in the decision processes of the NMAs.

We need to understand the production and business structure of NMAs to assess if privatization policies can improve economic efficiency of NMAs operation. Given the current business structure of NMAs, the transfer of public assets to private hands is not the solution.

6.3 Markets Contestability[38]

Some government departments become first corporations to move then on to their privatization. This is assumed to translate into better prices for the consumers and therefore higher social welfare.

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[38] An explanation of natural monopoly, contestability and sunk costs is provided in Tirole J. (1988). The Theory of Industrial Organization, MIT. (pp. 307-311)

Before proceeding to an eventual privatization of NMAs it is interesting to outline some concepts of the theory of markets contestability and to analyze in this framework the appropriateness of privatization for NMAs.

The theory of contestable markets suggests that the key to determining whether an industry is competitive is whether the firm(s) already in the industry, the incumbent(s), are susceptible to what is termed “hit and run” entry. That means that new firms are able to enter an industry for a period of time and then leave that industry without incurring any costs solely through the act of entering and leaving the industry. If this condition exists, then the market is said to be “contestable”. If a market is contestable, then all incumbent firms will have to behave in a competitive fashion. In a contestable market:

- Firms minimize their costs
- Firms make only normal profits, and
- Firms are not able to cross-subsidize one part of their operation from another area of their activities

An industry is susceptible to “hit and run” entry when there are no sunk costs involved in that industry. A sunk cost is a cost incurred due to entering an industry, which cannot be recovered when exiting an industry. The higher the level of sunk costs in an industry, the higher the level of uncompetitive behavior that will be possible by incumbent firms without fear of new firms entering the industry.

When sunk costs are an important feature in an industry, the privatization process alone does not improve competitiveness because the structure of the industry, after the privatization, continues to be a natural monopoly. The situation is worse compared to the starting point: The industry is still a natural monopoly, and is now privately owned, with all the potential for inefficiency.

The high level of sunk costs in the economic activity of NMAs is limiting the effects of privatization. Therefore, in the particular case of NMAs the transfer of assets to the private sector does not seem to be the solution. Other methods to improve efficiency should be considered: e.g. policies of contracting out seem to be more appropriate. This policy does not involve the selling off of public sector assets but allows private firms to run services within public sector areas.

6.4 Conclusion

Currently NMAs are experiencing transformation pressure in Europe. Political and economic authorities want to achieve an industry with a more competitive structure. In industries, like the production and collection of geodata, with high levels of sunk costs, it is not evident that privatization will help to increase competition. Privatization processes made in a rush, resulting in an under-valued sale of the public assets and followed by the exercise of market power by the new owners of the business, will just harm the taxpayer that will pay in last instance for the bad deregulation policies. Policies of contracting out and franchising appear to be attractive provided an appropriate division of the production process of geodata.

7. Conclusions and Recommendations

In this section we summarize the main conclusions of the study. We start by enumerating the goals the government faces. Then we highlight how the government political and economical goals affect the BEV's surveying activities.

The government goals are:

- To produce cadastral and topographic data, at a national coverage, for governing purposes: taxing purposes, national defence, planning, legislation, etc.
- To reduce the government deficit. Cost recovery policies are viewed as a way to self-finance the public government departments or to reduce their budgets.
- To provide access to public sector information in order to maximize the economic benefits and positive externalities the availability of data and information are believed to produce.

The BEV faces the following issues in relation to their surveying activities:

- The BEV faces political and economical pressure. The economic liberalization policies demand more economic efficiency from the public departments and reduce the public budgets in order to deal with public deficits. The BEV has to justify the public investment in cadastral and topographic data production.
- The BEV has to define the pricing policies for cadastral and topographic data. The pricing policies have to attend to the different nature of the cadastre and topographic data. The cadastre secures the ownership property rights, and produces in first instance private benefits to the owners of the land and, land and credit markets' players. The pricing policies for cadastral data seem to be adequate and match the individuals' willingness to support policy measures to improve ownership security. Topographic data at a national coverage is closely linked to National Defence purposes. Main users of topographic data are the public sector. The cost recovery policies in the case of topographic data imply charging for data that is already available for public purposes. Cost recovery policies seem to prevent potential users from the data usage. Open access to the data is believed to produce economic benefits in terms of product development, R&D and welfare benefits. The cost recovery policies have not produced, until now, good results in the countries where implemented.
- The BEV has to define the policies for data dissemination. Topics of importance are the definition of the geodata's copyrights and liability issues concerning the quality of the data. Improvements in the quality of data imply an increase in costs and expenditures at the BEV.
- The BEV has to decide on their role in the geodata market. The production of value-added goods can very likely create unfair competition and cross-subsidization problems. The sale of data produces costs, which in many cases are not compensated by the revenues from data sale. The public sector, through the BEV, intervenes in the economic activity in order to overcome market failures. The public sector is not aksed to prefer private business activities over public interest. Therefore in our opinion the public sector should decide what is needed to be produced in the public interest and let the private market find out about customers' tastes and needs.

The government goals are of different kind. On the one hand the government pursue a more efficient economy, through liberalization policies, reduction of the public sector intervention in the economic activities, etc. The public finance austerity policies aim to reduce the public deficit, and one way to deal with this is by reducing the public department budgets. On the other hand the government wants to maximize the welfare benefits and economic externalities derived from open access policies and the access to public sector information. Open access to public sector information is believed to produce economic benefits. These two goals are in conflict and the proper definition of public sector information is necessary. The BEV produces two types of data at the surveying service. The cadastral data has a private nature. The cadastre secures the ownership property rights and produces in first instance private benefits to the owners of the land and, land and credit markets' players. The pricing policies for cadastral data seem to be adequate and match the individuals' willingness to support policy measures to improve ownership security. Topographic data production at national coverage is closely linked to National Defence purposes. Main users of topographic data are the public sector. The cost recovery policies, in the case of topographic data, imply charging for data that is already available for public purposes. Cost recovery policies in this case seem to prevent the data usage by the private sector. Adopting cost recovery policies has not produced good results in the countries where implemented. Non-cost recovery policies, which imply charging for the costs of the data reproduction, are believed to produce greater benefits in terms of economic growth than the potential revenues that might arise from cost recovery policies.

A reasonable way to harmonize the government goals and the BEV's surveying activities is by providing open access to geodata, at costs of data reproduction. The BEV should avoid extra costs and expenditures associated to the sale of the geodata. By keeping away from the value-added market the BEV will avoid unfair competition issues and will let the market develop. Transferring the liability for data quality to the data users and resellers is a way to avoid extra costs of quality improvements.

We suggest that the BEV should avoid intervening in the geodata market as a competitive player. The public sector intervenes in the economic activity in order to overcome market failures or for redistribution reasons. The public sector is not aimed to satisfy private business activities over public interest. Therefore in our opinion the BEV should decide the foundation data or framework data that is needed to be produced in the public interest and let the private market find out about customers tastes and needs. The BEV's adoption of a market and customer oriented attitude produces marketing and product development costs, administration costs and conflicts, in terms of unfair competition and cross-subsidization issues, with the geodata competitive companies, which hinder the development of the geomarket.

We suggest that the fastest and easiest way to implement open access to the geodata is by providing access to the existing data, i.e. data "as is", without further quality improvements of the data. Liability in this case should be borne by the value-added reseller.

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ANNEX

The annex intends to be a complement of the study report. Therefore all data and calculations that are very detailed are enclosed in the annex in order to let the reader follow the thread of the study and the main arguments, without distracting his attention with too many details.

Annex A: Topographic Data: Base Dataset Definition, Production of Topographic Maps and Production at the BEV

Base Dataset

Historically NMAs have produced a base dataset that was typically a topographic dataset. The concept of geographic reference data has changed with the move into the digital era. In the past, the different components were combined in the form of multipurpose products (such as topographic maps). In the digital era, we are now looking to separate out these different components to increase the flexibility of their use (ETeMII Project Consortium 2001).

The first step should be to decide on which are the reference data components, and the currency of the data. Each country, given their particular geographical and political circumstances, will need additional or extra features. The ETeMII project (ETeMII Project Consortium 2001) identifies the following reference data components:

- Geodetic reference system (i.e., a co-ordinate system) for both horizontal and vertical measurements
- Units of administration
- Units of land rights, i.e., cadastre parcels
- Addresses
- Selected topographic themes, notably elevation, transport networks and hydrography, and
- Orthoimagery

Production Process of Topographic Maps

In this section we first describe the way in which topographic maps have been traditionally produced. Then we describe how the advent of digital technology affects the production of topographic maps and how NMAs adapted to this situation by digitizing their analogue maps. Finally we depict the production process of the BEV's base dataset, the 1:50.000 topographic map and identify the areas of the production process that can be considered to be a natural monopoly.
Sections I and II borrow heavily from (USGS 2001).

How to make a topographic map

The first step in producing a topographic map is acquiring aerial photographs of the area being mapped[39]. A pair of aerial photographs, each showing the same ground area taken from a different position along the flight line, are viewed through an instrument called a stereoscope, producing a three-dimensional view of the terrain from which a cartographer can draw a topographic map.

Field survey still plays an important role in making and revising topographic maps. After aerial photographs are obtained, field survey work may be required to establish and measure the map's basic

39 Photogrammetry is the science of obtaining reliable information by measuring and interpreting photographs (Aerial photographs and photogrammetry led to a revolution in mapmaking. This change has significantly increased map coverage and enhanced map standardization).

control points and to identify objects that need visual verification. Survey measurements are taken carefully to establish the control points that become the framework on which map detail is compiled.

Upon completion of the field survey, the map manuscript is compiled using stereoscopic plotting instruments. Overlapping aerial photographs are viewed through an optical system that causes the left eye to see one photograph and the right eye to see another. The result is a thee-dimensional impression of the terrain.

Map features and contour lines are traced as they appear in the stereo model. As the operator moves a reference mark, the tracing is transmitted to the tracing table, producing the map manuscript.

Last steps after the map manuscript is compiled are map scribing, editing and printing.

Digitizing topographic maps

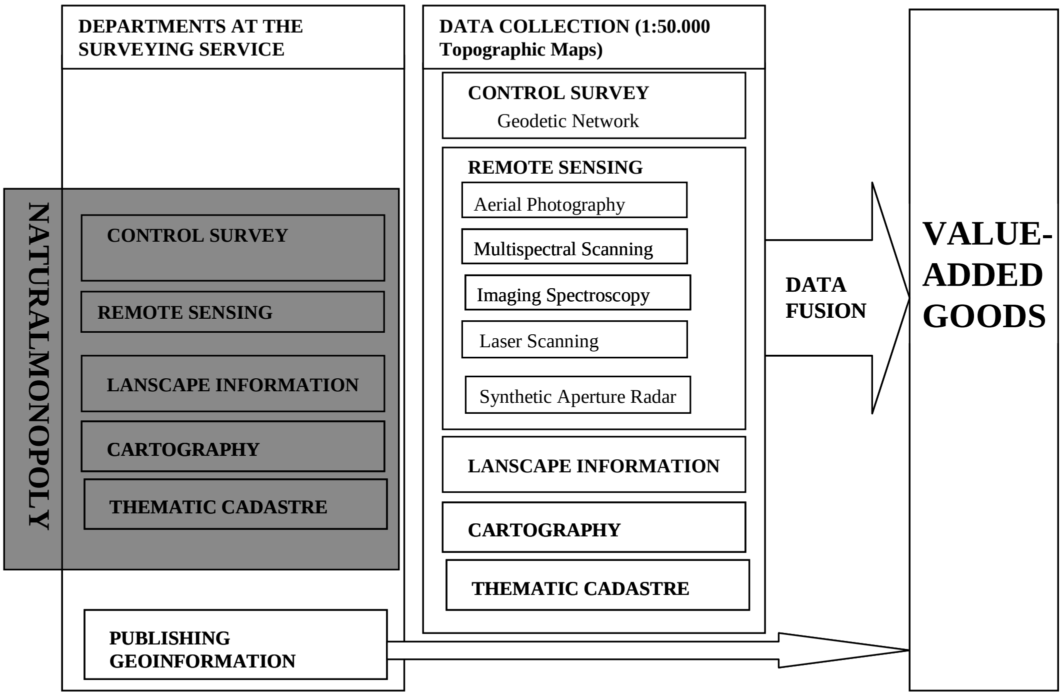
Most of the digital maps data are collected from existing topographic maps. Map digitization requires that each feature on each map be separately located, classified, and traced. A map can have many different layers – roads, contours, boundaries, surface cover, and manmade features, for example – that require digitization. Maps can be digitized by hand, tracing each map’s lines with a cursor, or automatically with scanners.

After digitizing, several editing operations remain. For example, attribute codes must be added to identify what each digitized line or symbol represents. A variety of other tasks must be performed to ensure that information is complete and correct, including matching features with adjoining files, matching features relative to each other within the file, and controlling the accuracy of attribute coding and positions.

Topographic Base Dataset Relation between how to make a topographic map and surveying goods and services offered by the BEV.

Topographic data collection is done by surveying, photogrammetry, laser scanning or remote sensing, and data processing is a time consuming and extensive process. This cost structure with relatively high fixed costs is similar to that of public utilities and might have a tendency to give rise to monopoly, because not many different parties are able to afford these usually very high initial fixed costs (Pluijmers Y. 2001).

In Figure A.1. we provide a picture that depicts the current BEV’s departmental structure and the products each of the departments produces. The picture provides the intuitive and graphical explanation of how the BEV’s topographic activities are referred to the production of the 1:50.000 scale map and how the production of this map concentrates most of the costs. The high costs are associated to the production of the 1:50.000 scale map, this high cost structures give rise to a natural monopoly. The BEV have traditionally produced a base data set, the 1:50.000 scale topographic map, which depict different features but typically include: elevation, hydrographic, roads, etc…The new technologies might allow the production process to be more flexible, meaning the independent production for each of the “selected” features, that will enable the interoperability of systems and the creation of specific goods and services, combination of the data with different databases, etc.



* Source: BEV 2000

Figure A.1. The Production Process of the Reference Dataset at the BEV: 1:50.000 Topographic Maps

Annex B: Cost-Benefit Analysis of the Austrian Cadastre

The Role of the Federal Computing Center (Bundesrechenzentrum)

The Federal Computing Centre (FCC) (Bundesrechenzentrum[40]), is a private company which was privatized in 1997 but 100% of the shares are property of the state. The FCC has around 700 employees and the business volume equals to ATS 1.7 billion (year 2001).

In Austria there is a land system (*Grundstücksdatenbank*, *Grundbuch und Kataster*) containing the real property register and the land register. In addition, the system contains coordinates for all boundary points as well as information on soil quality. The organizations involved are the Ministry of Justice, the BEV and the Federal Computing Centre. The FCC acts as a private service provider. A Digital Cadastral Index Map is under implementation. It covers 70 per cent of the country today and is under the responsibility of BEV. The usage is without any restrictions when it comes to direct access. There is a division of users into public sector and private sector. Public sector users can access the system via a governmental network. So far the private sector users have had to suffice with a much simpler and more limited technical solution (videotext). Inquiries concerning a certain person's holdings of real property are restricted to certain groups of users, e.g. notaries (who are involved in all real property transfers). Certain possibilities of selections and processing exist and a larger amount of information can be extracted from the system electronically. The data protection legislation includes these registers, but seems to be of minor importance as, by tradition, the information shall be generally accessible (open)[41].

Apart from the sale and access to cadastral data, the FCC fulfils activities in the following fields: project development, public administration IT projects, citizen and industry access to public administration procedure, computer centre service.

Ministry of Justice: Cost Estimation per Employee

Unit cost per employee at the Ministry of Justice

Ministry of Justice	
Total Number of employees	11,489
Personal Costs (Mio EUROS)	435.17
Cost per employee (Mio Euros)	0.04

Source: Austrian Budget 2001

Table B1: Cost per Employee at the Ministry of Justice

BEV: Cost Estimation per Employee

Cost per employee at the BEV	
Total number of employees	1564
Total outlays/expenditures	ATS 888.9 million
Cost per employee (ATS)	ATS 0.57 million

40 http://www.brz.gv.at/dt/fr1.htm

41 BEV, http://www.bev.gv.at/service/publikationen/un_englisch/uno_index_2f.htm

Cost per employee (€)	€ 0.042 million

Table B Cost per Employee at the BEV

<table>
<tr><th colspan="2"></th><th colspan="2">Total number of employees per department</th><th colspan="4">Total number of employees per activity (including the proportional part of employees at the personnel department ascribed to each activity)</th><th colspan="2">Cost of Labor per department at the BEV (cost per employee: ATS 0.57 Mio/€ 0.042 Mio)</th></tr>
<tr><th colspan="2"></th><th colspan="2"></th><th colspan="2">Absolute number</th><th colspan="2">Relative (%)</th><th>Mio ATS</th><th>Mio €</th></tr>
<tr><td colspan="2">Administration</td><td colspan="2">164</td><td colspan="2"></td><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2">Metrology</td><td colspan="2">250</td><td colspan="2">277.5</td><td colspan="2">18%</td><td>158.175</td><td>11.655</td></tr>
<tr><td rowspan="2">Surveying</td><td>Cadastral Survey</td><td rowspan="2">1150</td><td>750</td><td rowspan="2">1279</td><td>832.5</td><td rowspan="2">82%</td><td>54%</td><td rowspan="2">729.201</td><td rowspan="2">53.7306</td></tr>
<tr><td>Topographic Survey</td><td>400</td><td>446.8</td><td>28%</td></tr>
<tr><td colspan="2">Total</td><td colspan="2">1564</td><td colspan="2">1557</td><td colspan="2">100%</td><td>887.376</td><td>65.3856</td></tr>
</table>

Table B2: Cost at the BEV per department

Exchange Rates

Exchange rates

	Euro/ATS	$US/euro	$US/ATS
1996	13.76	1.27	10.83
1997	13.76	1.134	12.13
1998	13.76	1.121	12.28
1999	13.76	1.066	12.91
2000	13.76	0.924	14.89

Table B3: Exchange rates of the Euro and Dollar against the Austrian Schilling and the Euro (as used)

<table>
<tr><th colspan="3">Information about the Austrian Cadastral System and the Costs of Land Transfer</th></tr>
<tr><th colspan="2">Austrian Cadastre</th><th>Units/Euro/%</th></tr>
<tr><td colspan="2">Parcels (Million)</td><td>11</td></tr>
<tr><td colspan="2">Number of Owners (Million)</td><td>2</td></tr>
<tr><td colspan="2">Control Points*</td><td>300,000</td></tr>
<tr><td colspan="2">Boundary Points (Million)*</td><td>20</td></tr>
<tr><td colspan="2">Number of Map-sheets (1:1000-5000 scale)*</td><td>250,000</td></tr>
<tr><th colspan="2">Costs of Land Transfer</th><th>Units/Euro/%</th></tr>
<tr><td colspan="2">Property tax ((% of gov. income)</td><td>< 1%</td></tr>
<tr><td colspan="2">Transfer tax (% of purchase prize)</td><td>2-3,5%</td></tr>
<tr><td rowspan="3">Notary</td><td>Transfer of ownership (average amount)</td><td>2000</td></tr>
<tr><td>For mortgage (average amount)</td><td>400</td></tr>
<tr><td>Certification of signature</td><td>100</td></tr>
<tr><td colspan="2">Ownership Reg.fee (% of purchase price)</td><td>1%</td></tr>
<tr><td colspan="2">Mortgage Reg. fee (% of mortgage)</td><td>1,1%</td></tr>
<tr><td colspan="2">Real Estate Agency</td><td>3%</td></tr>
<tr><td colspan="2">Number of applications received to record a change in property ownership (1997)</td><td>800,000</td></tr>
<tr><td colspan="2">Number of mortages registered (1997)</td><td>400,000</td></tr>
</table>

Source: UNECE

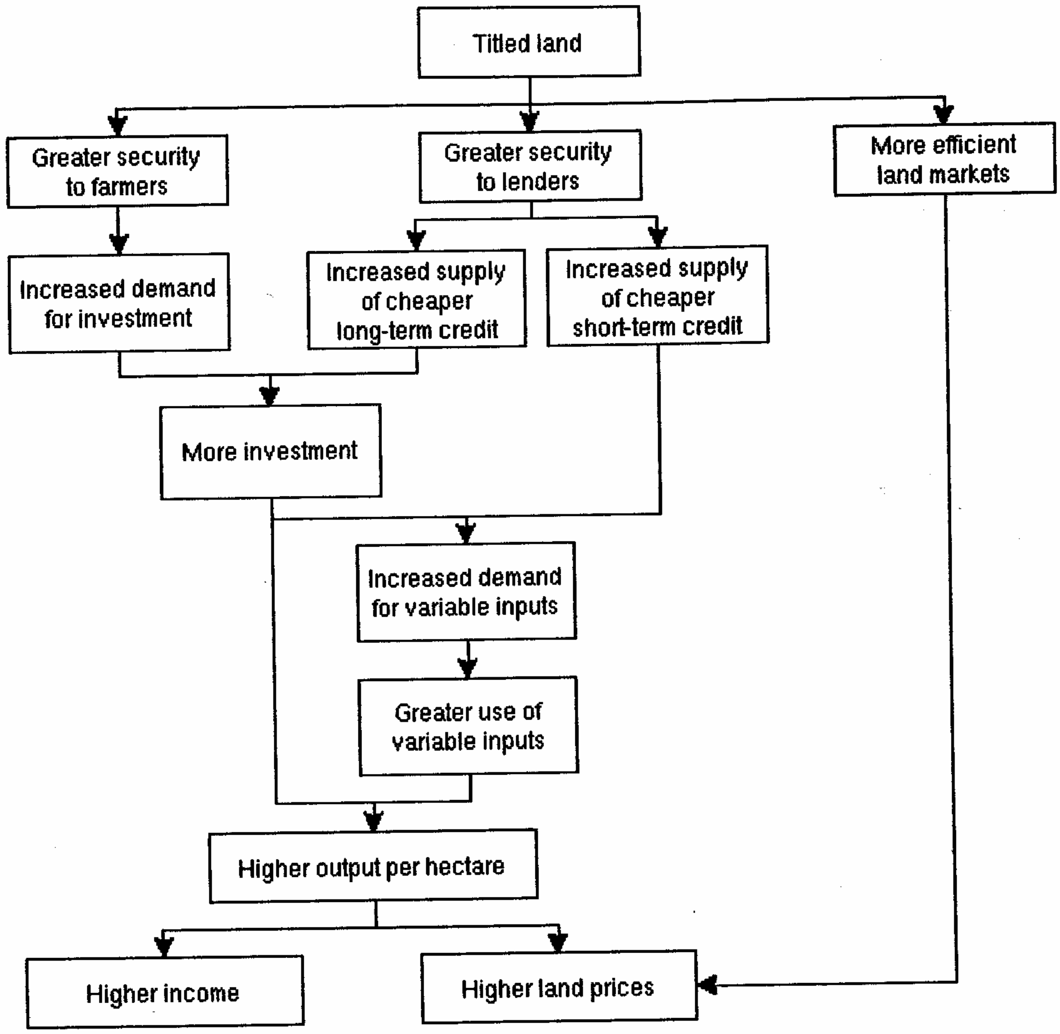
* Source: Muggenhuber, Krieglsteiner 1997

Table B4: Information about the Austrian Cadastral System and the Costs of Land Transfer

From the table above, it is interesting to notice that the property tax as a percentage of total governmental revenue is in Austria one of the smallest from a sample of European countries: The property tax in USA is the highest with 14.2% of total governmental revenue which is 3.0% of GNP; in Denmark, France, Netherlands it is only about 2.1%, in Austria it is less than 1%.

Potential Benefits of Land Titling

The following picture (Pagiola S. 1999) summarizes the economic benefits that land titling, as part of a Land Administration System, can produce, given a well functioning judicial and police system. The benefits are in terms of better functioning financial markets and investment.



Potential Benefits of Land Titling (Source: Pagiola S., "Economic Analysis of Rural Land Administration Projects (World Bank, 1999)

Annex C: Cost-Benefit Analysis of the Topographic Survey

Cost analysis of Topographic Survey

BUDGET: BEV Outlays		
Concept	million ATS	million €
Cost of personnel	700.37	50.9
Other Costs	188.53	13.7
TOTAL	**888.9**	**64.6**

Source: Austrian Budget 2001

Table C1 BEV's Official Budget

Number of employees working for the Topographic Service	
Topographic department	400
Personnel Department (part for the topographic department)	46.8
Total number of employees working for Topographic Service	**446.8**

Source: BEV (2000)

Table C2 Number of Employees working at the Topographic Service at the BEV

Total costs of the Topographic Survey	
Total number of employees for the Topographic Survey	446.8
Cost per employee	ATS 0.57 million
Total Costs (ATS)	**ATS 254.68 million**
Total Costs (€)	**€18.51 million**

Table C3 Costs of the BEV's Topographic Survey

The Austrian Economic Structure

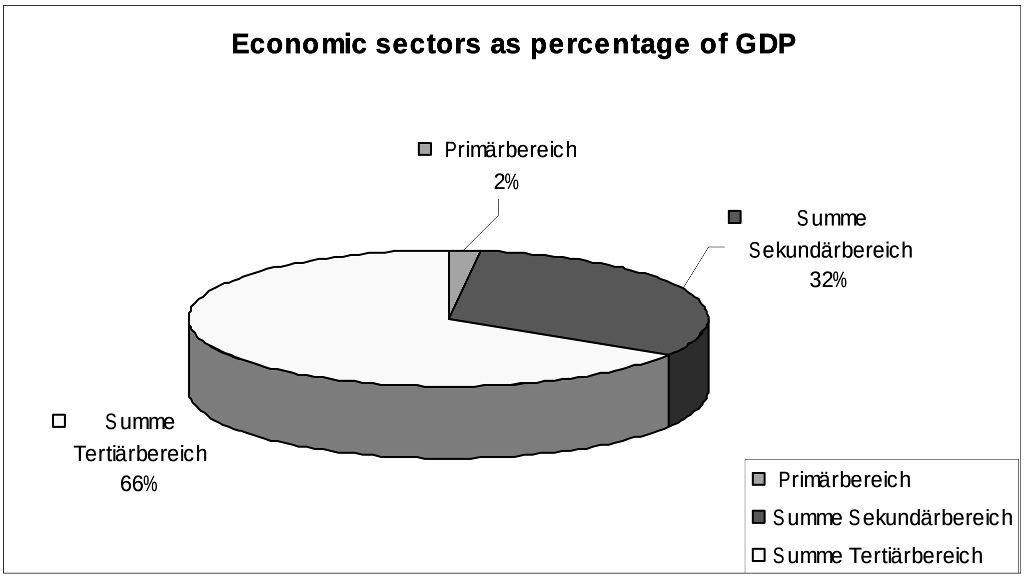


Figure C4. Austrian Economic Sectors as percentage of the GDP (Wifo, 2000)

Figure C4 represents the Austrian economic structure by economic sectors. The most important sector is the service sector with 66% of the total Austrian GDP. The primary sector is irrelevant representing

2% of the total GDP and the secondary sector amounts for 32% of the GDP. This type of economic structure is typical for an economically developed country. Figure C5 provides the break down of the tertiary sector by subsectors, main economic sectors in the tertiary sector are the Real Estate market (15.8%) and Trade (12.9%), then come Transport (6.77%), Credit and Insurance institutions (6.61%) and the public service (6.42%).

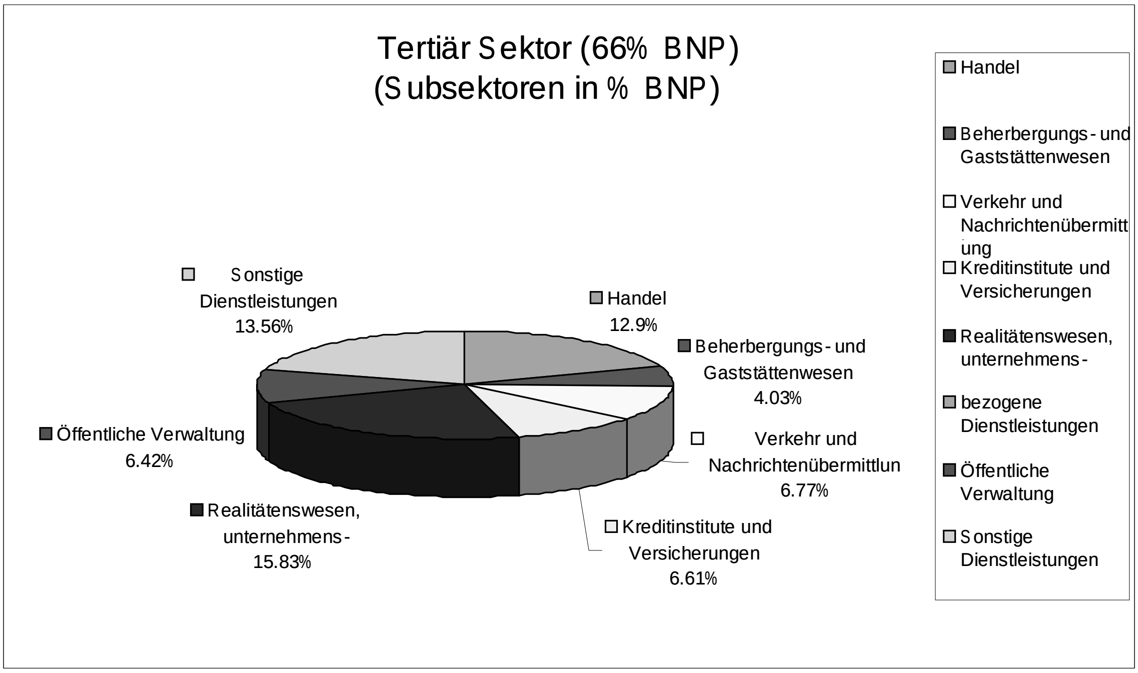


Figure C5. The Austrian Economic Structure (Source: 2000, WIFO)

Rating of each Economic Sector's Dependence on Topographic Data

Rating	Description	Proportion of value-added ascribed to topographic data (%)
A	High degree of dependence - the sector would not be able to produce its outputs without topographic data goods and services	80-100
B	Above-average dependence - only a relatively small proportion of the sector's outputs would be produced in the absence of up-to-date topographic data goods and services	60-80
C	Average dependence - approximately half of a sector's output is dependent on the use of topographic data goods and services	40-60
D	Below-average dependence - some of a sector's outputs are generated using topographic data goods and services	20-40
E	Well below average dependence- nearly all of the sector's outputs could be produced in the absence of topographic data goods and services	0-20

Source: OXERA/OS 1999

Table C6. Rating of each Economic Sector's Dependence on Topographic Data (Oxera/OS, 1999)

ECONOMIC CONTRIBUTION OF TOPOGRAPHIC DATA IN TERMS OF VAT REVENUES

Economic Sectors dependent on Topographic Data	Year 2000 (monetary units expressed in Billion ATS/Million Euros)											
	GDP (measured by value-added by industry)		Estimated VAT (20%)		Rating: Dependency of each sector on Topographic Data**		Rated VAT (OPTIMISTIC SCENARIO)***		Rated VAT (PESSIMISTIC SCENARIO)***		Rated VAT/GDP (OPTIMISTIC SCENARIO)	Rated VAT/GDP (PESSIMISTIC SCENARIO)
	Billion ATS*	Million EUROS	Billion ATS	Million EUROS	RATING	Percentual contribution of GI to the value-added of each sector	Billion ATS	Million EUROS	Billion ATS	Million EUROS		
Agriculture and forestry	51.30	3,728.20	10.26	745.64	E	0% -20%	2.05	149.13	0.00	0.00	0.07%	0.00%
Mining and quarrying	9.90	719.48	1.98	143.90	E	0% -20%	0.40	28.78	0.00	0.00	0.01%	0.00%
Electricity, gas and water supply	63.80	4,636.63	12.76	927.33	A	100% -80%	12.76	927.33	10.21	741.86	0.45%	0.36%
Construction	220.50	16,024.71	44.10	3,204.94	D	40% -20%	17.64	1,281.98	8.82	640.99	0.62%	0.31%
Transport, storage and communication	179.90	13,074.13	35.98	2,614.83	C	40% -60%	21.59	1,568.90	14.39	1,045.93	0.76%	0.51%
Real estate, renting and business activities	420.60	30,566.86	84.12	6,113.37	E	0% -20%	16.82	1,222.67	0.00	0.00	0.59%	0.00%
Subtotal	2,656.20	193,037.79	531.24	38,607.56			71.26	5,178.78	33.42	2,428.78	**2.51%**	**1.18%**
Gross domestic product at market prices	2,833.90	205,952.03										

*Source: Statistics Austria, WIFO.

**Ordnance Survey/OXERA

*** For the optimistic scenario the higher percentage from the rating is considered. For the pesimistic scenario the lower percentage from the rating is considered.

CONTRIBUTION OF TOPOGRAPHIC DATA TO THE AUSTRIAN GDP

Economic Sectors dependent on Topographic Data	Year 2000 (monetary units expressed in Billion ATS/Million Euros)									
	Austrian GDP (measured by value-added by industry)		Rating: Dependency of each sector on Topographic Data**		GDP Rated (OPTIMISTIC SCENARIO)***		GDP Rated (PESSIMISTIC SCENARIO)***		Rated GDP/GDP (OPTIMISTIC SCENARIO)	Rated GDP/GDP (PESSIMISTIC SCENARIO)
	Billion ATS*	Million EUROS	RATING	Percentual contribution of GI to the value-added of each sector	Billion ATS*	Million EUROS	Billion ATS*	Million EUROS		
Agriculture and forestry	51.30	3,728.20	E	0% -20%	10.26	745.64	0.00	0.00	0.36%	0.00%
Mining and quarrying	9.90	719.48	E	0% -20%	1.98	143.90	0.00	0.00	0.07%	0.00%
Electricity, gas and water supply	63.80	4,636.63	A	100% -80%	63.80	4,636.63	51.04	3,709.30	2.25%	1.80%
Construction	220.50	16,024.71	D	40% -20%	88.20	6,409.88	44.10	3,204.94	3.11%	1.56%
Transport, sotrage and communication	179.90	13,074.13	C	40% -60%	107.94	7,844.48	71.96	5,229.65	3.81%	2.54%
Real estate, renting and business activities	420.60	30,566.86	E	0% -20%	84.12	6,113.37	0.00	0.00	2.97%	0.00%
Subtotal	2,656.20	193,037.79			356.30	25,893.90	167.10	12,143.90	**12.57%**	**5.90%**
Gross domestic product at market prices	2,833.90	205,952.03								

*Source: Statistics Austria, WIFO

**Ordnance Survey/OXERA

***For optimistic scenario the higher percentage from the rating is considered. For pesimistic scenario the lower percentage from the rating is considered