Public Sector Geo Web Services: which business model will pay for a free lunch?[1]

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Abstract

Geo-information (GI) is increasingly having a bigger impact on socio-economic benefits. Over the last decade, use of GI has shifted from a specialised GIS niche market to serving as a direct input to planning and decision-making, public policy, environmental management, readiness to deal with emergencies, creation of value added products, citizen mobility and participation, and community platforms. The emergence of Google Earth and Google Maps has created a geo-awareness and has catalysed a thirst for custom-made geo-information. Governments possess, often high-quality large-scale GI, primarily created, collected, developed and maintained to support their public tasks. This rich source of GI begs to be used and reused both within the public sector and by society. Both the INSPIRE Directive (2007/02/EC) and the Directive on reuse on Public Sector Information - the so-called PSI Directive - (2003/98/EC) underwrite the philosophy of "collect once, reuse many times". Web services are an effective way to make public sector geo-information available. They allow information to be accessed directly at the source and to be combined from different sources. However, the costs of web services are high and revenues do not always cover the costs. Assuming that there is no such thing as a free lunch related to public sector GI (Longhorn and Blakemore, 2008), which business models and which financial models form the basis for public sector geo web services? This article explores the different models currently in use and illustrates them with examples.

Keywords: geographic information, public sector web services, business models, financial models; revenue models

1 INTRODUCTION

The terms "geographic information", "geographic data", "spatial information" and "spatial data" are interchangeably used as synonyms. For the purpose of this article, only the term geographic information (GI) will be used. Access to GI is of vital importance to the economic and social development of the nation. Nations around the world are developing geographic information infrastructures (GIIs), also referred to as spatial data infrastructures (SDIs), with access to GI at the core. For more advanced GIIs (re)use is considered the driver of a GII (van Loenen, 2006). One way to facilitate reuse of GI is through web services. The INSPIRE Directive even requires that as part of developing geo-information infrastructures network services should be used. National GIIs are now evolving from first to second generation GIIs. The existence of web services are regarded as the main technological drivers of second generation GIIs because they can fulfil the needs of users and improve the use of data (Crompvoets et

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al., 2004; Rajabifard et al., 2003). This article will give an inventory of the different models currently in use and illustrate them with examples. In section 2 a description of various types of web services will be provided, including a case study illustrating costs involved setting up a commercial Web 2.0 platform and the potential revenue web services can generate. Section 3 will supply a theoretic framework for business models with a breakdown of the four essential parts of a successful business model. Section 4 will build on the business model framework with a framework for financial models, including various cost and revenue models and price strategies. In section 5, the summary will show which business model and which financial model will be most suited and robust in a given situation. It will also show some current pricing trends for public sector geographic information (PSGI) in Europe. Section 6 will finish with some conclusions and offer some recommendations for public sector web services.

2 WEB SERVICES

2.1 Different web services

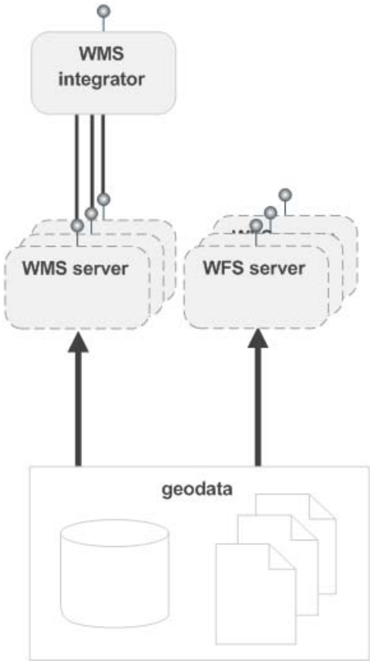
A web service is a platform that is accessible with open standard protocols such as SOAP and XML. A web services sends a request from the client-computer to a server. The server sends queries to the appropriate source servers and transmits a reply back to the client-computer. The advantage is that data is queried at the original source so it is as current as possible. There are a number of different types of GI web services, which roughly fall into two categories: web services using Open Geo Consortium (OGC) standards and web services using ICT standards.

2.1.1 Open Geo Consortium web services

The main OGC standards used for web services are Web Map Service (WMS), Web Feature Service (WFS), Web Coverage Service (WCS) and Web Integrator Service (WIS). WMS only produces a static image on screen from raster files. Because no actual data is transferred, no information can be downloaded. Therefore, it is easier to comply with protection of intellectual property rights (IPR). With WFS, discrete features (points, lines, polygons) are downloaded in XML to the client-computer. The same applies to a WCS whereby entire coverages (sets of features) are also downloaded in XML. Data from WFS and WCS are suitable for interpretation, extrapolation and other forms of analysis. Because the data itself is transferred from the server, measures to protect data subject to IPR are harder to implement for WFS and WCS than for WMS whereby no data is transferred. Therefore, WFS and WCS are probably more suitable for fee-based web services. A WIS is a service that can horizontally integrate various WMSs. Horizontal integration of WMS means that different WMSs of different organisations are bundled into one new WMS. A WIS allows for instance to integrate all regional WMSs containing planning information to be bundled into one national WMS for planning information. To the end-user, the WIS will appear as one web service (see

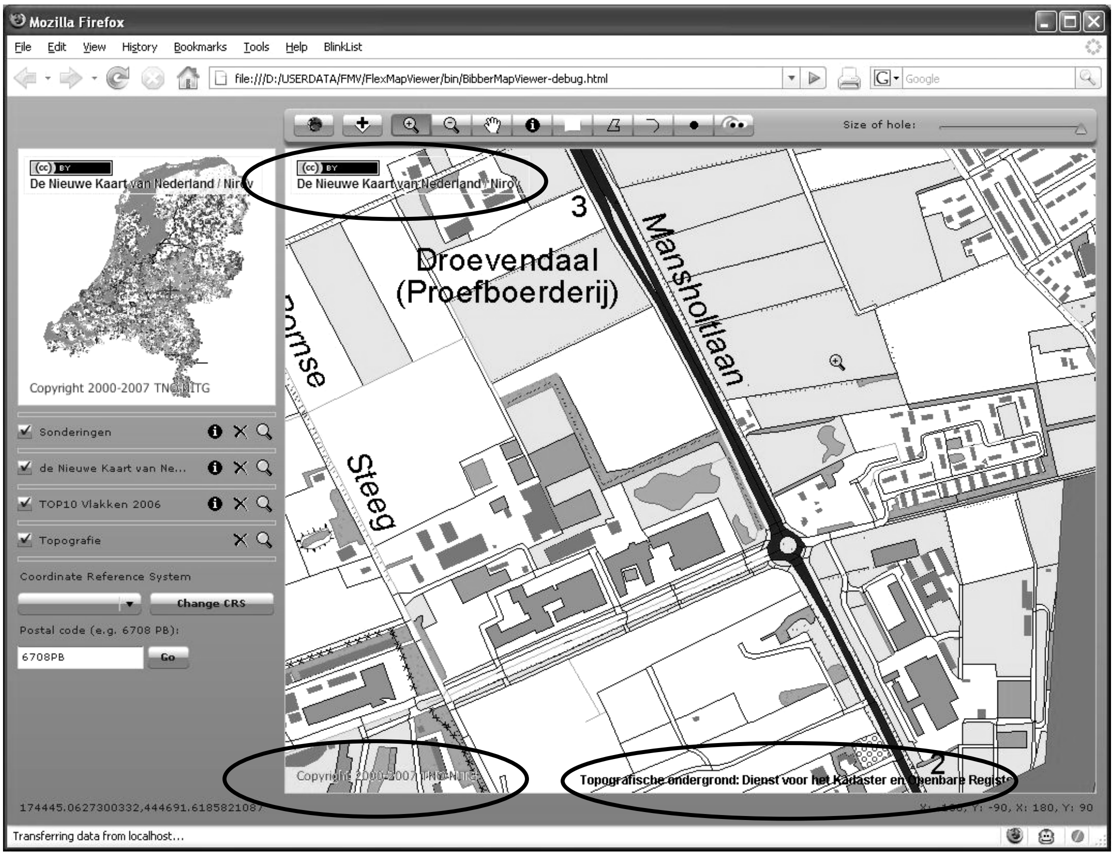
Figure 1).

Figure 1: Serving geo-information using WMS, WFS and WIS (source: http://www.geoloketten.nl/wms_integrator_services.html)



WMSs are very popular for “free” web services as they only produce a static image in a low-resolution format (e.g. jpg, pdf) that allows little to no editing. Often images generated from WMS are embedded into other services such as online route planners or community platforms. However, the images contain an attribution label as part of copyright requirements. If a map is generated from more than one WMS or from a WIS, multiple attribution labels will appear on the image, which may hamper legibility of the image (see Figure 2). In the Netherlands WMSs are the most popular web services used by both the public sector and the private sector. From interviews held for this research, it appeared that to date there is little demand yet for WFSs and WCSs. There are a few WFSs available, which are mainly used within the public sector and by specialised private sector companies such as engineering firms. However, the lack of demand for WFSs/WCSs in the Netherlands may be explained by the fact that potential users of these geo web services may be unaware these web services exist.

Figure 2: Several source attributions per map image (source: Bibber, GeoPortal Networks Working Party, https://portal.wur.nl/sites/geoloketten/default.aspx)



2.1.2 ICT standards web services

For geo web services ICT standards such as SOAP, are actually used more often than OGC standards. The most popular type of web service is a Data Service (DS). The private sector uses DSs because custom-made information is delivered to the client. Furthermore, a DS can combine geo-information with data from other databases. Query tools can then be used to perform analyses on the metadata. Licensed information can be protected with firewalls, although the same firewalls can make it harder to set up query tools. Apart from DSs, there are also Sensor Web Services and Simulation Models. Sensor Web Service is a type of sensor network consisting of spatially distributed sensor platforms that wirelessly communicate with each other. They are most often deployed for environmental monitoring and control. For this research, all ICT standard web services will be bundled into Data Services.

Although the technical specifications and standards used for the various types of web services are different, the economic aspects of them are not so dissimilar. In this article, no distinction will be made between the different types of web services when describing the economic aspects.

2.2 Costs of web services

The costs of setting up and keeping a web service operational are high. To develop a web service one has to invest in hardware, software, legal, technical, sociological and economic expertise, building up know-how, market and target group research, implementation costs, advertising and promotional costs, administrative and project management costs. Then there are the operational expenses such as servers, broadband capacity, licence fees for software and/or (geo) datasets, acquisition costs and personnel costs. During the operational phase of a web service reservations have to be made for future costs such as R&D, equipment depreciation and extra capacity.

The costs of an operational web service are very variable, depending on the type of service. Stieglitz et al. (2008) made a financial analysis of a virtual community as part of a case study. Virtual communities are a group of people sharing a common interest by using internet applications. Web 2.0 platforms are technologies, which enable formation of virtual communities. An increasing number of private sector organisations are using virtual communities to bridge the gap between users and the organisation by including users in the value chain. The financial analysis undertaken by Stieglitz et al. (2008) was conducted for a virtual community of retail investors at the Berlin Stock Market with memberships sold on a subscription base. Stieglitz et al. (2008) distinguish four separate phases in the life of a web service. These four phases are:

(1) the development phase (analysis, design and implementation);
(2) the operational phase;
(3) the adaptation phase (evaluation and evolution); and
(4) the disintegration phase.

Even in the disintegration phase, the web service still incurs costs such as migration costs to another platform, running contract costs and replacement of technology. Only in the operational phase is revenue raised through savings, advertisements and memberships / subscriptions. In their analysis, Stieglitz et al. (2008) noted that the total costs per month were relatively stable during the first year of the operational phase. Only after a critical mass of users and contributions is reached, growth can accelerate. Later in the operational phase, the costs will continue to increase but so will the revenue. With an increasing number of members, the cost per member will decrease until it approaches zero. However, when the number of active members reaches a certain level, the operational costs will step up because of the required extra capacity (servers, broadband, personnel). In addition, this specific virtual community is still in the operational phase. In later phases (adaptation and disintegration), the cost per member will probably increase again.

Although this case study applied to a commercial virtual community, the same principles apply to geo web services. From the various interviews held for this research, the biggest cost item mentioned is sufficient broadband capacity to keep the service operational at all times. Especially for WMS the required server and broadband capacity can be huge if there are many simultaneous users. In addition, it can take some time for an image to build up on the screen of the client-computer. If the build-up time is too slow, the user will abandon the web service. To save building-up time, images can be stored as tiles on the server(s) in advance. However, for large-scale information sets Terabytes of storage capacity is required. Geoportail, the French NGII web service requires 3 Gbps broadband capacity, two 50 Tb caches and a 100 Tb storage capacity (Richard, 2008).

2.3 Web service revenue

Web services are set up by the public sector for several reasons: to share information with other public sector organisations, to inform citizens and the private sector (with or without a legal obligation to do so), or as a way to market public sector information (PSI) for reuse. PS(G)I forms a rich resource for value added resellers (VARs) to create value added products and services. Because the public sector enjoys scale of economies and scales of scope, the costs are relatively low. The benefits may be financial for fee-based services or increased taxation revenue from VARs; or the benefits may be intangible such as a better-informed citizen or increased policy effectiveness. As intangible benefits are harder to measure, cost-benefit analyses tend to be negative. However, end-users of information also incur costs if information needed is scattered all around. These lost productivity costs can be significant when someone has to spend hours searching the Internet for useful information (Bates and Andersen, 2002). The savings made in search costs should be included in cost-benefit analyses when setting up web services for internal use.

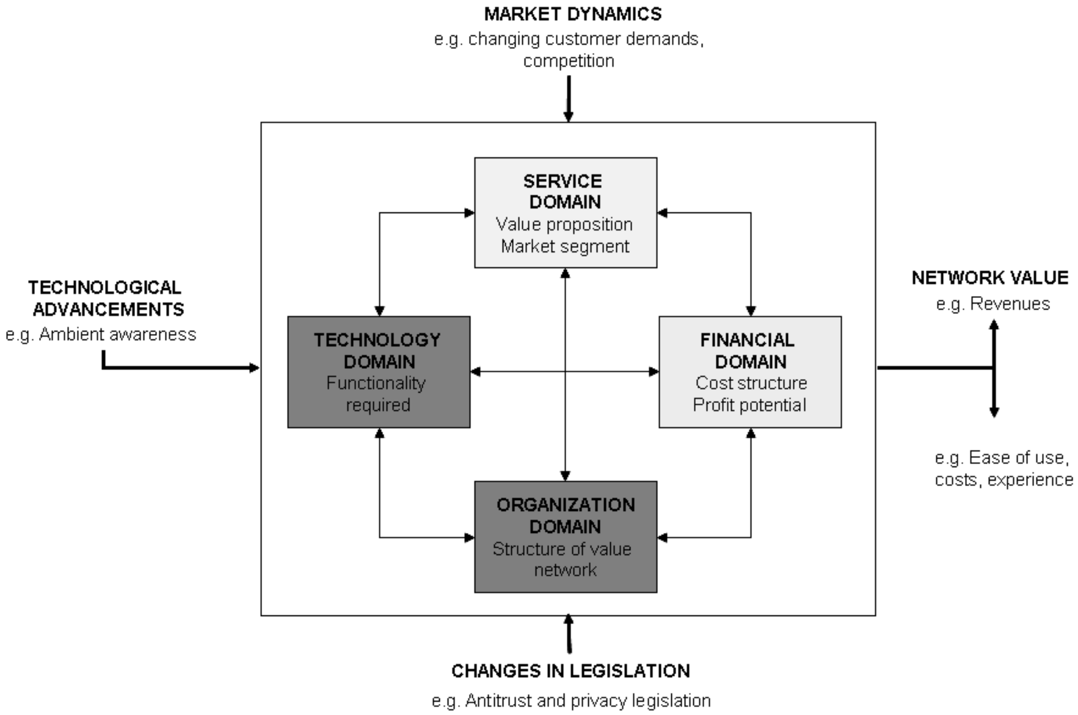
3 BUSINESS MODELS

There are many definitions for the concept of business models. Rappa (2003) offers perhaps one of the simplest definitions, that a business model the method is of doing business by which a company can sustain itself -- that is, generate revenue. A business model describes the strategies implemented to achieve a goal. A financial model is an essential part of a business model. The financial model describes the cost framework and how revenue will be generated. The simplest business model is producing and selling a good to customers with revenue higher than all costs incurred. Poorly worked out business models and financial models were one of the main causes of the demise of the dot-com companies at the end of the last century (see e.g. Razi et al., 2004).

3.1 Components of a business model

After a comparison of different business model definitions, Bouwman et al. (2008) distinguish four components of a successful business model, namely Service, Technology, Organisation and Finance. Together these components form the so-called STOF-model (seeFigure 3). The four components should be addressed in balance with each other. The starting point is the service domain which addresses aspects such as type of service, intended user group and the value of a service for meeting customer demands. The service domain serves as a guide to the technical design. Some of the aspects addressed in the technical design are architecture, infrastructure, accessibility and payment mechanisms. To develop and market a successful service often requires organisations to collaborate. Collaboration can be as simple as one organisation wanting to launch a web service and needing financial backing from a bank or it can be different organisations bundling information into one web service. The organisation domain describes the value chain required to realise a specific service. A value chain consists of actors with specific resources and capabilities that interact and work together to create value for customers and to realise their own strategies and goals (Faber et al., 2008). The organisation domain has to address the network and actor aspects as well. The last component to be addressed is the finance domain, which is the bottom line of any business model with revenues on one side and investments, costs and risks on the other side.

Figure 3: STOF model (source Bouwman et al., 2005)



Osterwalder and Pigneur (2002) note that a business model can only be successful if it includes the following three elements: (1) revenue and product aspects; (2) business actor and network aspects; and (3) marketing specific aspects. In their view, a business model should be based on the following columns:

- Product innovation;
- Customer relations;
- Infrastructure management, and
- Finances.

3.2 Types of business models

Malone et al. (2006) designed a simple diagram of 16 types of business models based on two dimensions. The first dimension looks at the type of asset right being sold. These are:

1. a *Creator* buys raw materials or components from suppliers and then transforms or assembles them to create a product sold to buyers;
2. a *Distributor* buys a product and resells essentially the same product to someone else;
3. a *Landlord* sells the right to use, but not own, an asset for a specified period of time;
4. a *Broker* facilitates sales by matching potential buyers and sellers. Unlike a typical Distributor, a Broker does not take ownership of the product being sold, rather only receives a fee from the buyer, the seller, or both.

The second dimension takes into account the type of asset for which rights are being sold. These types are physical (durable goods), financial (e.g. cash, insurance), intangible (e.g. copyrights, knowledge, goodwill), and human (people's time, effort). Combining these dimensions offers the following 16 business models, although effectively there are only 14 as two (human creation and human trade i.e. slavery) will be illegal in most countries.

Table 1: Schema of 16 types of business models (after Malone et al. 2006)

	Creator	Distributor	Landlord	Broker
Physical	Manufacturer	Wholesaler / retailer	Leaser (e.g. real estate)	Auctioneer (e.g. eBay)
Financial	Entrepreneur	Bank, investment firm	Lender / insurer	Insurance broker
Intangible	Inventor	Intellectual property trader	Publisher / brand manager / attractor (e.g. Google)	Intellectual property broker
Human	*Human creation*	*Slavery*	Contractor	Human resources broker

Since information is a physical good, only the business models on the top row are applicable to GI suppliers. GI suppliers are often both “Manufacturer” as well as “Leaser” because apart from producing GI, they often only sell the right to use the product rather than transfer ownership. There are some public business organisations trading as “Broker”, such as DataLand brokering municipal GI in the Netherlands. However, most of these organisations also trade as “Leaser” and the brokerage is often only a secondary business activity. Hence, in this article they are included in the “Leaser” category. The schema of viable business models can be adapted now for GI suppliers illustrated in Table 2.

Table 2: Schema of viable business models for GI-suppliers (gray) (after Malone et al. 2006)

	Creator	Distributor	Landlord	Broker
Physical	*Manufacturer*	Wholesaler / retailer	*Leaser*	Auctioneer
Financial	Entrepreneur	Bank, investment firm	Lender / insurer	Insurance broker
Intangible	Inventor	Intellectual property trader	Publisher / brand manager / attractor	Intellectual property broker
Human	*Human creation*	*Slavery*	Contractor	Human resources broker

4 FINANCIAL MODELS

4.1 Cost models

Financial models consist of two components: cost models and revenue models. The cost model describes which costs an organisation incurs to run a business. The revenue model describes how an organisation expects to generate income. For public sector organisations supplying PSGI there are two cost model regimes: marginal costs regime and cost recovery regime. With the marginal costs regime only costs of dissemination are taken into account, e.g. cost of a DVD or actual time taken to produce a copy. For web services, the marginal costs are zero if the operational costs of the web service are deemed part of supplying a public service. With the cost recovery regime, all costs that are made by the organisation to create, collect, process and maintain the information are included in calculating the dissemination costs. The PSI Directive even allows a reasonable return on investment.

4.2 Revenue models

All organisations, including public sector organisations, will have to employ a Revenue Model for PSGI web services. In the literature, many revenue models are described. Rappa (2003) distinguishes nine different categories of revenue models. These categories are listed in Table 3.

Table 3: Categories of revenue models (after Rappa, 2003)

Revenue model	Description
Brokerage model	Brokers bring buyers and sellers together and facilitate transactions, usually for a fee or commission
Advertising model	The web site provider provides content (usually, but not necessarily, for free) and services (such as email or blogs) mixed with advertising messages in the form of banner ads.
Infomediary model	Infomediaries collect information, e.g. information about consumers and their consumption habits, or information about producers and their products useful to consumers when considering a purchase. The infomediary then acts as an information intermediary.
Merchant model	Wholesalers and retailers of goods and services. Sales may be made based on list prices or through auction.
Manufacturer (direct) model	The manufacturer or "direct model" allows a manufacturer to reach buyers directly and thereby compress the distribution channel.
Affiliate model	The affiliate model offers financial incentives (in the form of a percentage of revenue) to affiliated partner sites. The affiliates provide purchase-point click-through to the merchant. It is a pay-for-performance model -- if an affiliate does not generate sales, it represents no cost to the merchant.
Community model	The viability of the community model is based on user loyalty. Users have a high investment in both time and emotion. Revenue can be based on the sale of ancillary products and services or voluntary contributions; or revenue may be tied to contextual advertising and subscriptions for premium services.
Subscription model	Users are charged a periodic fee to subscribe to a service. It is not uncommon for sites to combine free content with "premium" (i.e., subscriber- or member-only) content. Subscription fees are incurred irrespective of actual usage rates.
Utility model	The utility or "on-demand" model is based on metering usage, or a "pay as you go" approach. Unlike subscriber services, metered services are based on actual usage rates.

Not all revenue models described by Rappa are suitable to PSGI web services, such as the Brokerage, Advertisement, Infomediairy and Merchant Model. In addition, the term ‘Usage Model’ may be a better description of the model than the term ‘Utility Model’. Public sector organisations with a Marginal Costs regime will not need to charge for their web services at all. Therefore, some extra models are added to the list, including some revenue models out of the creative sector. As most public sector organisations are holders of (semi-)monopolistic data, they employ the Manufacturer Model by definition, therefore this model is further omitted. When the viable business models for PSGI suppliers (see Table 2) of Malone et al. (2006) are combined with the adapted revenue models of Rappa, the following revenue models appear:

1. **Subscription model:** Revenue is raised through periodic fees. This is a popular model for supplying access to a service that is frequently used, e.g. iTunes. The advantage for the web service provider is that revenue is raised in advance and thus providing more certainty of regular income. The advantage for the user is that costs of accessing information are known in advance and access is unlimited within the subscription limit. A disadvantage is that both research and practice show that consumers are reluctant to pay for online services (Schiff, 2003), unless there is a direct relation with their private lives

(Reitsma 2007). Sometimes a basic subscription is offered for free and versions with more features attract a fee (e.g. Google Earth for free, Google Earth Plus $20/year & Google Earth Pro $400/year). Subscription models are best suited to specialist information, or (semi-)monopolistic information, e.g. large-scale base maps.

2. **Usage Model:** Revenue is raised through actual usage of a service. Usage may be measured in time, per bytes, per area or per session. The web service provider has to be able to cope with small amounts of money. The usage model is best suited to ad hoc users whereby *access* to services is more important than *possession.* In addition, the usage model is only suited to web services with geo-data from only a few suppliers, as the pricing structure will become very complicated and intransparent (MICUS, 2003; 2008b). Another disadvantage for geo web services is that charging per hectare or bytes will render large-scale area coverage very expensive.

3. **Royalty model:** Revenue is raised through royalties paid after a value added product has been successfully produced. The price of a service is dependant on the results of the user. The price, the royalty, is usually a fixed percentage of the turnover or the revenue of the value added product of the user. The advantage of this model is that a firm only has to pay for the GI after a value added product is successful so there is room for experimenting. The disadvantage of this model is that contracts have to be signed in advance making this model less suitable to click-through licences. Users of the supplied information have to be monitored. In addition, there is no short-term certainty of income.

4. **Free Model:** There is no direct revenue raised through this model, although there will be indirect benefits. Public sector organisations employ this model, either as a legal obligation or for efficiency reasons (no sales staff). The immediate benefits are intangible, e.g. a better-informed citizen or better policy effectiveness, or the benefits may be financial in the long term, e.g. extra taxes when value added products are created. However, making GI available free of charge may be in breach with national Fair Trade Legislation in some countries as it may be deemed an act of unfair trading practices if the private sector already has made vast investments to create similar services. The creative sector also uses the Free Model to achieve name recognition or for altruistic reasons.

5. **Hybrid models:** These are models showing some of the characteristics of the models described above. Below some of the more common varieties are described.
    a. **Enticement model:** A part of the content is provided free of charge as a lure to entice the user. Revenue is raised from sale of premium content or other related services. This is one of the oldest revenue models first introduced by King Gilette to create a market for his disposable razor blades (Anderson, 2008). Often cross-subsidising is employed, i.e. content is offered for free and revenue is raised from sale of related products such as merchandising (e.g. free mobile phones with revenue from phone calls / text messages; songs downloadable for free and revenue is raised from sale of concert tickets and/or merchandising).

b. **Community model:** The viability of the community model is based on user loyalty. Users invest both time and emotions to produce a communal service. Revenue can be raised by sale of ancillary products and services or by donations; or revenue may be tied to contextual advertising and subscriptions for premium services. The best-known example of a Community is Wikipedia. An example of a GI-community is OpenStreetMap (OSM), a project whereby volunteers go out with GPS units to produce open source street maps for distribution free of charge. OSM operates in many countries on six continents. Some private geo companies have donated cartographic information or money to OSM as well in return for their data or as a platform for innovative applications (http://www.opengeodata.org/?p=223). In Germany, the open geodata of OSM were used for the development of a 3D Geodata Infrastructure as part of the research project 'Geodata Infrastructure 3D' (http://www.gim-international.com/news/id3688-OpenStreetMap_D_Prototype_for_Entire_Germany.html). Virtual communities are frequently used by the private sector to involve users in the developmental and evaluation phases of services as the users provide useful feedback and ensure quality control.

c. **Street performer protocol:** A protocol popular in the creative domain and with software developers. Under this protocol, a producer will release a work (e.g. a book or software application) into the public domain after a certain amount of money has been received in a trust fund. Interested parties pay their donations to this trust fund, which is managed by a publisher. When the work is released on time, both the producer and the publisher are paid from the trust fund. If the work is not released on time, the publisher repays the donors. In some variations, the product is commercially released on the market rather than into the public domain. The producer will repay a return on investment to the donors when the product makes a profit. This protocol is very dependant on the reputation of the producer. This protocol would also be suitable to screened-off web services whereby the users are known in advance. Once the participants have donated their share of development costs and expected operational costs, the service would then be available to the participants to use.

d. **Combination model:** Combinations of the above models are quite often employed, e.g. combining the Royalty Model with a start-up fee. The UK Ordnance Survey uses this model for VARs. Another possible combination would the Enticement Model combined with the Subscription Model, e.g. giving away a small sample of the Cadastral Map to consumers. The Dutch Large Scale Base Map combines the Subscription Model with the Utility Model as well as offering a user right for the entire dataset for a one-off fee. Another Model is the Data-For-Data model whereby different public sector organisations participate in a joint program, with or without paying an upfront contribution. They donate their data into this program to produce large-scale geo-information. In return, the organisations receive user rights for this large-scale geo-information, Norge Digitalt in Norway uses this model to finance large-scale datasets. The Data-For-Data Model can be combined with the Street Performer Model if a participant donates money instead of data.

4.3 Summary of revenue models

Table 4 provides a summary of the various revenue models, their advantages and disadvantages and their suitability to various web services.

Table 4: Revenue models with pros, cons, and their suitability to web services

Model	Advantages	Disadvantages	Suitable for
Subscription Model	• Certainty of regular revenue • Adaptable to users • Lock-in of users • Suitable for click-through licences	• Not popular with consumers • Only suitable for specialised data that is required frequently	• WMS • WFS / WCS • DS
Usage Model	• User-pay system, only pay for actual usage • Suitable for ad hoc users • Suitable for click-through licences	• Only suitable when access is more important than possession • Need mechanisms to deal with small payments • Pricing may be prohibitive for large quantities • Pricing mechanism complex when combined with other web services	• WMS • WFS / WCS • DS
Royalty Model	• Suitable for experimentation / innovation platform • Low accessibility • May generate long term indirect revenue for VA products	• Uncertainty of revenue (amount, time) • Must monitor progress of experimenters • No revenue from consumers • Nor suitable for click-through licences	• WMS • WFS / WCS • DS
Free Model	• Low accessibility • Indirect revenue (better informed citizen, more effective policy) • May generate long term indirect revenue for VA products • Suitable for click-through licences (if still required)	• No direct or immediate revenue • May be in breach with national Fair Trade Legislation	• WMS • WFS / WCS • DS
Hybrid Models • Community Model	• User is closely involved (feedback, quality control) • Improvement of service / user friendliness • Encourages experimentation / innovation platform	• No direct or immediate revenue (unless combined with another model)	• WMS • WFS / WCS • DS

• Enticement Model	• Lures potential users • Lock-in of users	• No direct or immediate revenue (unless combined with another model)	• WMS • DS
• Street Performer Model	• Financing service is done upfront • Unlimited use for donors / participants	• Donors / participants must be known and willing to donate in advance • Dependant on good reputation of producer	• WMS • WFS / WCS • DS

4.4 Price strategies

Apart from the Revenue Models described above, price discrimination can be applied as well. The British welfare economist A. C. Pigou described as early as in 1920 a pricing theory, which included price discrimination (Pigou, 1920). Price discrimination can only be applied in a limited fashion by the public sector, as the PSI Directive does not allow that a public sector body distinguishes between different groups of users using the data for similar purposes. It may be possible to offer rural GI cheaper than urban GI because the latter is more dynamic and needs to be updated more frequently (Longhorn and Blakemore, 2008). In addition, there may be more need for urban information, i.e. a larger market segment. Another form of price discrimination that may be applied, is offering volume discounts but the volume price is the same for everybody. An example would be to decrease the unit price per hectare when a larger area is selected, e.g. as applied to the Automatisierten Liegenschaftkarte (ALK) in North Rhine Westphalia, Germany. Alternatively, a time-based approach could be employed, e.g. charging a higher fee for more timely weather information products, or charging a lower fee for usage outside normal business hours.

In the last couple of years there appears to be a trend that large scale PSGI is coming down in price, because either it was too expensive for the private sector or the prices created barriers to effective reuse within the public sector. With prices being lowered, the number of (re)users is increasing, so the actual total revenue may even go up. Recent examples are found in Austria, Netherlands and Spain. The Austrian Federal Office of Meteorology and Surveying (BEV) have significantly reduced their fees for their PSGI. For instance, the fee for the cartographic model was reduced by 93% and usage went up by 200-1500%, and the digital cadastral map went down by 97% and usage up by 250%. The majority of new users are small to medium enterprises (Schennach, 2008). In the Netherlands, the so-called New Map of the Netherlands (NMN) has been available online with a Creative Commons licence since January 2006 (see www.nieuwekaart.nl). The NMN offers a complete overview of planned spatial developments and functional changes in the Netherlands. Before the NMN became available free of charge, about 20 datasets were sold. Since then, the number of discrete reusers - both from the public and the private sector - downloading the NMN on a regular basis have stabilised to around 200 (Nirov, 2007). The Spanish Cadastre made the complete cadastral map of Spain available on the internet in March 2003. An analysis of the impact of free access to spatial data in Catalonia demonstrated that such initiative is highly profitable to public institutions, by saving a lot of time, simplifying processes and making optimal use of the available information. The impact on private companies is also positive (MICUS, 2008a).

5 SUMMARY OF BUSINESS MODELS

Since the development and operational costs of web services are in general high and the distribution costs low, the underlying business model and financial model must be carefully considered. For public sector bodies the costs of web services will be relatively lower due to their economies of scale. Data often is already available as they are often the holder of such data, and personnel often can be drawn from ICT departments. However, some major aspects still have to be addressed.

The web service should be designed with a clear vision. The STOF Model offers a useful framework to address key components. Firstly, the service component must be addressed. Aspects such as intended users (other public sector bodies, private sector), which functionalities the web service should have, should be considered. Once a type of web service (WMS, WFS/WCS, WIS, DS) has been selected, technical adaptations may have to be made to cope with data protection and, if needed, payment facilities. Server and broadband capacity should match the expected number of simultaneous users, bearing in mind that new web services often attract many visitors in the first months before the number settles. Web services such as TIM-online in North Rhine Westphalia (Germany), GeoNorge in Norway and Geoportail in France attract millions of visitors per year and their number still increase progressively. It is advisable to design a feedback mechanism for users for quality control.

Developing web services often requires collaboration with other departments or organisations. Therefore, attention must be paid to the actors and networks involved. However, networks are dynamic; changes in policy and legislation will cause actors and their roles to change during the period of collaboration. So, it is important to establish formal and informal agreements on the respective roles and responsibilities within the network. If information is used from third parties, e.g. aerial photography from the private sector, care has to be taken that licence restrictions are complied with. It is vital that when licence agreements with third parties are drawn up, it is made clear in advance that the information will be made available through web services to avoid legal problems afterwards.

Lastly, the financial aspects have to be considered. These aspects include selecting the most suitable revenue model for the type of information made available and which tariff scale, if applicable, will be employed. If fees are to be charged, it is important to set the fees appropriately, as the fee structure is the most visible part of a web service. If the fees are too high, they will form a bar for potential users and insufficient revenue will be raised to cover the costs. Fees that may appear too low to recover costs in the short term may turn out to attract more users that are new and thus actually increase revenue.

The Subscription Model is best suited to web services that offer frequently used information. The user has a clear indication of ongoing fees in return for unlimited use of data within the subscription limit. The supplier has a clear indication of revenue received upfront. The Usage Model is best suited to ad hoc users whereby access to services is more important than possession. However, the Usage Model is only suitable when data is only available from only one or a few sources as the pricing mechanism can become complicated. The Royalty Model is most suited to VARs who need some time to experiment to develop a viable product or service. For the supplier the short-term revenue is uncertain but the long-term revenue may compensate the initial losses. This model is therefore very suitable to public sector bodies that either have an additional source of funding or already have established a steady flow of income out of earlier royalties. The Free Model is best suited to information supplied by public sector bodies funded out of general revenue. It is an open access model, which should remove the current barriers to reuse of PSGI. However, supplying certain PSGI data may be in breach with Fair Trade Legislation if the private sector has already developed similar datasets. The Hybrid Models, either combining aspects of the above models or borrowing elements of revenue models from the creative domain, offer interesting possibilities. The Community Model involves the end-user and thus, provides essential feedback for a successful web service. The Enticement Model can be used in combination with fee-based web services to attract new customers. The Street Performer Model can be adapted for establishing GIIs for the public sector.

6 CONCLUSIONS AND RECOMMENDATIONS

In the last decade, the way GI is used has shifted from only being used in niche applications to becoming embedded everywhere in society. Technological and societal changes have made unlocking PSGI easier. As GIIs are evolving from first generation to second generation GIIs, more and more PSGI web services are set up. However, as technology has changed to make PSGI available, so should the underlying business models and financial models, especially in light of the upcoming INSPIRE implementation. If the only users of a PSGI web service are other public sector bodies, especially when the web service is part of a NGII, then the only viable revenue model is the Free Model or the Data-for-Data Model as variant of the Street Performer Model. Not only is it counterproductive for public sector organisations to invoice each other every time a web service is used, there is also a real risk that public sector organisations will prefer to use (a combination of) alternative “free” sources such as Google Earth and OpenStreetMap rather than their “own” public sector geographic information. This contradicts with the spirit of the INSPIRE Directive (see Giff et al., 2008).

If PSGI web services are made available outside the public sector to society, then the only viable revenue model for viewing services such as WMS is the Free Model. The Royalty Model could also be used, as this is effectively a “free” model since no value added products will be created by just viewing. The private sector, which may need PSGI for their own business processes or to produce value added products, will be prepared to pay for good quality PSGI provided the fees are not too prohibitive. Therefore, for reusers of WFS, WCS and Data Services the Subscription Model, the Royalty Model or Hybrid Models would be suitable. Although the Usage Model is commonly applied, in the long term it is not be viable even for high-quality Large Scale Base Maps. The fees, even with price discrimination discounts, will become too steep for larger areas and the fee structure will become complicated when combined with other data.

To ensure that PSGI is truly shared through web services as envisaged by INSPIRE, national governments will have to provide sufficient funding to guarantee continuous quality. This means that the current cost recovery regime has to be reconsidered. Recent reports in 2008 such as the Cambridge Report (Cambridge University, 2008) and the MICUS Report on Assessment of Re-use of PSI (MICUS, 2008a) support this point of view. While the Cost Recovery model ensures that a public sector organisation can guarantee that PSGI is maintained at a sufficient level of quality of PSGI (van Loenen, 2009), the model is no longer suited to using web services for PSGI. This is because the specific PSGI data is no longer just accessible from that public sector body but from multiple web service avenues. In the long term, the benefits of making PSGI available free of charge or for lower fees will pay off in the form of intangible benefits and extra revenue raised in the form of taxes when more value added products will be created.

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ABBREVIATIONS

ALK	Automatisierten Liegenschaftkarte (Computerised Property Map)
BEV	Austrian Federal Office of Meteorology and Surveying
DS	Data Service
GI	Geo Information
(N)GII	(National) Geo Information Infrastructure
IPR	Intellectual Property Rights
OGC	Open Geo Consortium
OSM	Open Street Map
PS	Public Sector
PS(G)I	Public Sector (Geo) Information
NMN	New Map of the Netherlands
STOF	Service – Technology – Organisation - Finances
VAR	Value Added Reseller
WCS	Web Coverage Service
WFS	Web Feature Service
WIS	Web Integrator Service
WMS	Web Map Service

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