DATA PRICING POLICY

Ray Harris
Department of Geography
University College London
26 Bedford Way
London WC1H 0AP
UK
r.harris@geog.ucl.ac.uk

KEY WORDS: Price, policy, EOPOLE, objectives, free, marginal, market, Internet

ABSTRACT

The purpose of the paper is to explore the benefits and disadvantages of the different pricing models commonly used in Earth observation. The data pricing policy options are: free data for all users; marginal cost price for all users; market driven, realisable prices for all users; full cost pricing; two tier pricing; information content pricing; access key pricing. Each of these options is discussed using the same four part structure: a definition of the term, arguments which have been proposed in favour of the option, arguments presented against the option, and the implications of the option for the Earth observation sector. The paper also discusses the opportunities for new pricing approaches offered by the Internet.

1 INTRODUCTION

1.1 EOPOLE context

Data policy is of vital and growing importance in Earth observation. The project entitled Earth Observation Data Policy and Europe (EOPOLE) has been examining a range of data policy issues, including pricing policy. EOPOLE is supported by the European Commission through the Framework IV Programme. The EOPOLE web site contains a wide range of information concerning Earth observation data policy:

www.geog.ucl.ac.uk/eopole

This paper reports on discussions in EOPOLE about pricing policy as well as presenting a wider set of issues concerning the central issue of data pricing policy. The paper is a development of a paper presented at EOPOLE workshop 6 held in Hydra, Greece, May 2000.

1.2 Pricing models

Earth observation uses a variety of pricing models. The purpose of this paper is to explore the benefits and disadvantages of the different pricing models commonly used in Earth observation. The data pricing policy options listed below are discussed in the paper.

- free data for all users;
- marginal cost price for all users;
- market driven, realisable prices for all users;
- full cost pricing;
- two tier pricing;
- information content pricing;
- access key pricing.

Each of these options is discussed using the same four part structure: a definition of the term, arguments which have been proposed in favour of the option, arguments presented against the option, and the implications of the option for the Earth observation sector. The information and ideas presented here are developments of earlier work on this subject reported in Harris (1997) and Harris and Krawec (1993). The paper also discusses the opportunities for new pricing approaches offered by the Internet.

2 PRICING POLICY OPTIONS

2.1 Free data for all users

Definition of the term

The term free of charge is defined here as no charge to the recipient at the point of delivery. No charge is made for the data themselves, nor for the medium on which the data are distributed. Earth observation data are therefore received by a user without any financial charge to that user.

Arguments in favour

1. Sharing of Earth observation data should be encouraged with the lowest possible barriers to this sharing. Data supplied to all users free of charge allows open and easy sharing of these valuable environmental data. A policy of free data encourages the widespread use of Earth observation data and hence contributes to the development of the sector.
2. The tradition of free exchange of meteorological data has been highly successful and suggests that environmental data for research purposes may benefit from a similar policy.
3. Experience in the United States suggests that the free exchange of basic meteorological data actually contributes to the commercialisation of the Earth observation sector by encouraging the value added sector to develop applications on the basis of free data.
4. The policy is simple to administer.

Arguments against

1. If large volumes of data are available free of charge, there may be no discipline in the demands by users for the data.
2. If no cost is associated with the data, they may also be perceived to have no value.
3. The supplier continues to pay for the data rather than the user, so the user does not have a sufficiently clear say in the amount and type of data collected. If data were supplied free to all users the costs of providing them would need to be recovered through public and/or private sector funding, which would not necessarily be in proportion to the use of the data made by different contributors.
4. Free supply has not generated sufficient recognition of the value and economic impact of the data, particularly meteorological satellite data. This makes it more difficult to justify increased budgets for satellite programmes. The more successful an Earth observation programme then the greater the costs falling on the data supplier rather than on the data user.

Implications of free data for all users

The classic case for this option is AVHRR data. These data are provided free of charge over the Internet. The cost of the transfer of the data is placed on the user who is accessing the data, i.e. the user bears the cost of acquiring the data rather than the supplier bearing the cost of disseminating the data.

Providing data free of charge to all users maintains the cost of providing the data on the supplier. In a closed loop system such as EUMETSAT this is acceptable because the community which funds the system is also the recipient of the data. When EUMETSAT wishes to enhance its capability, for example by a new Meteosat satellite, it requests its member agencies for further financial support.

Data supplied free of charge to all users could be perceived initially by users to be a positive initiative. However, the cost of data is only one part of the total costs of a research, operational or commercial programme. So, by seeing the data as free, users may underestimate the other, supporting tasks which are required for the successful completion of a programme.

It is not normally the cost of data that curtails use by the research community but rather the availability of research funding. If funding is not available for research using Earth observation data, including labour, equipment, external information and overhead costs, then free data will have little more than pictorial or curiosity value.

2.2 Marginal cost price to all users

Definition of the term

The price which recovers the costs incurred in providing data beyond the costs of the basic ground infrastructure is the marginal cost price. This is the short run marginal cost price because it does not seek to recover the ground infrastructure investment.

The marginal cost price is impossible to define accurately, partly because it is the result of administrative decisions and partly because organisational accounting data are normally not available in sufficient detail to determine a realistic price which accurately reflects the short run marginal cost of providing a given data set. Therefore, terms such as the marginal cost of reproduction and delivery and the marginal cost of filling a user request (COFUR) have been employed in a general sense to give supplier organisations flexibility in how they treat the definition of a marginal cost price.

Arguments in favour

1. Making all users pay for data, even a nominal price, encourages discipline in the selection of and requests for Earth observation data. The marginal cost price can be set at a sufficiently low level to encourage widespread use of the data.
2. The recovery of marginal costs avoids budget deficits resulting from satisfying extra demands for data.
3. Marginal cost prices allow wide ranging and flexible demonstrations of applications in all sectors, some of which may later become operational uses. This allows exploration of the data for uses which the Earth observation instrument may not have been intended (e.g. NOAA AVHRR data for vegetation applications).

Arguments against

1. As in the case of providing data free of charge, the bulk of the costs of providing data need to be covered by the data supplier.
2. Some users can make commercial gains from the use of the data without making a commensurate contribution to the costs.
3. The costs of administering a marginal cost price policy could be disproportionately high in comparison with the revenues generated. (Indeed, the US policy on data management for global change research states that for small data sets and those data accessed infrequently, the administrative burden of marginal cost recovery may outweigh the benefits of charging such costs, and data may be more efficiently provided at no cost.)

Implications of marginal cost price for all users

ESA has introduced marginal cost prices for its ERS and Envisat data. The Envisat data policy (ESA 1998) notes that:

> "ESA will fix the price for all Envisat data intended for category 1 use. The price will be set at or near the cost of reproduction of the data."

Furthermore, ESA will use the free data model for some of the Envisat data:

> "ESA will waive the category 1 price for approved projects in the Envisat Announcement of Opportunity scheme and in other cases following approval by the Earth Observation Programme Board."

A marginal cost price serves to maintain the *status quo*. Users receive data at low cost and so any increase in costs at a later stage, such as to commercial prices, will present a structural funding problem to users. The maintenance of the *status quo* means that there is a barrier to evolution in pricing policy. Such evolution is necessary to respond to the changing forces acting on the participants in the sector, such as the changing use of Earth observation for environmental purposes.

Suppliers do not generate any additional income from marginal cost prices to reinvest in the provision of new services and products. Such innovations have to be funded from capital programmes which require new justifications. Where new products or services are required by only small numbers of users then such justifications by suppliers will not be easy to carry through.

2.3 Market driven or realisable price for all users

Definition of the term

Because no supplier has so far recovered the costs of the total space segment and ground segment, the term 'market driven' cannot be used in a full commercial sense. An administrative decision has to be made to identify which components of the data supply chain are included in defining a market driven, or realisable, price for Earth observation data. In the present state of the Earth observation sector, the market driven or realisable price is also that price agreed between a willing seller and a willing buyer. This willingness is not governed by perfect market conditions because of government support for the space segment and part of the ground segment.

Arguments in favour

1. Market driven prices generate a margin which can be re-invested in the enterprise, which marginal prices do not.
2. The policy is viable even for research users provided research programmes include the price of data as part of their research budgets.
3. For research users the policy puts the provision of Earth observation data on the same basis as that of other goods and services, for example computing facilities, telecommunications services, heating, lighting and rent.

Arguments against

1. The data may be too expensive. This can particularly restrict access to the data by researchers, which in turn slows down the rate of progress in Earth observation.
2. Pricing policies defined by the space agencies are typically concerned with data rather than with the information required by end users. A market driven pricing policy can make the acquisition of information derived from long term, global data sets very expensive.
3. As most Earth observation data are eventually used for government purposes at present, governments should not have the extra financial burden of market overheads in obtaining data.
4. The policy is likely to restrict the use of data by less developed countries on cost grounds.

Implications of market driven or realisable prices for all users

SPOT is an example of an organisation that adopts market driven or realisable prices. SPOT currently claims that its operating costs are covered by the revenue from its data sales.

An increase from marginal costs to market driven prices has been blamed for the significant decline of Landsat data use by the academic community in the United States (Shaffer 1992). However, the decline of Landsat sales to the academic sector began in the late 1970s and the NOAA and EOSAT increases in prices had no discernible effect on the downward progress in the level of demand by the US academic sector (Harris 1997).

Because market driven prices are not full commercial prices in the sense that they do not recover all costs, there is an arbitrary decision to be made about the level of the market price. This decision on pricing level need not be singular. There are benefits in a staged transition from marginal cost prices to market driven prices.

In its space strategy for 1999 - 2002 the British National Space Centre (BNSC 1999) notes that:

> "Market-oriented Earth observation missions should be driven, and part-funded, by industry, in order to ensure a strong commercial focus. One mechanism for pursuing such missions is the proposed new ESA Earth Watch programme."

2.4 Full price

Definition of the term

Prices set at the full price, or competitive market price (Ordnance Survey 1996), capture the investment costs of building and launching an Earth observation satellite and its payload plus the costs of the ground segment and the marketing

activities. In addition, the price reflects the profit needed on any one satellite and the investment in research and development for the next generation of Earth observation satellites.

Arguments in favour

1. A full, commercial price would recover all the initial investment costs.
2. It would be possible to investigate easily the development of new instruments directly geared to user needs.
3. Full prices can provide a basis for the sustainable and long term growth of the Earth observation sector independent of government funding.

Arguments against

1. The price levels would be very high.
2. A full price policy would also fail to recognise the need to invest in space for scientific and humanitarian returns as well as for operational and commercial benefits.

Implications of full prices

Space Imaging is the first company in the private sector to be responsible for the full delivery of an Earth observation system and the sale of its data and derived products. Therefore the prices charged by Space Imaging are a good guide to the levels of full pricing of Earth observation data. Space Imaging products are available per sq km subject to minimum order conditions. Table 1 summarises the main Space Imaging product offerings.

	CARTERRA Geo Products	**CARTERRA Reference Products**	**CARTERRA Precision Products**
Price per sq km North America	$12-$17	$29 - $44	$66 - $99
Minimum order value	$1000	$1000	$1000
Minimum order area	67 sq km	27 sq km	12 sq km
Price per sq km outside North America	$29 - $44	price on application	price on application
Minimum order value	$2000	$2000	$2000
Minimum order area	27 sq km	-	-

Table 1: Sample Space Imaging product prices, March 2000. Source: Space Imaging web site (www.spaceimaging.com) 6 March 2000.

Many governments, particularly those in Europe, see an important goal in producing an Earth observation sector which eventually has a commercial basis. For example, the 1996 UK space policy produced by the British National Space Centre had as one of its Earth observation objectives (BNSC 1996) to:

> "Create the conditions under which a commercial industry in EO, competitive in the world market and fully sustained from private and public sector operational users, can be created by 2005."

In the longer term this commercial basis is both desirable and necessary because it cannot be anticipated that governments will continue to fund Earth observation indefinitely. The key question is when will this transition occur?

2.5 Two tier pricing

Definition of the term

A two tier pricing policy has been proposed by several organisations, for example ESA and NASDA, to allow preferential treatment in financial terms of research (and other) users. The two tiers of pricing are normally market driven prices for all users, except for the users in the categories given preferential treatment who receive data at (typically) the marginal cost price.

Arguments in favour

1. The research community, through publications and other channels, is contributing to the public welfare. Therefore, data for research use should be available for a small charge to cover marginal costs.
2. At the same time, commercial users should pay a price which reflects the value which they derive from the use of the data.
3. The policy gives flexibility to adapt to changing circumstances. For example, if research use develops into commercial use over the long term, then a two tier policy can accommodate this development.

Arguments against

1. If Earth observation data are to be widely used, markets must be stimulated and hence any new policies should not undermine commercial markets. This policy could undermine the development of commercial markets.
2. A two tier pricing policy requires policing to ensure no abuses of the system occur and could, therefore, be unsustainable. The borders between scientific research in Earth observation and practical, commercial applications are difficult to define and short, quick transitions can be made between the two.
3. A two tier policy will add administrative costs overall which must be borne somewhere in the data supply chain.

Implications of two tier pricing

The Japanese Space Agency (NASDA) has a clear policy on two tier pricing. It has agreed to distribute a limited amount of Earth observation data at marginal cost to researchers who agree to the terms and conditions of 'Research Purpose Data Distribution' (NASDA 1999). The agreement covers data from ADEOS, MOS, JERS, TRMM and Landsat. Researchers have to agree to a set of conditions, including:

- Belong to a recognised organisation (a national or local government, a governmental institution, a college or a university) and prove their status in that organisation.
- Data use is restricted to the research use stated in the application form.
- Data provided may not be transferred to any third party.
- The results of the research should be released to the scientific community in a publication. When the researcher publishes the study the data rights and credits, from table 2 below, are to be clearly indicated in the publication.

Satellite name	Data right and credit
ADEOS	NASDA retains ownership of the data. NASDA supports the author(s) in acquiring the data at marginal cost.
MOS	NASDA retains ownership of the data. NASDA supports the author(s) in acquiring the data at marginal cost.
JERS	MITI and NASDA retain ownership of the data. NASDA supports the author(s) in acquiring the data at marginal cost.
TRMM	The US government and NASDA retain ownership of the data. NASDA supports the author(s) in acquiring the data at marginal cost.
Landsat	The US government retains ownership of the data. Space Imaging EOSAT and NASDA support the author(s) in acquiring the data at marginal cost.

Table 2: Rights and credits in Earth observation data provided by NASDA for research use. Source: NASDA (1999).

With ERS and Envisat, ESA is introducing a novel two tier pricing structure. ESA will make ERS and Envisat data available for category 1 (research and development) and category 2 use (all other uses) (Harris 1999). For category 1 use ESA will charge the user the marginal cost of the ERS or Envisat data. ESA has then developed a new scheme for category 2 use, as follows (ESA 1998).

> "For category 2 use, ESA will fix the price of Envisat standard products and associated services which it provides to the distributing entities. The price will be set at a level comparable to the price for category 1 use.

> Distributing entities will be allowed to set prices for Envisat products and services for category 2 use at or above the price level which ESA charges the distributing entities. For specific purposes, and with the prior agreement of ESA, distributing entities will be allowed to set prices for data products below the price level which ESA charges the distributing entities.
>
> ESA reserves the right to fix a ceiling level for the market price which distributing entities can charge to users for Envisat standard products."

This is an interesting combination of marginal cost pricing and realisable pricing, where the realisable price determination is left to the distributing entities rather than the data supplier.

A two tier pricing policy is an arbitrary structure, and consequently it can create tensions between the categories of users included in the two tiers. Research users who qualify for the lower price tier may leak the data thereby purchased into a use which falls in the higher tier category. This is why there is a convergence on the term *use* rather than the term *user*. This means that a significant element of a two tier pricing structure is the monitoring and policing of the implementation of the two tiers.

2.6 Information content pricing

Definition of the term

Pricing policy in Earth observation has largely been designed around selling scenes of data. SPOT, Landsat and ERS data, for example, are sold by scene or by parts of scenes. An alternative model is to sell Earth observation data by their information content rather than by their geographical extent.

An example of selling data by information content is the monitoring of oil slicks in SAR data. It can be envisaged that a customer would wish to purchase only those SAR data in which evidence of an oil slick is present. This in turn requires an assessment of the information content of the SAR image to examine the data for the presence of an oil slick. Only if a suspected oil slick were present would the customer purchase the data, and maybe then only the information on the location of the suspected oil slick rather than buying all the SAR data.

The paper by Noack *et al* (1999) presented at EOPOLE workshop 4 describes a DLR system which attempts to characterise and catalogue Earth observation data by their content as well as by their space and time location properties.

Arguments in favour

1. The focus of the approach is on information rather than just data.
2. The user would only buy data (or information) which were directly relevant to the application.
3. The data delivery system would be geared to an information service and to value added information related to customer needs.
4. There is greater scope for the development of data brokers and other contributors to the Earth observation value chain.
5. The price would depend on the quantity of relevant information rather than on the volume of raw data.

Arguments against

1. Because the focus is on the information content rather than the volume of data, this leads to questions of the value of the information. In turn the value of the information depends on the organisation using the information and the role of the information in the organisation's value chain.
2. The disadvantage of an information content pricing policy revolves around how to set the prices. For the example of oil slicks the question becomes one of how much the information is worth to the customer. This in turn depends on the customer's ability to pay and an assessment of the value added by the extra information on the location of oil slicks.

Implications of information content pricing

There is a class of events for which information content pricing is a useful approach. For episodic events such as oil slicks, earthquakes, floods, major storms and volcanic eruptions an information content pricing policy can be realistically envisaged.

For scientific and operational applications which require data on a regular basis, such as crop monitoring, sea surface temperature mapping, global change analysis and ice edge detection, the case for setting a price based on information content is not so clear.

2.7 Access key pricing

Definition of the term

The discussions of pricing policy in Earth observation revolve around the prices of data and products. While this concerns the purchase of a licence to use the data, rather than the data themselves, the focus is still on the price of the data. An alternative approach is to provide the data for free, but encrypt them so that only those users with a decryption key can gain access to the data.

Access key pricing is the price charged by a supplier for an access key to a data set or part of a data set.

Arguments in favour

1. Encourages wide dissemination of Earth observation data.
2. Focuses attention on those data which are required for a particular project or service.
3. Direct broadcasting technologies are growing in capability and could be harnessed to the benefit of Earth observation.
4. Emphasises the value of the information rather than the data themselves.

Arguments against

1. Could involve large volumes of data for dissemination.
2. Restricts access to those organisations with access to suitable technologies.
3. Not yet a mature technology for all Earth observation data. The approach is better suited to low rate Earth observation data.

Implications of information content pricing

EUMETSAT already encrypts its data and sells a decryption key to the data. A broader application of this approach could benefit Earth observation. Receiving stations could receive all relevant Earth observation data, but only have access to those data which are accessible with a decryption key. The decryption key could be transmitted over the Internet to paying customers. The decryption key could have specific conditions, for example access only for certain passes, geographical locations or time periods. The decryption keys could themselves have relatively short lives (say one month) which means that fraudulent access to data could be limited by changing the keys.

While this approach to pricing is attractive, it would require a step change in the investments by user organisations. Satellite telecommunications technologies and services are reducing in price, but their adoption in Earth observation has been limited. The ASTRON project of the European Commission may assist in encouraging a more widespread use of these technologies.

3 INTERNET OPPORTUNITIES

In the past Earth observation has been a leader in information technologies. Now, however, Earth observation is in the happy condition of following other technologies, particularly in communications. The lessons for pricing policy are emerging day by day, especially with the approaches to the Internet of the *dot.com* companies. The Internet encourages a fresh approach to selling information.

Technologies such as MP3 are providing a means of transferring large volumes of data over the Internet. MP3 itself is designed to compress and disseminate digital music data, and so is not orientated to Earth observation data. However, generic systems which disseminate image data will become more widespread and more useful. This then asks: how Earth observation can benefit from new data transmission capabilities? Access key pricing is likely to become a technical possibility over the Internet as bandwidth improves as well as by direct broadcasting from satellites.

Many Internet applications focus on what the customer wants to buy and provide an easy means of buying those products. For Earth observation we can envisage users buying data sets for specific, small regions and for specific time periods. The applications providers, in sectors such as agriculture and disaster management, can have access to Earth

observation data faster, and then distribute the data and value added products to their own customers rapidly. Reuters announced in 2000 a strategy based on Internet technologies, and this may provide a useful model for the dissemination of Earth observation data and products in the future.

Schreier (2000) discusses a range of options which Earth observation could exploit by using the Internet to selling Earth observation data. The options are summarised below.

- All Earth observation data are offered for free while the data supplier generates revenue from the advertisers who use the web site.
- Sophisticated on-line services deliver only the Earth observation data the user really needs. Rather than ordering a whole Earth observation scene the user requests only those parts and layers of the image he is interested in. New developments such as the DLR EOWEB and Microsoft's Terraserver allow sub-regions to be specified and parts of the data to be ordered and delivered over the web.
- Earth observation data are auctioned via the web. If this were linked to satellite programming then the auction would be for data rights (subject to international agreements) rather than for the data *per se*. Inverse auctioning could be when a user posts on the web a data requirement plus the amount he is willing to spend to have the requirement fulfilled.
- The effective application of Earth observation data is only as good as the tools to analyse the data. A closer synergy between data supplier and software provider could generate new pricing models. For example, the data could be provided free but the costs could lie in the software to access the data. A comparative example is with cell phones, where some providers provide a cell phone for free but the user has to sign a two year service contract.

4 CONCLUSION

There is no single pricing policy that is right for all Earth observation data. Pricing policy is the servant of the mission objectives. A pricing policy is (or should) be put in place to enable the objectives of an Earth observation mission to be achieved.

Users in the Earth observation sector often claim that data are too expensive and should be provided completely free or as cheap as possible. These comments are often not set in context. Data costs rarely exceed 20 per cent of project costs, and often there is no consideration of the other costs involved in completing a project. A continuing claim for very low cost data does little to encourage sustainable Earth observation.

The emphasis should always be on the value of the data provided by Earth observation. The new ERS and Envisat data policies are geared towards maximising the beneficial use of the Earth observation data, with the exploitation left to the distributing entities and not to ESA. This means that the distributing entities will be able to have an improved assessment of the value of their data and product offerings.

ACKNOWLEDGEMENTS

I warmly acknowledge the support of the European Commission Framework IV for their support to EOPOLE. The discussions about data policy within the EOPOLE team have always been stimulating and of value to the Earth observation sector: many of the ideas are reflected in this paper and I thank the EOPOLE team, and in particular Nicola Olby, for this.

REFERENCES

BNSC (1992) *UK space activities 1991/92*, Department of Trade and Industry, DTI/Pub 948/12.5K/7/92, London.

BNSC (1999) *United Kingdom Space Strategy 1999 - 2002, New Frontiers*, Department of Trade and Industry, DTI/Pub 4268/15k/8/99/NP.URN 99/1012, London, 64pp.

ESA (1998) *The Envisat data policy* approved on 19 February 1998 (ESA/PB-EO(97)57 rev.3).

Harris R and R Krawec (1993) Earth observation data pricing policy, *Space Policy* 9(4), 299-318.

Harris R (1997) *Earth observation data policy*, Wiley, Chichester, 155pp.

Harris R (1999) *Main trends in Earth observation data policy*, working paper for EOPOLE workshop 1, London, January 1999.

NASDA (1999) *Information on Earth observation data distribution for researchers*, Earth Observation Research Centre, NASDA, Tokyo, 23 July 1999.

Noack W, M Datcu, K Seidel and G Schreier (1999) *New technologies for the extraction of information - selling information rather than data*, working paper for EOPOLE workshop 4, Brussels, October 1999.

Ordnance Survey (1996) *Economic aspects of the collection, dissemination and integration of government's geospatial information*, A report arising from work carried out for Ordnance Survey by Coopers & Lybrand, Ordnance Survey, Southampton, 70pp.

Schreier G (2000) *Products and ordering for online and multi-media products – the Internet approach*, working paper for EOPOLE workshop 6, Hydra, May 2000.

Shaffer L (1992) US data policy for Earth observations from space, *Space in the service of the changing Earth*, volume III, eds T D Guyenne and J J Hunt, ESA SP-341, ESTEC, Noordwijk, 1477-81.